Exploring the Design Dynamics of Community-based Social Innovation Projects by Applying the Theory of Infrastructuring

by

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Abstract

Social innovations are products, services and models that meet social needs and generate new social connections or collaborations. Interaction design research aimed at supporting social innovation projects has only recently begun to gain momentum. To better support social innovations and further promote social change, interaction designers need to better understand the emerging possibilities, limitations and implications in those projects.

In this dissertation, to further explore how interaction designers can play a role in promoting social innovation, I utilize the theory of infrastructuring in relation to the theoretical framework publics (Le Dantec, 2016) for interpreting the underlying design process in social innovation projects in community contexts. I believe the application of the infrastructuring concept allows design to have a role in describing in detail the design process of those projects. Infrastructuring helps to reveal the inner workings of such projects. Moreover, personally being involved in several social innovation projects, such as being a community gardener, I was amazed by and interested in understanding more about the creativity of people in the design process of these projects. Hence, the goal of this research is to provide a comprehensive description and interpretation of the collective design of community-based social innovation projects.

This dissertation reports on a multiple-case study that describes the design process of three community-based social innovation projects in the city of Vancouver - Inner City Farms, Vancouver Tool Library, and Woodland Community Garden. Based on the description, design implications are proposed to discuss the potentialities of interaction design in supporting the design process of such projects. On the one hand, this research highlights the aspects of the design process in which interaction designers can play a significant role and further support social innovation. On the other hand, applying the notion of infrastructuring to the collective design of community-based social innovation projects provides an opportunity to extend the understanding of design toward a more dynamic and open-ended process where conflicts, standards, and adaptions are interwoven within an infrastructuring process.

Keywords: infrastructuring; design process; social innovations; community-based

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Chapter 1.

Introduction

Today, our world is facing a range of intractable issues, such as climate change, lack of economic opportunity, and widening income inequality. These problems have proven to be difficult to solve by existing institutions, policy makers, and market operations. However, at the same time, a growing number of people have started to realize the problems in their daily lives and have chosen to act in alternative and sustainable ways of living. For example, as an alternative to private means of transport, people share cars and bicycles as their everyday travel mode to reduce economic and environmental costs; families decide to share their dining areas and recreational spaces; and communities build gardens in their neighborhood that are managed by residents to grow their own food and create a social space. As Manzini wrote in his book *Design, When Everybody Designs*:

> We must expect to be living this turbulence for a long time, in a double world where two realities live together in conflict: the old “limitless” world that does not acknowledge the planet’s limits, and another that recognizes these limits and experiments with ways of transforming them into opportunities (Manzini, 2015, p.2).

These new ideas that both meet social needs and create new social relationships or collaborations are defined as social innovations (Manzini, 2015). In fact, an increasing number of people, from different cultures, are collectively designing their social innovation projects to create their own lifestyles based on their own ideas of well-being. However, very few researchers in interaction design have explored and investigated these design processes, and fewer have reflected on how interaction design can support the collective design in such projects. How do individuals collectively design in those community-based social innovation projects?

This doctoral work seeks to understand the underlying design process in social innovation projects in community contexts and to explore how interaction designers can support such processes so as to promote social changes. In this doctoral work, I apply the theory of infrastructuring in relation to the theoretical framework publics (Le Dantec, 2016) in understanding the collective design of community-based social innovation

projects. The theoretical framework is considered to provide an analytical tool to understand the design process, thus enabling me to reveal the implications for interaction design to support such design process.

1.1. Purpose of study and research questions

The purpose of this study is to validate the effectiveness of the theory of infrastructuring in relation to the theoretical framework of publics (Le Dantec, 2016) in describing the design process of community-based social innovation projects and to uncover the characteristics of the design process that interaction designers can support. I draw on the framework proposed by Le Dantec because it provides a practical analytical tool that is an alternative to other related infrastructuring frameworks (e.g., technology driven infrastructuring). Le Dantec's framing can be easily situated in and developed further through interaction design research.

The questions this study aims to address are:

- How does the theory of infrastructuring in relation to the theoretical framework of publics (Le Dantec, 2016) effectively describe the collective design of community-based social innovation projects in an urban Canadian city?

- Based on the theory of infrastructuring, what are the characteristics of the design process in community-based social innovation projects that can be supported by interaction designers?

Detailed answers to these questions are woven through the chapters that follow, but the next few paragraphs give a sense of the position from which I begin, the concepts I draw upon, the methodology I adopt, and the contribution I make with this research of understanding and analysing the design process of social innovation projects in a community context.

1.2. Motivation for this research

For me, there are two reasons to do this research. The two intrinsic motivations are related to my dual roles in this research. First, as an immigrant student living in Vancouver for my doctoral study, I have participated in several community-based projects and civic activities to meet neighbours and make more connections to the city I live in, such as being a community gardener and a volunteer for local non-profit organizations. By these vivid experiences, I realize how residents in Vancouver creatively change their lifestyles by acting upon their ideas of well-being. In many of those projects, new social or economic models are created. I am attracted by these amazing projects and interested to understand the underlying process better. This research allows me to understand the detailed processes of those projects.

On the other hand, as an interaction design researcher in a world in which social innovation projects are emerging and gaining momentum to give rise to social changes, I am curious to find how interaction design could support these projects so as to further promote social changes.

1.3. Introducing the terms

1.3.1. Conceptualizing social innovation

In this research, I draw on Manzini's notion of social innovation, which is defined as "new ideas (products, services and models) that simultaneously meet social needs and create new social relationships or collaborations" (2015, p.11). A major characteristic of social innovation projects is that they are for meeting social needs. Therefore, they are more "socially and culturally driven" (Manzini, 2015, p.16). In doing those projects, new social forms are created and people's capacities to act are enhanced.

In addition, in this doctoral work, the social innovation projects are intentionally framed in community contexts, in which situations are "bounded by place, shared experience, and common cause" (Le Dantec, 2016, p.3). Examples of community-based social innovations include resource-sharing projects in which people share their resources with others to reduce the economic costs and also rebuild their neighbourhood community (e.g., co-housing and tool library projects), neighbourhood

gardens that are set up by urban residents to improve their quality of life and promote social inclusion (e.g., community gardens), and initiatives running on new models of production based on local available resources (e.g., community supported agricultures).

1.3.2. The use of ‘infrastructuring’ in this thesis

There are diverse definitions to the word “infrastructuring” across disciplines. In this research, I applied Le Dantec’s notion of infrastructuring in relation to the concepts of publics, issues, and attachments (2016).

Specifically, a public “seeks to work constructively within the messy and contentious reality of discourse where all voices – from mainstream to marginal – jockey to participate and arrive at desired outcomes” (Le Dantec, 2016, p.15). The evolution of issues drives the “dynamic and contingent nature of publics” (Le Dantec, 2016, p.18). Attachments are the “organizing force” that makes actors, institutions, and artifacts affected by an issue gather and take actions toward a common end (Le Dantec, 2016, p.21). Specifically, actors are individuals who are affected by a particular set of issues. They enlist themselves to take action to overcome, alleviate, or amplify the effects of the issue of concern. An actor is defined as the "source of an action”(Latour, 2005). Central to the relations is the interplay between “dependency on” and “commitment to”. Based on these concepts, infrastructuring is defined as a process in which a public identifies and marshals sociotechnical resources – via existing and newly articulate attachments – to contend with social issues (Le Dantec, 2016, p.26). The discussion of sociotechnical systems has a straightforward relation to the field of Science and Technology Studies (STS). In the 1950s, Trist and Barnforth found that not only social aspects, but also the technical systems used, can impact the productivity of a working organizations (Trist & Bamforth, 1951). They further developed the sociotechnical approach for analysis and intervention in working organizations. Later, the sociotechnical approach was brought into the field of computer system application. For example, based on the sociotechnical design approach, Mumford argues that equal wright should be given to social and technical issues when new computational systems are designed (Mumford, 2000). Here in Le Dantec’s notion of infrastructuring, sociotechnical is about the social configurations that publics bring about and then evolve in responding to the technological interventions that are entangled when groups of people move to act.

This notion of infrastructuring is used to account for and understand the underlying design process of social innovation projects in which multiple actors, artifacts, and institutions are involved. More precisely, it enables me to depict how diverse resources gather around and interact in such projects. With this theoretical framework, the goal of this doctoral work is to describe the underlying process and uncover the characteristics of the design process in community-based social innovation projects.

1.3.3. Defining design and interaction design

Traditionally, design is considered as an expert activity aimed at the design of products. In this study, design is defined in a broader sense and more complex way. It is not only about the design of products, but also services and organizations. It includes experts, but also end users. Specifically, I draw on the notion of design from Manzini's description:

> Design is a culture and a practice concerning how things ought to be in order to attain desired functions and meanings. It takes place within open-ended co-design processes in which all the involved actors participate in different ways. It is based on a human capability that everyone can cultivate and which for some – the design experts – becomes a profession. The role of design experts is to trigger and support these open-ended co-design processes, using their design knowledge to conceive and enhance clear-cut, focused design initiatives (Manzini, 2015, p.53).

According to Manzini, in the transition toward to a connected and sustainable society, all design should encourage "sociotechnical experiments" (Manzini, 2015, p.54) in which the traditional way of thinking and acting will have to be reinvented. Through these sociotechnical experiments, design knowledge is produced to empower actors and institutions in "inventing and enhancing original ways of being and doing things" (Manzini, 2015, p.54).

In this research, I view community-based social innovation projects from the perspective of design. In other words, design is applied as the epistemology in this study to help me understand the underlying process of these projects. Specifically, it allows me to see how actors creatively identify and integrate the social and technical resources in their participations in those projects.

In this dissertation, I borrow the definition of interaction design from Rogers's description:

> By interaction design, we mean designing interactive products to support the way people communicate and interact in their everyday and working lives (Rogers, 2011, p. 8) .

In this study, I look at interactions beyond the ones between human and technology. The outcome of interaction design is not merely limited to digital artifacts.

1.4. Methodology

My methodology approach is qualitative multiple-case study. There is a shared understanding that the case study method has advantages in providing a holistic description of social phenomenon within a real-life and contemporary context . My approach to case study is based on multiple cases, which is considered as a more robust selection than single case study (Herriott & Firestone, 1983). Each case selected in this study is for pursuing patterns of literal replications thus to describe the characteristics of design process in social innovation projects. Specifically, the three cases selected in this research are:

- Inner City Farms project running on a Community Supported Agriculture model that links farmers and consumers directly, which results in a non-profit organization constituted by farmers and passionate volunteers.

- Vancouver Tool Library project sharing tools in the community in order to reduce economical and environmental waste in the community, which initiates a community service cooperative.

- Woodland Community Garden project aiming to enable neighbours to grow their own food and strengthen social fabric in the community, which results in a community gardening group formed by residents living in the Woodland community.

In the process of data collection, I interviewed 23 participants who were involved in the projects to understand their design processes in the three projects. I also observed the projects by serving as a volunteer and participating in events, such as

workshops and work parties. The sites of the projects as well as the working environment of participants were directly observed during the fieldwork. Moreover, documents related to the projects, such as design files, policy files, agreements, annual reports, and online articles were also collected as evidence.

Raw data, such as interviews and field notes, were converted into formatted write-ups and prepared for analysis. I followed Saldaña's strategies of conducting coding in two major stages: first cycle and second cycle coding (Saldaña, 2013). In first cycle coding, I assigned codes to the data segments through provisional coding, descriptive coding, and in vivo coding approaches. Specifically, "issues", "publics", "attachments", and "the work of infrastructuring" from the theoretical framework of publics were applied as provisional codes in the analysis process. In the second cycle coding, summaries were clustered into a smaller number of categories. Through these steps, the underlying process of each project was comprehensively understood. The characteristics promoting the growth of each social innovation project were uncovered and presented. Based on the within-case study, a mixed strategy called "stacking comparable cases" (Miles, Huberman, & Saldana, 2013, p.103) was applied to conduct the cross-case analysis. A meta-matrix was created and themes were proposed as characteristics of design process in community-based social innovation projects.

1.5. Contributions and audience

1.5.1. Contributions of this research

This doctoral study contributes four main points to the interaction design community. First, the three case studies presented in chapter 5, 6, and 7 together offer detailed and rich evidence of the collective design of social innovation projects in community contexts. Second, the three case studies offer rich evidence in validating the effectiveness of the infrastructuring theory in describing the design process of such projects. Third, this work provides thoughtful evidence to further improve the theoretical framework. It emphasizes that the dynamic local situation – which is a higher level of local infrastructuring work – is a necessary component for comprehensively understanding the design process of community-based social innovation projects.

Finally, this dissertation provides implications for interaction design to support such projects.

1.5.2. Audience for this research

This dissertation will be of interest to interaction design researchers who want to gain a better understanding of the underlying design process of social innovation projects in community settings. This work will allow interaction design researchers to better understand the actors, the relationships that exist and develop between actors and social and material resources, and the influences of local situations in the design process. In addition, this research will offer interaction design researchers several directions for further study of the design process of those projects.

In addition, for interaction design practitioners, this research offers design opportunities to facilitate the design process in community-based projects. This work also provides a variety of inspirational examples that show how creative and resourceful the individuals are in creating their life style. Through those detailed examples, my goal is for practitioners to see an alternative version of what the community and the city could be.

Finally, this doctoral work will be of interest to researchers who want to better understand the theory of infrastructuring and the framework of publics. Through analyzing the three cases by using the framework, this research offers rich examples of how the theoretical lens could be utilized and expanded.

1.6. Outline of this dissertation

Chapter 2 outlines the research background of this study. In this chapter, I first present the theoretical framework of this research, which is the theory of infrastructuring. Then, I discuss the social innovation and the design research about it. After that, I present the literature about the applications of infrastructuring in design field, such as participatory and social design work and discuss the implications that the concepts of infrastructuring have brought to them.

In Chapter 3, I describe the methodology that is applied in this research. I also present how this research is designed based on the selected approach. In this chapter, I also briefly introduce the three cases as well.

In Chapter 4, I present the details about the data collection and analysis procedures of this study. The types of evidence and the methods used for analyzing the data are described in details. In addition, the strategies used to construct validity and reliability of this study are articulated.

Chapter 5, Chapter 6, and Chapter 7 are detailed reports of the three cases studied in this research. In each of these chapters, I first provide the description of the case, collected evidence, and how they were analyzed. Then, findings from studying each case are presented in detail. At the end, I further reflect on the findings and present my deeper interpretations.

In Chapter 8, I present the process and outcomes of the cross-case analysis. I discuss the implications for interaction designers to support the design process of community-based social innovation projects. I also discuss the limitations of this doctoral work in this chapter.

In Chapter 9, I provide some remarks in conclusion of the thesis. I revisit the research questions, highlight the contributions of this thesis, and propose suggestions for future studies.

Chapter 2.

Research Background

In this chapter, I start by presenting the literature of concepts of infrastructuring and the theoretical framework publics that will be applied to describe the underlying design process of social innovation projects in community contexts. Next, I offer an overview of social innovation and design as a motivation for conducting this research. After that, I continue by presenting the applications of the notion of infrastructuring within design, particularly participatory design and social design in community contexts.

2.1. Theoretical background: the theory of infrastructuring

In this section, the concept of infrastructuring and the theoretical framework publics are articulated. This concept serves as a cornerstone for interpreting the underlying process in the community-based social innovation projects. Significantly, theoretical propositions in this multiple-case study are drawn from it.

2.1.1. The concept of infrastructuring

The term ‘Infrastructuring’, or ‘artful infrastructuring’, coined by Karasti and collaborators (Karasti & Baker, 2004; Karasti & Syrjänen, 2004), is an attempt to build a sensitive understanding of community participatory design. Karasti and Syrjänen characterized infrastructuring as a continuous process that is constantly becoming, and as the integration of new tools and technologies with existing people, materials and tools (Karasti & Syrjänen, 2004).

Infrastructuring draws on the notion of infrastructure (Star & Bowker, 2010; Star & Ruhleder, 1996) and Suchman’s notion of “artful integrations” (Suchman, 2002). In their work, Star and Ruhleder argued that infrastructure should not be seen as substrate that other things can operate on top of (1996). They explicitly proposed that infrastructure “occurs when the tension between local and global is resolved” (p.113). It evolves with the “community evolution and adoption of infrastructure as natural” (p.132). By the notion of “artful integrations”, Suchman highlights the significance of the integrations across

artifacts and the integrations between devices and the settings of their use, rather than the discrete or decontextualized artifacts (2002, p.99). Through artful integrations, she argues, innovation and change is no longer merely brought about by professional designers but also could be made by everyday practitioners. Building on the above two notions, infrastructuring refers to a continuous process in which multiple relations are developing and socio-material assembly is constantly becoming.

More recently, researchers have worked at the intersections of infrastructuring, information and communications technology, and participatory design. For instance, to describe the dynamics in the infrastructuring process of cyberinfrastructure projects, Edward et al. denoted three types dynamics - reverse salients, gateways, and path dependence (Edwards, Jackson, Bowker, & Knobel, 2007). The three dynamics have been embraced and developed by many researchers on information technology (e.g., (Tilson, Lyytinen, & Sørensen, 2010) and (Helena Karasti, Baker, & Millerand, 2010)). Also, focussing on infrastructuring in the field of information technology, in his book *A Vast Machine*, Edward proposed “infrastructural inversion”, which emphasizes models and data of climate and the relationships between them (Edwards, 2010). In addition, the concept of infrastructuring has been applied by participatory design researchers in the workplace (Pipek & Wulf, 2009), in communities with open, and heterogeneous structures (e.g., (Ehn, 2008), (Björgvinsson, Ehn, & Hillgren, 2010), and (Bjögvinsson, Ehn, & Hillgren, 2012)), and the context of jurisdictional identity schemes (Clement, McPhail, Smith, & Ferenbok, 2012). The works mentioned above show that the theory of infrastructuring is powerful. However, the majority of the studies confined themselves to technology design and the social aspects are overlooked. Furthermore, these examples limited the understandings of continuous infrastructure development to its longevity, but are short on articulation of the dynamics, changes and the evolutions that happened in it.

In my use of the term infrastructuring, I turn chiefly to Le Dantec, who investigated the application of infrastructuring in the formation of publics at particular groups (Le Dantec & DiSalvo, 2013; Le Dantec, 2016). I selected Le Dantec’s framework over other related frameworks of infrastructuring because Le Dantec’s framing can be more easily located within, operated, and developed further through interaction design research. It provides a practical lens for interpreting the dynamics in community-based social innovation projects and offers scaffolding that other related (and even design-oriented) frameworks of infrastructuring do not provide. In the section

below, I will provide a brief overview of the framework of publics. Particularly, I will present how the infrastructuring is defined regards to publics.

2.1.2. Infrastructuring and publics

The word *public* has been applied in a number of different ways by researchers. One way it applies to is the relationship between an institutional entity and the community of individuals who are members of the entity (Lippmann, 1927). The connection between publics and design is made by Bruno Latour. In his book "*Reassembling the Social: An Introduction to Actor-Network-Theory*", Latour argued that publics are increasingly formed around future things (Latour, 2005). A typical example is a genetically modified organism. Groups were formed long before any evidence had been collected to act against their deployment. Another point Latour made is an object-oriented democracy (Latour & Weibel, 2005), in which objects and things are considered as playing critical roles in democratic governance. In addition to Latour, Marres (2007) highlights the issues that accompany the formation of a public. She points out that publics come into being based on their articulation of the issues, which is not fixed but constantly changing according to the character of the formed public.

In his book, Le Dantec selected to use Dewey's notion. Public, a conception from Dewey (Dewey, 1927), is defined as a particular configuration of people bound by common cause in confronting a shared issue. They are not a priori social groups. A public "seeks to work constructively within the messy and contentious reality of discourse where all voices – from mainstream to marginal – jockey to participate and arrive at desired outcomes" (Le Dantec, 2016, p.15). The frame of publics thus provides an issue-oriented focus of relevance in community-based work. Furthermore, it provides "a pragmatic perspective and authority dynamics form complex and fluid social alignments" (Le Dantec & DiSalvo, 2013, p.246).

The frame of publics includes three elements – issues, attachments, and infrastructures. First, a basic element to form a public is issues. Issues determine the individuals who get involved, thus shaping the public. The evolution of issues drives the "dynamic and contingent nature of publics" (Le Dantec, 2016, p.18).

Second, attachments are the “organizing force” that makes actors, institutions, and artifacts affected by an issue gather and take actions toward a common end. Attachments include multiple relations and motivations, central to which is the interplay between “dependency on” and “commitment to” (Marres, 2007). When issues become articulated, “the network of real or potential attachments changes” (Le Dantec, 2016, p.23). Therefore, attachments provide an “alternative narrative” about the dynamic relationships formed around issues and a means “of understanding the conflicts inherent in the constitution of publics, by recognizing the interplay and emergence of dependencies and commitments that form as a public forms” (Le Dantec & DiSalvo, 2013, p.246). Attachments are important because they build out the collective capacities to act on issues (Le Dantec, 2016, p.63).

Based on the concepts of publics, issues, and attachments, in his book, Le Dantec articulated that the process that a public integrates social and technical resources to act towards issues is a process of infrastructuring:

> As a public identifies and marshals the social and technical resources to contend with social issues, these resources become a form of infrastructure for the public: a durable and ready-to-hand support that enables constituents of a public to act. The work of creating it is a process described succinctly as infrastructuring, in which the infrastructure arises out of the relations and the resources entangled in the present issues and attachments (Le Dantec, 2016, p.26).

According to Le Dantec, what infrastructuring does, is “move from a focus on creating a particular artifact (and the attendant fixity of context and artifact) to design as constituting a public in which issues and attachments are conjoined into sociotechnical networks for addressing present and future conditions” (2016, p.28). With respect to publics, Le Dantec sought to define infrastructuring as “the work of integrating sociotechnical resources – via existing and newly articulate attachments – that enable adoption and appropriation beyond the initial scope of the design space” (Le Dantec, 2016, p.26).

This notion of infrastructuring provides us a perspective for understanding how individuals, artifacts, and institutions gather around a set of issues in community-based settings. Differing from Manzini’s focus, which is the people who take part and the social forms (“collaborative organizations”) they generate, infrastructuring offers a vantage point to articulate and interpret the ongoing and dynamic process of the development of

social innovation projects. Specifically, we can explore the issues, actors, artifacts, and institutions affected by the issues, and the relations between them.

Above I presented the concepts of infrastructuring. My goal in this dissertation is to apply this concept to further the understanding of the underlying design process of social innovation projects and uncover the characteristics of those processes. The theoretical framework articulated above serves as an analytical tool to reveal the inner workings of these projects.

The notion of infrastructuring in the framework of publics is selected for articulating the process of social innovation projects for several reasons. In social innovations, as previously discussed, people reallocate existing resources and skills and solve (or change) the problem. Publics, issues, and attachments “provide a conceptual scaffolding for understanding forms of community action that revolve around marshalling diverse resources to confront social issues” (Le Dantec, 2016, p.25). Thus, infrastructuring with respect to publics could offer a ready way to describe and interpret the process of social innovation projects. Specifically, “issues” are helpful to identify the social needs that people want to solve or change. “Attachments” are conceptual tools to unpack the design process of social innovation projects, in which diverse actors interact in different ways and at different times. Moreover, “attachments” support the articulation of how diverse resources are identified and marshalled and become a support for the public influenced by the set of conditions.

2.1.3. Discussion

Above I have presented the concepts of infrastructuring, particularly infrastructuring in regard to publics. The concept provides a lens for articulating and understanding the latent design process and revealing the dynamics in social innovation projects. It serves as a fundamental theoretical framework for this multiple-case study.

In this dissertation, I will utilize this conceptual tool of infrastructuring to describe the design process of social innovation projects.

2.2. Social innovations and design

In this section, I present a short overview of social innovation definitions. Importantly, I also aim at highlighting the characteristics of social innovation that determine the criteria for selecting cases. After that, major works on design for social innovation are presented.

2.2.1. Social innovation definition and characteristics

Social innovations can be defined in multiple ways. Among them, the most influential one was developed by The Young Foundation in the U.K. which has endeavoured to develop social innovations theoretically and practically (Murray, Caulier-Grice, & Mulgan, 2010). They define social innovations as activities or services driven by meeting a social need.

The main aspects of social innovation are to meet social needs and create new social relations, which make social innovation become different from other types of innovation, such as lead-user innovation. Lead-user innovation, put forward by Hippel, is defined as making discrete products or objects because of more available and cheaper tools for individuals (Hippel, 2005). It is not social innovation because the products made by individuals are for their everyday life rather than giving rise to social changes.

In this dissertation, what I mean by social innovation draws on Manzini's definition in his recent book *Design, when everyone designs* (2015). Based on Murray et al.'s description, Manzini defined social innovations as:

> new ideas (products, services and models) that simultaneously meet social needs and create new social relationships or collaborations. In other words, they are innovations that are both good for society and enhance society's capacity to act (Manzini, 2015, p.11).

By this definition, Manzini argued that contemporary technology development and the increasing number of individuals who recognize the need to "reinvent their lives" (p.11) make the new social forms possible today. He articulated that social innovations take place to solve "intractable social problems" (p.12). In these social innovations, people reallocate existing resources and skills and solve (or change) the problem in a totally different way. Societal and environmental benefits are simultaneously made in the

social innovations. And most significantly, the innovation is not only technically driven but is triggered by a social change. These qualities clearly differentiate social innovations from other types of innovation (e.g., technical innovation). In this dissertation, these qualities also serve as the criteria for my case selections.

2.2.2. Design for social innovation

> Design for social innovation is everything that expert design can do to activate, sustain, and orient processes of social change toward sustainability (Manzini, 2015, p.62).

To explore how expert designers can design for social innovation, in Manzini 's book, a main concept proposed is "collaborative organizations" (2015). By this concept, Manzini aims to describe the design action for social innovation as seeking ways to make the existence of collaborative organizations both "possible and likely" (2015, p.77).

Collaborative organizations are both the means and the results of social innovations. They are "social groups emerging in highly connected environments," in which "members choose to collaborate with the aim of achieving specific results" and also "create social, economic, and environmental benefits" (2015, p.83). These organizations are different from traditional communities because their members can freely join or leave and the organizations are very open to other people and ideas. Manzini argues that individuals in collaborative organizations are creating a new type of co-design process which is "a vast, multifaceted conversation among individuals and groups who set design initiatives rolling at the nodes of the networks they are part of: a social conversation in which different actors interact in different ways (from collaborating to conflicting) and at different times (in real time or off-line)" (2015, p.48). He says that the task of expert design is to contribute to this co-design process that aims at social change. In Manzini's view, design experts' role in this co-designing process is to "make things happen, to listen to the feedback and reorient the action" of other actors (2015, p.67).

2.2.3. Discussion

Manzini's work on design for social innovation depicts a promising future that design and design experts could play a role in contemporary world. The work done in

this dissertation is an extension of that. Different from Manzini's focus on the protagonists of social innovations, the focus of this dissertation is to understand the underlying process in social innovation projects in order to contribute to the discussion of the significant role design can play in supporting social change in the future. In particular, I utilize the concepts of infrastructuring and publics (Le Dantec, 2016) as a way to interpret the underlying process and uncover the dynamics of the process.

In 2.1, I have introduced the concepts of infrastructuring and publics as they suggest a lens through which we can view design beyond discrete products towards an ongoing process that embraces social-technical relations. Below, I present how this fruitful concept of infrastructuring is explored in relation to participatory and social design. More precisely, I offer a look at how participatory and social design moved from focusing on product design, to creating the conditions in which capacities can be developed and solutions to future issues can be considered.

2.3. The application of infrastructuring in design research

In this section, I present the applications of the notion of infrastructuring within design, particularly participatory design and social design in community contexts. As previously elaborated, with regard to social innovation projects, the formation of publics is communities of actors driven by social changes. These communities are free, open, and reversible. Participatory design and social design concerns with communities focus on "a wider range of social relations" and "maintain communities [that] are social constructs with open, dynamic and heterogeneous structures" (Karasti, 2014, p.143). Therefore, I believe an overview of them helps the further reflections of design's role in supporting social innovation projects. More specifically, the infrastructuring approaches discussed in participatory design and social design are believed to open up my thinking about design for social innovations.

2.3.1. Participatory design

Participatory design originated from workers' movements towards democratization in Scandinavian countries around 1970s. It can be defined as:

> A process of investigating, understanding, reflecting upon, establishing, developing and supporting mutual learning between multiple participants in collective 'reflection-in-action'. The participants typically undertake the two principle roles of users and designers where the designers strive to learn the realities of the users' situation while the users strive to articulate their desired aims and learn appropriate technological means to obtain them (Robertson & Simonsen, 2013, p. 2).

By participatory design, people who are identified as affected by the design outcome are able to join in the design process and express their points (Ehn, 2008).

In recent years, researchers have started to apply participatory design to empower marginalized groups and communities, which also aims to contribute to democratization. For example, Carroll and Rosson describe the application of participatory design into design information technology to facilitate community life in non-profit community groups, non-governmental social service providers, and local levels of government (Carroll & Rosson, 2007). Oswal argued that disabled user groups should be understood and considered when digital technologies are designed (Oswal, 2014). In addition, participatory design approach is also employed to empower individuals with aphasia (Galliers et al., 2012) and aging people (Leong & Robertson, 2016). In this body of literature, participants can offer their professional perspectives and preferences so as to inform or transform the artifacts designed for them (Carroll and Rosson, 2007). Therefore, in the process of participatory design, "the role of designer and researcher blur and the user becomes a critical component" (B.-N.Sanders, 2002, p. 2).

The major approach in these participatory design studies is to design projects with identifiable stakeholders. However, scholars have recognized that participatory design faces significant challenges in today's world, in which designs are entering open public spaces where the groups of users are hard to pre-define (Björgvinsson et al., 2010). In other words, the struggle of participatory design is not of inclusion of all stakeholders, but the struggle about "self-actualisation" (Maslow, 1943) of the community and its members, which is a sustainable and ongoing process of development (Carroll and Rosson, 2007, p.247). Further, Ehn pointed out that there are unidentified users who may adopt and appropriate designed objects in ways that are completely unanticipated (2008). In other words, participation of identifiable stakeholders in the design process cannot ensure the use in the real world by future unforeseen users.

To explore how professional designers can design for unforeseen users' design at use time, which is the activity of "design after design", Ehn explored meta-design, which is "a way to meet the equally unachievable design challenge of all-encompassing anticipation or envisioning of potential design to take place in use after project design" (2008, p.92). By identifying users as designers at use time, the focus of participatory design is shifted from designing products or services to creating environments for future design in everyday use (Ehn, 2008).

Björgvinsson and colleagues frame this new focus as design *Things*, a "socio-material assembly that deals with matters of concern" (2010). This socio-material assembly includes humans as well as non-humans. More importantly, "matters of concern" undermine the assumptions about the identifiable relevant stakeholders in participatory design research.

From Ehn and Björgvinsson et al.'s work, we can find there emerged a move in design beyond designing devices toward designing social and material *Things* that facilitate unforeseen users' appreciation and appropriation. This move provides professional designers a direction – and a challenge – especially in today's world where everyone designs.

To design *Things*, the socio-material assembly through which "matters of concerns" are dealt with, the powerful concept of infrastructuring was brought into participatory design.

Infrastructuring is believed to open up alternative ways for designers to think and behave. Ehn describes infrastructure as a socio-material thing which is "relational and becomes infrastructure in relation to design-games at project time and (multiple potentially conflictious) design-games in use" (Ehn, 2008, p.96). It is the social-material public *Things* in design games at use time. Ehn argues that in the process of infrastructuring, which is the objects of design in use, participants as well as their ways of using the infrastructure should be kept open.

Believing that infrastructuring is not limited to design-games in use, Björgvinsson articulated that the whole process of design should be seen as part of infrastructuring (Björgvinsson et al., 2010, p.43),

> Infrastructuring entangles and intertwines potentially controversial “a priori infrastructure activities” (like selection, design, development, deployment, and enactment), with “everyday design activities in actual use” (like mediation, interpretation and articulation), as well as “design in use” (like adaptation, appropriation, tailoring, re-design and maintenance) (Karasti & Baker, 2004; Pipek & Wulf, 2009; Twidale & Floyd, 2008).

Both these works emphasize a step toward long-term design that *Things* can be established through infrastructuring, in which continuous co-creation can be realized.

2.3.2. Social design

Ventura and Bichard view social design as a rapidly growing discipline, which engages contemporary designers in addressing wider social and political issues (2017). In their work, the designer is redefined as “social agent” (Ventura & Bichard, 2017, p. 227) who is equipped with a set of professional skills. As a legacy of participatory design, social design is applied to service or product development. The designed devices are developed for benefiting a community of people (Dell & Venkatesh, 2012). Through the social design project, connections between potential stakeholders and communities are initiated and facilitated (Hagen & MacFarlane, 2008). Product is offered as innovative solution to social issues (e.g., (Kusano, Ohno, & Kohtake, 2014)). In most literature of this corpus, social design is primarily considered as a method of product development. Communities of people are viewed as end-users who need designers’ support to deal with their social conditions.

In addition to framing communities as end users of designed products, researchers start to recognize the active role of community as “embedded social actors who draw on external networks, resources and infrastructures to manage the problems” (Ahmed et al., 2013, 14:1). Social design then is thought to embed designed products into specific social practices and networks and help people overcome their common problems as a united community. Discussions around the empowered social actors allow us to see how communities have the ability to leverage their resources and infrastructures to contend with the problems.

Very recently, with the concept of publics and infrastructuring, Le Dantec considers social design as “the set of practices rooted in community contexts” (2016, p.6). Rather than developing product, he argues, social design focuses on issues and

builds out social and technical capacities to contend with the issues. Through social design, the community itself is the designers who are able to deal with their present conditions.

Insightfully, Le Dantec proposes two implications for social design in terms of design as infrastructuring. First, he points out that design as infrastructuring makes design “no longer about product per se”, but about “creating the conditions in which solutions to future issues can be considered” (2016, p.87). In this way, the work of social design is not to create a device, but a social-material thing that enables a community to act. Second, Le Dantec discusses the effects of social design made into communities’ practices. He argues that social design should not be seen as an “exogenous influence” through devices that have designed effects on the community. Rather, social design, he addressed, should be treated as “co-constitutive, situating the specific effects of design within the community’s interpretations of those effects” (2016, p.89).

Design as infrastructuring, Le Dantec further argues, broadens our interpretation of invention, which could be a social invention (an infrastructure rather than a product) brought by a public through the attachments around issues. Consistent with Ehn’s “design for future use”, Le Dantec argues that participatory design should view the socio-technical as a dynamic resource instead of a stable setting in which technology is deployed (Le Dantec, 2016, p.27).

2.3.3. Discussion

Above, I have presented how the visions of participatory design and social design have moved from design projects with identified stakeholders, to design socio-material assembly that deals with matters of concern, to design as infrastructuring. In this process, the boundary between expert designers and non-expert designers is blurred. That is, the publics are “operating in a diffuse and competent design mode” (Manzini, 2015, p.48). In addition, the period of design process is extended. The project becomes an ongoing and open-ended process with an always “beta version” result (Manzini, 2015, p.52).

With the concept of infrastructuring, participatory design and social design have widened the view of innovation (Björgvinsson et al., 2010). In addition to the technocratic

view of innovation, social innovation “that arises out of social interactions and action that arises from the constitution of a public” is included (Le Dantec & DiSalvo, 2013, p.247). In this dissertation, I aim at uncovering the dynamics of those social interactions and actions in social innovation projects. On the one hand, it highlights the aspects of the social innovation projects in which interaction design can play a role and further support social change. On the other hand, I believe this effort will provide an expanded and deeper understanding of design as infrastructuring through which participatory design and social design can be operated.

2.4. City of Vancouver

In this section, I present an overview of local context of the City of Vancouver and the history of its community activism. I also describe and discuss a City of Vancouver urban sustainability initiative – Greenest City Action Plan. My goal is to understand the context of the three cases in more detail so as to better interpret the design process of the community-based social innovation projects in the city.

2.4.1. The City of Vancouver

The City of Vancouver is the eighth most populous city in Canada, with a population of 631,486 according to the 2016 census. The City’s population is very diverse with immigrants from many nations, such as China, India, and Philippines. The diversity is valued as a source of creativity and strength of the city. Policies and laws were adopted in the City to provide everyone with equal rights and access, regardless of race, origin, and ability. Located in the south-eastern corner of British Columbia, the City is also the business centre of the province.

2.4.2. History of community action in Vancouver

It has been a long tradition for citizens in Vancouver to participate in community affairs and city government. This is recognized as one of the reasons that make Vancouver become one of the best places to live in the world. In this section, I briefly present the history of community action in Vancouver.

In the late 1960s, community groups and neighbourhood associations formed to protest the massive urban planning projects in Vancouver. Among the activism, the most famous one was the community action exploded in the neighbourhood of Strathcona, an oldest residential community in Vancouver. In 1967, the city proposed to build a highway through the Strathcona neighbourhood into downtown Vancouver. The highway would have partially destroyed Chinatown and Gastown, which are historic areas in the city. Residents in Strathcona then protested the plan to preserve their neighbourhood. After the protest by the local residents, the city abandoned its plan and stopped the construction of a freeway. The protest was important. Because of this action, Vancouver is the only major North American city without a freeway going through its centre. More significantly, based on the experiences of local residents, the community action showcase the idea that neighbourhoods are at the core of city planning, and communities take an active and important role in directing the city development.

In addition to stop the clearance and redevelopment of the neighborhood, the community actors and neighbourhood organizations also provide services to turn their communities into socially and economically vibrant and healthy. They are not-for-profit, but they actively seek support and funding for vulnerable populations and communities of need. For example, in 1970s and 1980s, community activists made the Social Credit government to provide more services and funding for the Downtown Eastside to solve of problem of HIV infection and drug users. However, this community activism gradually "lost much of its impetus for opposing government intervention and priorities" (Roe, 2009).

More recently, community-based projects are initiated to make progress on environment and equity. For instance, Repair Matters is a project that empowers people to fix their broken objects rather than throw them away. The goal of this project is to engage more people in Vancouver with zero waste. By working with food producers, independent green grocers, and traditional restaurants, the Hua Foundation's Choi Project aims to bring local vegetables back to the Chinese families. Sharing economy (e.g., tool sharing and car sharing) has also been developed in the city to help make Vancouver less wasteful and more connected. These community projects are thriving across the city especially after the development of the Greenest City Action Plan 2020.

2.4.3. Greenest City Action Plan 2020

The City of Vancouver is one of the early innovators around the world to recognize and take actions to address the problems of climate change. This is evidenced by the policy history made by the city, such as the Clouds of Change report in 1990 and Agricultural Land Reserve Act in 1972. Recently, they city also created the Greenest City Action Plan 2020, aiming to further lead the environmental activities in the city on a long-term scale.

The City of Vancouver is recognized as one of the most liveable cities in the world. However, its environmental footprint is actually three times larger than the Earth can support (Vancouver, 2017). To address the environmental problems, the city has created a set of policies and plans to ensure Vancouver remain liveable for its residents. For example, Zero Waste is one specific strategy that the city has created to reduce the waste, preserve resources, and eliminate waste. The Climate Change Adaption Strategy was adopted to prepare Vancouver for the impacts of a changing global climate. Among the created plans and strategies, the most famous and ambitious one is the Greenest City Action Plan. In the following section, I discuss the Greenest City Action Plan and the projects that have been developed in the city in supporting the Greenest City goals.

The Greenest City Action Plan is an urban sustainability initiative created in 2009 in the City of Vancouver. Its main mission is to guide the city to become the greenest city in the world by the year 2020. The Greenest City Action Plan consists of ten primary goal areas and 15 measurable targets. Specifically, the ten goal areas and 15 measureable targets include: 1) Green economy: double the number of green jobs over 2010 levels by 2020; double the number of companies that are activity engaged in greening their operations over 2011 levels by 2020. 2) Climate leadership: reduce community-based greenhouse gas emission by 33% from 2007 levels. 3) Green buildings: require all buildings constructed from 2020 onward to be carbon neutral in operations; reduce energy use and greenhouse gas emissions in existing buildings by 20% over 2007 levels. 4) Green transportation: make the majority (over 50%) of trips by foot, bicycle, and public transit; reduce average distance driven per resident by 20% from 2007 levels. 5) Zero waste: reduce solid waste going to the landfill or incinerator by 50% from 2008 levels. 6) Access to nature: all Vancouver residents live within a five-minutes walk of a park, greenway, or other green space by 2020; plant 150,000 new trees by 2020. 7) Lighter

footprint: reduce Vancouver's ecological footprint by 2020 over 2006 levels. 8) Clean water: meet or beat the strongest of British Columbian, Canadian, and appropriate international drinking water quality standards and guidelines; reduce per capita water consumption by 33% from 2006 levels. 9) Clean air: always meet or beat the most stringent air quality guidelines from Metro Vancouver, British Columbia, Canada, and the world health organization. 10) Local food: increase citywide and neighbourhood food assets by a minimum of 50% over 2010 levels.

Since it was initiated, many actions mentioned in the plan have been completed, such as creating more community gardens and farmers markets. The progress towards this ambitious vision was made not only by the City's work, but also its collaborations with residents, businesses, and communities. There are considerable exciting community-based projects that have been initiated city-wide in past years responding to the goals and targets set up in the Greenest City Action Plan 2020. Moving forward, the City continues to take action at the department level and provide support and services so as to enable the sustainable community and lively communities it envisions.

2.4.4. Criticism of Greenest City Action Plan 2020

Above, I have briefly introduced the local conditions of City of Vancouver and the Greenest City Action Plan 2020 that was created to guide the city to become the greenest city in the world by 2020. The goals and targets listed in the plan are very encouraging and ambitious. However, it is also important to recognize the problems associated with it.

One obvious challenge is that the city is so liveable and it attracts immigrants from all over the world, which causes increasing density inside the city. Criticism about the action plan points out that there is a possible link between the green ambitions and the lack of affordable housing (Affolderbach & Schulz, 2017). According to the 2016 Global Real Estate Bubble Index (Obiko Pearson & Dmitrieva, 2016), Vancouver ranked first because of its housing prices. Therefore, Vancouver's green development would have made the city more desirable to residents and caused the rise in housing costs and population density.

Second criticism of the Greenest City Action Plan is related to the conflicts between the local economic and environmental objectivess. In his thesis, Soron points out that the Greenest City Action Plan “fails to confront the most fundamental features of neoliberalization that prevent an effective response to the ecological crisis” (Soron, 2012, p. 83). He rejects the possibility of continued economic growth because of the resource limitation in the city. Soron argues that, in promoting economic growth, the economic targets listed in the Greenest City Action Plan fundamentally contradict its environmental goals, as “it cannot produce absolute reductions in material use of pollution” (p.84).

The third problem of the Greenest City Action Plan is the tension it creates between citizen participation and the formal procedural regulation. Scerri and Holden argue that policy-makers should not only involve local actors merely in planning, but also in idea-generating forums and qualitative dialogue (Scerri & Holden, 2013). They believe that planning for sustainable development should both “foster and manage the democratizing pressure”, which arises as informal below participation meets formal ‘top-down’ process (Scerri & Holden, 2013, p.261). Similarly, Holder and Larsen argue that the city fails to create enough connections with citizens and communities or realize the potential value of maintaining the relationships created during the Greenest City Action Plan process (Holden & Larsen, 2015). They think the Greenest City Action Plan is “a trade-off between authentic and empowering citizen engagement and the feasibility of long-term implementation” (p.363).

2.5. Summary

In this chapter, I have presented the background of this research. First, the theoretical framework of publics and the theory of infrastructuring were articulated. The goal is to utilize this framework as an analytical lens to understand the design process of social innovation projects, thus the characteristics of design process in such projects can be uncovered. Specifically, enabled by the concept of infrastructuring with respect to publics, I can have guides for articulating how sociotechnical resources are integrated and marshalled in contending issues by publics. In other words, the process starts with a common issue shared by a public. To address the issues, a public builds out diverse relations and reaches multiple resources via existing and newly articulated attachments.

Based on these concepts, the articulation of the characteristics inherent in the process of social innovation projects can be possible.

Second, how the social innovation is interpreted in this research is presented. Specifically, social innovation projects aim to solve or change social problems that are intractable. In these projects, people make changes in a novel way. They make both societal and environmental contributions. What makes social innovation projects unique is that the innovation is driven by a social change instead of technical innovation. An overview of recent works on design for social innovation has also been presented.

Third, I have presented how the visions of participatory design and social design have moved from design projects with identified stakeholders to design as infrastructuring. By uncovering the ongoing dynamism and flux involved in the social innovation projects, in which the public identifies and integrates multiple resources, I believe this study informs the continuing work of participatory and social design. Moreover, these revealed dynamics will highlight the aspects of social innovation projects in which interaction design can play a role for further meeting social goals.

Finally, I presented an overview of local context of the City of Vancouver and the history of its community activism. I also describe and discuss its Greenest City Action Plan.

In the next chapter, I will present details of research methodology and research design.

Chapter 3.

Research Methodology and Research Design

In this chapter, I first restate the theoretical framework, research purpose, and my research questions. Then, I present the research methodology and design of this study. I also articulate the reasons why a qualitative multiple-case design was selected in this research. Guided by the selected approach, cases and units of analysis are also described in this chapter.

3.1. Theoretical framework restatement

The framework of this research is the theory of infrastructuring in relation to the theoretical framework publics (Le Dantec, 2016). It is adopted to understand the collective design of community-based social innovation projects. Specifically, in this theoretical framework:

- Issues are a set of social conditions. It is the basic element to form a public. Issues are evolving. The shape of issues changes as different actors become involved.
- A public is a particular configuration of people affected by the issues. It is dynamic and contingent with the presence and evolution of issues.
- Attachments are the relations through which sociotechnical resources participate actively with each other. Sociotechnical resources include actors, artifacts, and institutions and other categories that might be included. Central to the relations is the interplay between “dependency on” and “commitment to”.
- Infrastructuring is the work of integrating sociotechnical resources via present and newly created attachments to contend with issues.

3.2. Research purpose and questions restatement

The purpose of this study is to validate the effectiveness of the theory of infrastructuring in relation to the theoretical framework of publics (Le Dantec, 2016) in describing the collective design of community-based social innovation projects and to uncover the characteristics of design process in such projects that interaction designers can support.

The questions this study aims to address are:

- How does the theory of infrastructuring in relation to the theoretical framework of publics (Le Dantec, 2016) effectively describe the collective design of community-based social innovation projects in an urban Canadian city?

- Based on the theory of infrastructuring, what are the characteristics of the design process in community-based social innovation projects that can be supported by interaction designers?

To address the goals and questions of this research, it is important to select an appropriate type of research method (Maxwell, 2005). Below, I illustrate the research methods that were selected in this study and the reasons why they are believed to be most appropriate.

3.3. Using qualitative research methodology

Compared to quantitative research, qualitative research focuses on people and specific phenomena, and emphasizes individuals' words rather than statistical data (Maxwell, 2005). Thus, a qualitative approach was selected to address the questions and goals of this research.

3.3.1. The characteristics of qualitative research methodology

"Qualitative research begins with assumptions and the use of interpretive/theoretical frameworks that inform the study of research problems addressing the meaning individuals or groups ascribe to a social or human

problem”(Creswell, 2013, p. 44). It deals with the social and cultural phenomenon in real-world context and provides a comprehensive and detailed understanding of the problem or issue under study (Creswell, 2013a).

In quantitative research, the relationship that exists between a researcher and the participants are de-emphasized. In qualitative research, an investigator talks directly with people, goes to their homes or working places, and listens to their stories. That is, the diverse perspectives that participants hold about the problem are interpreted and reflected by the researcher in the qualitative research process. The outcome of qualitative research is a holistic and complex account of the phenomenon under study (Creswell, 2013).

In this dissertation, I am interested in understanding the underlying process of community-based social innovation projects. The detailed information of those processes can be obtained by talking directly to the actors involved in those projects. The stories that they share can then provide multiple perspectives for me to understand the design process. In addition, to better answer the research questions, the context in which these projects are embedded need to be understood. Quantitative research cannot tell the process that the actors experience, the context in which they responded or the deeper thoughts behind these responses, while qualitative research empowers the participants to share lively stories with me. Therefore, it indicates that qualitative research is appropriate for use in my study.

3.3.2. Qualitative research approaches

Under the umbrella of qualitative research, there are many research methodologies. Common qualitative approaches include narrative research, phenomenological research, grounded theory research, ethnographic research, and case study research (Creswell, 2013).

Each approach has a distinct focus (Creswell, 2013). Narrative research is used for exploring a person’s life. Phenomenology is to understand the nature of the lived phenomenon. Grounded theory is applied when a theory is to be developed based on the data collected from the field. Ethnography is used to understand a culture-sharing

group. Case study is applied when the focus is to develop an in-depth interpretation of one or more cases.

Creswell also differentiates the five approaches in terms of the research problems that are suited for applying them. For example, a narrative research is a good choice when there is a need for lived and told stories of individuals. Phenomenology is suitable when it needs to describe the essence of the experience. Grounded theory can be considered when there is a need for “unified theoretical explanation” (Corbin & Strauss, 2007, p. 107). In ethnography, the researcher describes the patterns that emerged from a culture-sharing group (Harris, 2001). Finally, case study is the preferred research approach when there is a need for providing a comprehensive and in-depth understanding of an issue.

In this dissertation, case study approach was selected. The deeper considerations and rationales for this decision are articulated in the following section.

3.4. Selecting multiple and descriptive case study as the methodological approach

In this section, I illustrate more details about the case study research method as the methodology of this research. Furthermore, I present the specific types of case study design that were selected and the reasons behind my decisions.

3.4.1. Case study research method

The purpose of the thesis is to validate the effectiveness of the theory of infrastructuring in relation to the theoretical framework of publics in describing the underlying design process of community-based social innovation projects. It is believed that a case study approach is the most suitable choice among the five qualitative research approaches. This is because the case study method has advantages in providing a holistic description of social phenomenon within a real-life and contemporary context (Yin, 2009).

In his book, Yin defines the case study research method from two aspects: the scope and features of a case study (Yin, 2014). On the one hand, a case study is

conducted to investigate a real-world and contemporary phenomenon in great detail. The investigation includes contextual situations that closely relates to the case. It is not always easy to sharply distinguish the phenomenon from its context in a case study. On the other hand, a case study involves large number of variables of interest. It thus depends on multiple data sources of evidence that require triangulations. In addition, the data collection and analysis process in a case study can be guided by theoretical propositions that are developed in advance. Based on these distinctive features of case study, Yin illustrates that the case study research method is relevant when research questions are to explain current circumstances or require a comprehensive description of certain social phenomenon. Further, he argues that the case study research method has a distinct advantage when an investigator has very little or no control of a real-world set of events.

For this study, there is little to no control of the real-life design process in community-based social innovation projects. In addition, the multiple data sources of evidence that the case study method enables offer detailed and in-depth description and interpretation of the design process of such projects. Furthermore, the theory of infrastructuring in relation to the framework publics acts as an important role in guiding the data collection and analysis process in this study. Therefore, a case study research method was selected for this research, to provide a holistic understanding of the design process in real-life and contemporary social innovation projects.

3.4.2. Types of case studies

This section describes my considerations of what type of case study to select in this research. Various terms are used to categorize case studies. Yin identifies case studies as exploratory, descriptive and explanatory (Yin, 2003). He also categorizes case studies as single, multiple, and holistic and embedded. Stake distinguishes case studies as intrinsic, instrumental, or collective (Stake, 1995). Below, I present the rationales for selecting the types of case study design in terms of this research.

Collective study

In terms of intent, a case study can be categorized as an intrinsic case study, an instrumental case study, or a collective case study (Stake, 1995). In an intrinsic case study, the investigator illustrates a unique case and describes its unusual characteristics

in details. In an instrumental case study, the researcher focuses on an issue and depicts the issue in a selected case. In a collective case study, the researcher illustrates issue through studying multiple cases.

For this research, I chose a collective case study. Through studying multiple cases, the design process of community-based social innovation processes can be explored and described in detail. Each case in this study is an instrument for exploring the issues in this study. The uniqueness of the cases is not the main focus in this study.

Multiple-case design

To conduct a strong case study research, Yin explicitly presents two basic types of design for case study (Yin, 2014). They are single-case design and multiple-case design.

Of these types, single-case study is a suitable choice when studying a “critical, unusual, common, revelatory, or longitudinal” case (Yin, 2014, p.51). When a study contains more than one case, it is a multiple-case study. Compared to a single case study, a multiple-case study collects more compelling evidence and thus is considered as a more robust selection (Herriott & Firestone, 1983).

In this dissertation, a multiple-case study was selected rather than a single-case study. Through applying the theory of infrastructuring, the purpose of this study is to describe the underlying design process and uncover the characteristics of the process in social innovation projects. It is not to state an extreme, unusual or common case to the theory. In addition, the study is not revelatory because the phenomenon of social innovation projects has been previously accessible by social science researchers. Finally, this study does not fit the longitudinal rationale for selecting single-case design; because it does not specify how the projects are designed by certain conditions through examining the case at two or more points in time. Instead, this research aims to account for the design process of the social innovation projects.

Besides, Yin advises that multiple-case designs are preferable to use over single-case designs. He argues that the analytic benefits of multiple cases are notable and the conclusions will be more powerful.

Hence, to depict the design process of community-based social innovation projects and uncover the characteristics of such processes, a multiple-case study was selected in this research. It is believed that the information from multiple social innovation projects can produce compelling evidence to form a strong statement of the underlying design process in these projects.

Literal replication design

In multiple-case designs, each case is selected to pursue patterns of literal replication (similar results) or theoretical replication (contrasting results). Yin suggests that two or three literal replications can be considered when “the theory is straightforward and the issue at hand does not demand an excessive degree of certainty” (Yin, 2014, p.61).

In the multiple-case study of this dissertation, the theory of infrastructuring in relation to the framework of publics (Le Dantec, 2016) that the propositions of this research are built on is unambiguous and direct. Therefore, three cases that are believed to be literal replications were selected.

Holistic case studies

In multiple-case study, each individual case can be either holistic or embedded depending on the studied phenomenon and research questions (Yin, 2014). When an individual case includes more than one subunit of analysis, the multiple-case study is embedded. In an embedded multiple-case study, subunits can be selected through techniques such as sampling or cluster (McClintock, 1985). These subunits often provide momentous opportunities for broad analysis and insights into the cases.

According to the research questions and the interested phenomena of this research, a holistic case study was selected. The unit of analysis is the social innovation project and the context of the case is the city of Vancouver where the project was initialled and developed. Moreover, because the relevant infrastructuring theory underlying this case study is itself of a holistic nature, the holistic design was advantageous to be selected in this research.

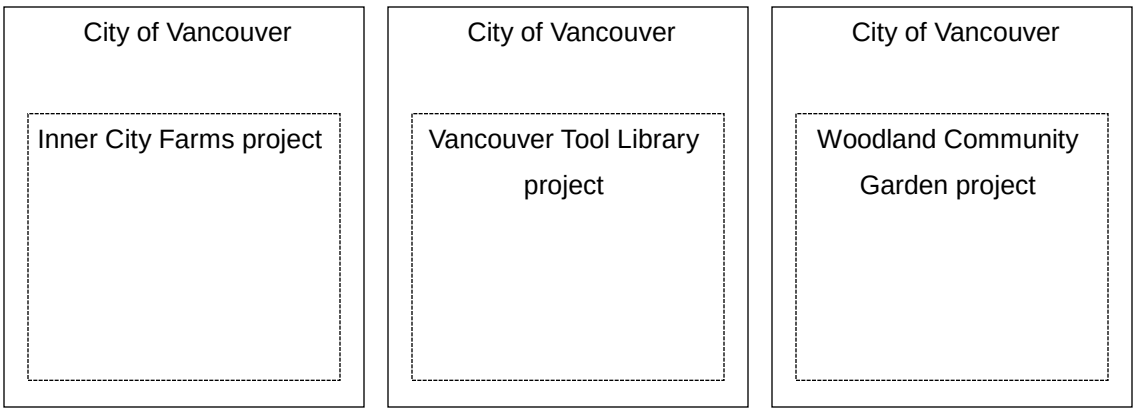


Figure 3.1. Multiple-case and holistic design

Descriptive case study

Regarding the purpose of research, a case study can be categorized as explanatory, exploratory, or descriptive. An explanatory case study is used when the investigator's intention is to explain the supposed causal links in contemporary interventions. When the outcomes of the evaluated intervention are not clear and hard to portray, the exploratory case study is suitable. A descriptive case study is used when the research is to describe an intervention or phenomenon occurring in the real-life setting (Yin, 2003).

For this research, my goal is to describe the design process in social innovation projects and uncover its characteristics. The goal is not to explain the causal links or explore the outcomes of intervention. Therefore, a descriptive case study is selected in this research.

In summary, in this section, I have presented the types of case study research designs and articulated the reasons why this research was categorized to certain types. To sum up, this case study research was designed to be a descriptive multiple-case study in which collective cases were investigated. Moreover, the cases were selected to produce patterns of literal replication.

3.4.3. Procedures for conducting a case study

In the above sections, the reasons why the selection of a case study approach is suitable for this research were articulated. The types of case study that this research adopted were also introduced. In this section, I briefly describe the procedures for

conducting a case study based on Creswell (2013) and outline the main phases in this research guided by the case study design.

In conducting case study research, selecting which cases to study is an important step (Creswell, 2013). In order to show different aspects of a research problem, Creswell suggests using “purposeful maximal sampling”, a technique that identifies and chooses individuals or groups that are well informed or experienced with the central phenomenon (Creswell & Plano Clark, 2007). To study the collective design process of social innovation projects, the identification and selection of cases in this case study research was illustrated.

For the data collection step, multiple sources of evidence are drawn on in case study research. Forms of evidences that a case study investigator can collect include, for example, interviews, documents, archival records, direct observations, participant observations, and physical artifacts (Yin, 2013). In this case study research, four types of information were collected. They are interviews, documents, direct observations and participant observations. Details about the data collection procedure of this case study research will be described in Chapter 4.

The data analysis procedure includes a detailed description of the case and the context of the case. These detailed views of aspects enable the investigator to understand the complexity of the case. To identify issues within each case and look for common themes across cases, Stake (1995) proposes four types of data analysis: direct interpretation, categorical aggregation, patterns, and naturalistic generalizations. Direct interpretation draws meaning across parts of an individual instance of data. With categorical aggregation, researchers reach new meaning about cases through aggregation of multiple instances. Patterns are established by looking at the similarities across categories. Naturalistic generalizations are lessons learned from the case that could apply to a population of cases. In a multiple case study, a typical format for data analysis consists of a within-case analysis, cross-case analysis and assertions of the meaning of the case (Creswell, 2013). In this dissertation, Chapter 5 to Chapter 8 will present the details of data analysis in this multiple case study research. The themes within the case and analysis across the cases will be articulated.

The final phase of the case study research is to reporting the meaning or lessons that comes from learning about the issue of the case. In this dissertation, Chapter 8 will discuss the outcomes of this inquiry.

3.5. The three cases and city of Vancouver

To study the collective design of social innovation design projects, three projects in city of Vancouver were identified and selected as the cases in this study. In this section, I first briefly introduce the context of the three cases – the city of Vancouver. After that, identification and selection of cases in this case study research is illustrated.

3.5.1. City of Vancouver

The context of the cases selected in this research is the city of Vancouver, which is located on the west coast of Canada. It is a dense city with citizens from diverse cultures and ethics. A large part of the population is immigrants, including Chinese, South Asians, Latin Americans, and so on.

In 2011, the City Council approved the Greenest City 2020 Action Plan, which was developed to guide Vancouver to become the greenest city in the world by 2020. There are 10 goals outlined in this action plan: climate and renewables, green building, green transportation, zero waste, access to nature, clean water, local food, clean air, green economy, and lighter footprint.

Specifically, in terms of local food, Vancouver aims to become a global leader in urban food systems. In the action plan, it explicitly points out that the city will “adopt and implement urban farming policy to further enable commercial food production in the city and increase the number of urban farming business from 18 to 35” and “increase number of community garden plots from 4,423 to 5,500 … with particular emphasis on encouraging broader participation by ethno-culture groups” (Vancouver, 2016, p. 46). With respect to the goal of lighter footprint, the city will “develop a municipal sharing economy strategy” and “continue to expand the Greenest City Fund” (Vancouver, 2016, p. 64).

Therefore, a variety of projects that are considered as building blocks to reach those goals have gained overwhelming support from the city.

3.5.2. The cases

As previously discussed, this study uses a literal replication design. Each project was selected by following the criteria outlined below:

- A project that is aimed to solve an intractable social problem and for well-being.
- Actors in the project do things in a radically new way. They reallocate existing resources and skills to create new service and new meaning.
- Societal and environmental benefits are simultaneously made in the project.
- A project that is triggered by introducing a new social form, instead of a technical invention.

By following the criteria, I selected three projects as my cases in this research. Since the study was designed to be holistic, the units of analysis were the three selected projects.

In the following sections, I introduce the main qualities of each project and explicitly articulate how each of them meets the criteria. I also highlight the differences between the projects. Detailed narratives about each project are presented in the individual case reports, in Chapters 5, 6, and 7.

Inner City Farms

The project Inner City Farms runs with a model of community-supported agriculture (CSA), which is a new production and economic model. The project takes advantage of unused yards inside the city area and grows vegetables in them. It sells the vegetables directly to the people who are registered as CSA share members before the season starts. In this project, multiple groups get involved and all of them benefit from the project. Although there is a team of around 10 volunteers working for the farm every year, the project mainly relies on the head farmer’s work. In every growing season,

he leads the farming team, gets connected to families and restaurants, and delivers the vegetable shares.

Figure 3.2. Inner City Farms

The Inner City Farms project aims to solve the unsustainable food problems caused by industrialization in Vancouver. Farmers in the project grow food by using a radically new mode. They redefine the private yards of people's houses as potential farming land and encourage individuals who are passionate about farming to join the program to together make a change. Social links between farmers and consumers are created and a better urban environment and food culture are developed through the project.

More details about Inner City Farms project are presented in Chapter 5.

Vancouver Tool Library

The Vancouver Tool Library project is run by a group of volunteers who want to share tools and reduce the economic and environmental costs in the community. Through sharing tools and running workshops, the project connects neighbours and creates a new form of social community. The project is run by a group of volunteers, who organize themselves through a board of directors and coordinated teams. There is also a paid manager who works 25 hours every week in the tool library. Currently, the tool library has over 1,800.

Figure 3.3. Vancouver Tool Library

The Vancouver Tool Library project aims to respond to the problem of economic and environmental wastes caused by purchasing and using tools in the city. Its goal is to contribute to a more sustainable living. A new type of service – tool sharing – is provided by the project. Actors identify the tools as shareable resources as well as people's skills in using tools as shareable knowledge. Through sharing physical tools and skills in using them, both societal and environmental benefits are made in this project.

In Chapter 6, I present more details about the Vancouver Tool Library project and deeper interpretations about it.

Woodland Community Garden

The Woodland Community Garden is set up and managed by Woodland neighbours who aim to improve the quality of daily life and create a more lively and friendly environment in that area. The garden is located at the Woodland Public Park and includes 77 garden plots. Gardeners manage themselves as a group and maintain the garden through collaborative work.

Figure 3.4. Woodland Community Garden

The garden is built to enable neighbours to grow their own food and increase the social fabric of the Woodland community. Neighbours utilize part of the parkland as gardening place and involve a number of individuals who contribute a variety of skills to the project.

More information about the Woodland Community Garden project is presented in Chapter 7.

3.5.3. Discussion

From the above brief descriptions of the three projects, we can find there are similarities and differences among them. First, all three projects are aimed at the sustainability of the city, but the functions or services each project creates are different. Inner City Farms project provides local produced vegetables to citizens. Vancouver Tool Library enables communities to get access to tools more easily. Woodland Community Garden gathers neighbours through the gardening plots so that people can grow their own food together in the community.

Second, the scale of each project is different because of the numbers of actors involved in them. Specifically, about 20 people participate in Inner City Farms, including the professional farmers and interns. They grow vegetables for about 50 families and five to ten local restaurants. In the project of Vancouver Tool Library, about 30 volunteers act as administrative members and shop volunteers who keep the project moving. The number of members who use the tool services is about 1,800, which is very large. In the

Woodland Community Garden project, there are about 100 members who grow vegetables and manage themselves collectively.

Third, the organizational structure of the three projects is different. In Inner City Farms project, it mainly relies on the head farmer's decisions and work. In the tool library project, the board team makes decisions and set the directions of the project. In the community garden, gardeners together discuss their issues and find solutions to them. This means the organizational structure is flatter than the other two.

Fourth, the main resources allocated in these projects are different. Private yards of landowners are used as farming land in Inner City Farms. In the tool library, tools become the resources that people share. In the community garden project, public land is repurposed for gardening.

Fifth, all the projects are consistent with the Greenest City Action Plan, but the specific goals they meet are different. The Inner City Farm and Woodland Community Garden mainly meet the city's target of increasing city-wide and neighbourhood food assets. However, the Vancouver Tool Library meets the target of reducing Vancouver's ecological footprint.

The table below presents an overview of the comparisons of the three projects.

Table 3.1. Comparisions of the three cases

Case	Inner City Farms	Vancouver Tool Library	Woodland Community Garden
Project type	CSA	Tool sharing	Community gardening
Resources reallocates	Private yards	Tools	Public parkland
Organizational structure	Significantly depends on one person (centralized)	Board team, coordinators, shop volunteers (hierarchical)	Gardeners themselves (flat)
The number of actors as service providers	20	30	100
The number of individuals as users	50 families and 5 -10 restaurants	1,800	100
City goal	Local food	Lighter footprint	Local food

3.6. Summary

In this chapter, I presented the methodology and design of this research. Specifically, a qualitative and descriptive multiple-case approach was identified as the research method in this study. I also explained the rationales for selecting this approach. The descriptive multiple-case approach is believed to be a suitable choice to answer the research questions and reach the purpose of this study. It allows an in-depth description and understanding of the design process of real-life social innovation projects in a community context.

In addition, three projects were selected as the three cases in this research to produce a literal replication. Finally, I also briefly described each case and presented the comparisons among them.

In the next chapter, I will present the further details about the types of data collected and the ways they were analyzed in this research.

Chapter 4.

Data Collection and Analysis

In this chapter, I describe the details of the procedures of this multiple-case study. Specifically, the preparation before data collection, the details in collecting the evidence in the field, and the strategies and techniques applied in analyzing data in this case study are sequentially presented.

4.1. The preparation to collect case study evidence

There are several steps I took before I went into the field to collect data. In this section, I describe these steps in detail. First, I present the case study protocol that I developed, which includes a detailed plan for conducting the study. Second, I describe the process for the final selection of the cases involved in the field study. In addition, I present the pilot studies and the lessons learned from them.

4.1.1. Case study protocol

Yin (2014) believes that a protocol can increase the reliability of case study research. It is essential especially in a multiple-case study. This is because case study protocol can guide the researcher in the data collection process. Moreover, a protocol keeps the investigator focused on the topic of the case study. It also encourages the researcher to consider the practical problems of the study in advance.

In this study, the case study protocol includes three sections. First, it describes the expected sources of evidence that help answer the research questions. Second, it presents the operational procedures of data collection in the field. The final part of the protocol describes the procedures for protecting the participants in the study. Each section is presented below.

Types of evidence

In his book, Yin lists six sources of evidence that are commonly used in case study research (Yin, 2014). They are “documentation, archival records, interviews, direct

observation, participant-observation, and physical artifacts" (p.105). These various sources of evidence are believed to be complementary and thus it is suggested to include as many as possible in a case study (Yin, 2014). The use of multiple sources of evidence provides benefits to a case study because it allows the triangulation and corroboration of the collected data through "converging lines of inquiry" (Yin, 2014, p. 120). Therefore, the results and conclusions made in a case study are more accurate. The validity of a case study is strengthened.

In this study, four sources of evidence are relevant:

- Interviews, which take the form of semi-structured and in-depth interviews.
- Documentation, which takes the form of design files, membership policies, event reports, and online articles.
- Direct observations, which include visits to the physical space of each case and observation of the location and the furnishings of the interviewee's work space.
- Participant-observations, which include being a participant in the events and serving as a volunteer in the organizations.

Of these four types of data sources, the most important source is the interview. This is because the collective design process is latent behind the life of a project. Through interviews with individuals, data about the design process of social innovation projects can be obtained. Further to the interviews, documents are collected to help verify evidence collected from other sources, for example, the names of the people and organizations mentioned in the interviews. They also provide more details about the issues that are discussed. In addition to interviews and documentation, direct and participant observations are selected as evidence sources in this study. They are useful in providing additional information about the design process and understanding the dynamics of it.

Instruments for doing fieldwork

Instruments used in this study were prepared before conducting the fieldwork. These instruments include:

- Digital devices: an audio recorder and a camera
- Writing instruments: a pen, a notebook, paper clips, and empty table shells.

The digital audio recorder was used in face-to-face interviews to record the whole process of the interview for later transcriptions. A camera was used for taking pictures of the physical space of the projects visited as well as the events participated in. A notebook was used for recording field data and keeping memos in real-time.

Besides these devices for doing fieldwork, additional documents were prepared for gaining access to interviewees. For example, a participant recruitment letter was prepared for key informants to let them show or send to potential participants.

Procedures for protecting participants

Prior to fieldwork, protecting participants from any potential harm was carefully considered.

Before conducting this research, a research ethics report was reviewed and accepted by the Simon Fraser Research Ethics Board. A Consent Form was also prepared to allow participants to be explicitly informed about the conditions and instructions associated with this research. It is also promised that the names of participants are to be pseudonyms, so that their confidentiality can be protected. In addition, all the collected data are stored and viewed as confidential information, and are not going to be shared or discussed with persons who are not relevant to this research.

Therefore, in preparing to collect evidence, I also prepared necessary documents. These documents included informed consent forms and an ethics report.

Data collection questions

The most important part of the protocol is a list of questions that embodies the questions the researcher investigates (Yin, 2014). In the case study protocol, I also proposed a set of questions that I would like to explore in this study. The major goal of the questions is to keep the investigator on track in the process of data collection (Yin, 2014). Yin suggests that the protocol questions could be quickly reviewed before starting a field interview to remind the researcher about the information that needs to be collected. The protocol questions thus are for queries to the investigator instead of to the

participants. In Yin's language, there are "five levels of questions" (Yin, 2014, p.91). They are:

- Level 1: questions to specific participants
- Level 2: questions asked of individual cases
- Level 3: questions asked of the pattern of findings across multiple cases
- Level 4: questions asked of an entire study
- Level 5: questions asked beyond the scope of the study

Among these questions, it is suggested that level 2 questions should be concentrated on heavily for the case study protocol. In the protocol of this study, I listed the questions at this level as my interview guide. These questions are:

- What are the significant problems in the design process in this social innovation project?
- Who are the people affected by those problems?
- What are the resources (actors/tools/materials) that were involved in the design process?
- What are the relations that were created among them?

In the protocol, I also developed a document that lists level 1 questions. This document is prepared as an instrument to be shared with my participants to make them familiar with the questions before the interviews. These questions are listed in the section In-depth interviews.

It should be noted that the level 2 questions are about the case level (unit of analysis) of the case study (Yin, 2014). They are different from the level 1 questions that are asked of individual participants (unit of data collection). In this study, although data collection strongly relied on the information from individual interviewees (unit of data collection) who participated in the developing of social innovation projects, the protocol questions were about the projects, not the individual participants. Other evidence about

the design process of the social innovation project was obtained from documentable outcomes, direct and participant observations.

4.1.2. The pilot studies

The benefit of running a pilot study is to help the investigator improve the data collection plans before the actual case study (Yin, 2014). The pilot study provides the research to refine questions and even clarifies important concepts in a study (Yin, 2014).

In this research, pilot studies were conducted before applying for approval from Institutional Review Board (IRB). They were also conducted prior to the final articulation of the theoretical propositions of the study and the final selection of cases. At the very beginning, before I had better concepts on infrastructuring and social innovations, the study aimed to understand the “collaborative making practices” of “collaborative organizations”, which proved to be not clearly articulated and it was decided not to use it in the end after the pilot studies. The initial criteria for case selection were: heterogeneous actors, embodied involvement, open-ended process, and public visible outcome in urban areas. The criteria were also proved to be not clear-cut enough in selecting cases.

The goals for running pilot studies were multifold. First, pilot studies were conducted to clarify the main issues being studied. Second, the pilot data were believed to help refine the theoretical propositions as well as criteria for selecting cases. Third, the final research design was informed with a fresh set of empirical data collected in the pilot studies. In addition, the interview questions could be stated in a more congenial tone for participants in cases.

The pilot cases

In selecting cases for the pilot study, Yin mentions that the main criteria are “convenience, access, and geographic proximity” (Yin, 2014, p. 96). According to these principals, the pilot studies in this research involved four cases. All of them are urban collaborative projects that integrated heterogeneous actors and resulted in visible public outcomes. The first pilot case is the Choi Project. The second project is the Green Bloc Project. The third one is the Prado Parklet Project and the fourth pilot case is the project ThisFish. Each project is briefly introduced below.

Pilot case #1: The Choi Project

The Choi Project is a program of the Hua Foundation, which aims to provide more local, pesticide-free, and hormone-free food products that can be used in Chinese traditional cuisine. The Hua Foundation is a grassroots non-profit organization that aims to develop solutions and advance movements for Chinese-Canadians to reconnect with Chinese cultural heritage while promoting environmental sustainability. They believe healthy food can motivate people to care about their environment and, with this in mind, they initiated the Choi project. The Choi project commenced as the Choi guide pamphlet which provided a broad education about local Asian leafy green vegetables. Following that, the operators of the project started to work with local businesses to create bilingual signage that informed people about seasonal vegetables. They then cooperated with local businesses to offer workshops that teach younger generations how to cook traditional food. Aside from working with local businesses, they have also hosted workshops with The Food Connection and at Strathcona Elementary, sharing food traditions and talking about sustainability. They have also held workshops for growing local food with Fresh Roost. The project is supported by Vancity and Vancouver Foundation's Greenest City Fund in partnership with the City of Vancouver. It also has been involved with many local partners, such as urban growers, local businesses and artists.

Pilot case #2: Project Green Bloc

Project Green Bloc is a pilot project that was started by residents of the Riley Park neighbourhood. Working with Evergreen, residents aim to reduce their collective ecological footprint by 25 percent over three years through science-based models and community collaborations on a neighbourhood scale. By applying the latest research, community dialogues and supporting lively activities and workshops, Project Green Bloc also helps its residents learn about their patterns of consumption and encourages them to work together to reduce their ecological footprint. Project Green Bloc brings people together to create a more sustainable and happy neighbourhood. The project is designed to act as a model that residents of cities across North America can use to build a movement together.

Pilot case #3: Commercial Drive Parklet

The Commercial Drive Parklet was transformed from two parking spots on the street outside of Prado Café. It is the only parklet in Vancouver that is undertaken by active residents of the neighborhood. It expresses the attitude that streets are not only for cars but also for the neighborhood community. The original team of the Commercial Drive Parklet includes a social artist who lives in the neighborhood, a designer, a landscape architect and employees from Prado Café. The project is supported by a combination of public and private funding as well as through a Kickstarter campaign. They also looked for donations of materials and construction labor and contacted the City, adjacent business owners and the Commercial Drive Business Improvement Association for support. With regard to the construction materials and skills, the team got support from multiple institutions and individuals. They include, but are not limited to, local forest and paint companies, students from schools, local artists as well as neighborhood residents. The physical construction of the parklet was much delayed from the original expected timeline because it took longer for the City to approve their design. This is because the City needs to examine every element of the parklet and talk to street engineers, transportation, and bylaw officials to make sure each group checked the project. Now, the Prado café has the responsibility to clean and maintain the parklet.

Pilot case #4: ThisFish

ThisFish provides an online tool which maps seafood from boat to plate. It is a program for social networking and seafood traceability. Initiated by Ecotrust, which aims at designing economic alternatives that benefit people, ThisFish was designed and built with invested partners that include retailers, processors, and fishermen. People are able to trace their purchased seafood on the Internet by inputting a tracking code. In this way, consumers can find the fishers who caught the seafood and the industries that provided support as well as more information about their seafood. It increases the accessibility of community to markets and creates transparency of the seafood supply chain. ThisFish helps connect consumers with producers and builds shared values and commitment to a more sustainable future for fishing industry.

In summary, these four cases are all collective-designed projects that are operated by social groups in collaboration with the support of other local organizations or

individuals. Since their launch, they have consistently developed and grown, and various networks have gradually evolved.

Lessons learned

In studying these pilot cases, I learned a number of lessons. These empirical experiences significantly helped me in improving my research plan. Specifically, there are two categories of issues that were altered and evolved in the research design: 1) substantive issues and 2) methodological issues.

In terms of substantive issues, I realized that the major aspect of the study was not clearly articulated. Individuals that I interviewed in the pilot cases were confused about the meaning of “collaborative working”. In other words, to clearly identify “the most important issue” (Yin, 2014, p.168) of my case study, I should have a better theoretical framework to define and articulate the collaborative working process. Second, I realized the criteria on case selection needed to be improved. For example, regarding the temporality, some projects (e.g., Project Green Bloc) were completed. Some projects were still going on (e.g., The Choi Project). As to the result of the projects, several of them produced new forms of organizational models (e.g., ThisFish), but some did not (e.g., Project Green Bloc). Therefore, I realized that the criteria for selecting cases should be more specified and clear-cut.

Furthermore, “the pilot study can provide information about relevant field questions and about the logistics of the field inquiry” (Yin, 2014, p. 97). In terms of the methodological issues, I learned that there are multiple stakeholders in each project. It would be a big challenge in this study to recruit them. A sound method should be selected and planned when reaching out to the stakeholders.

The lessons learned from the pilot studies were used parallel with a continuing review of the literature on the infrastructuring theory. Therefore, the final research design benefited from both the theories and the empirical experiences learned from the pilot studies.

In conclusion, I believe the goals of the pilot studies were achieved. Based on the lessons I learned from it, I revised the original case study protocol. Specifically, the theory of infrastructuring in relation to the theoretical framework of publics (Le Dantec,

2016) was applied to better define and articulate the design process of the social innovation projects. The issues, publics, attachments, and the work of infrastructuring that occurred in these processes are focused as the significant aspects in this case study. In addition, a much clearer definition of social innovation projects was introduced and used as better criteria for case selection for this study. There were also methodological changes that were made according to my experiences in the pilot studies. The Snowball strategy was thought to be an effective method to recruit participants with the support from key informants. A recruitment letter was prepared for the key informants to share the information about this study with other potential participants. Participant observation was added to the data collection method to help me understand the project better. In addition, the interview questions were revised to have less duplication and be more efficient. Therefore, the multifold objectives for running the pilot studies were accomplished.

4.1.3. Screening the candidate cases

With the experiences that I obtained from the pilot case studies and the revised criteria for case selection, in order to find cases suitable for this study, I applied two strategies.

First, I searched social innovation projects in Vancouver online and viewed their websites to get a preliminary understanding about them. Then I sent emails to the general managers of these projects to explain my research purpose and request an opportunity to investigate their projects. Second, I asked for suggestions from my friends and lab mates, especially those who have experiences with nontraditional organizations, to find out more social innovation projects. Three projects became the candidate cases of this study.

After that, I had a personal meeting with each project manager to illustrate my research and the details of the study. Especially, their responsibilities, rights and benefits were introduced in our meetings. After my ethics application was approved, I emailed them the informed consent form and the list of interview questions and scheduled our interview time and place. I also sent the recruitment letter to them to help me recruit potential participants.

4.2. The collection of case study evidence

In this section, I present the detailed steps of the data collection in the field. I first provide the field procedures and then offer the details of each step. More vivid examples of the data that I collected in the procedure are presented in individual case reports.

4.2.1. Field procedures

In the field, I used the revised case study protocol to guide the data collection. Specifically, evidence was collected in four major steps: in-depth interviews, document collection, direct observations, and participant observations.

In-depth interviews

The informed consent form and the list of interview questions were sent to participants through email. Participants were asked to view the form and the questions before the interviews to become familiar with the study and prepare thoughts on the answers to the questions. In addition, in the same thread of emails, we scheduled our meeting time and location.

Interviews were conducted at scheduled times. In terms of the places, some interviews were carried out in a coffee shop, some were at the site of the project, and some were undertaken at the participant's home. All of the interview venues were determined by participants' preferences. In the interviews, I followed the interview question guide and applied the semi-structured interview method. A digital audio recorder was used to record every interview. At the same time, notes were taken in each interview to remind me of the important information as well as the mentioned documents that I would ask for after the interview. Each interview lasted about one hour.

The in-depth interview questions are designed to collect three types of information.

First, questions were asked to explore the participant's understanding of the projects and their roles and experiences in the projects. Questions in this set included, for example:

- Can you give a brief introduction of this project?

- Can you give a description of your roles in this project?
- Can you explain why and how you become involved in this project?

This set of questions was designed to allow me to understand their perspective in viewing the project and to warm them up for answering further questions about the design process of the project. In answering these questions, participants shared information about the projects, including the mission and essence of the projects and their positions and responsibilities.

Then, questions were asked about the design process of the projects. This set of questions was created to explore the dynamics that happened in those processes, such as the problems and challenges, the resources involved, the relations built, and the limitations and possibilities of resource integrations. This set of questions was designed by following the theory of infrastructuring in relation to the framework of publics. For example, questions included:

- Can you tell the challenges and problems happened in this process? How were the problems solved?
- Can you describe involved actors, organizations, and tools in this project?
- Can you describe the changes that were made on rules, standards or agreements in this process, if there are any?
- Can you tell any resources that the project was interested to obtain but actually not? Why didn't those resources get involved into the project?
- Among all the resources that have been integrated in the project, what are the ones that you think meet the needs for project development but might not be the best choices? Can you explain why they were still selected?

Throughout this set of questions, interviewees shared details about the process of the development of the projects. The individuals, organizations, tools and materials involved as resources were identified and described. The information related to the dynamics that occurred in the processes that were provided.

At the end of the interviews, participants were asked some very open-ended questions. These questions were designed to collect information that might not be covered by previous questions and to encourage participants to offer some thoughts about this study. Questions include:

- Can you tell the changes occurred that are not covered in our above interview questions?
- What are the aspects that need more support or improvement in this project based on your experience with it?

Documents

After every interview, I asked participants to email me related materials that they mentioned in the interview, such as policy files, email conversations, agreements, photos taken during their design process, and other documents they would like to share with me.

Besides the documents mentioned in the interview, I also collected additional documents from the project websites, such as annual reports, membership rules, and related articles from the media.

Documents that were sent from participants through emails were downloaded and saved in a folder on my laptop, which is protected by password. Online articles and project reports were also saved as PDF files in the folder for later data analysis.

Direct and participant observations

The sites of each project were visited and observed. Some sites were visited many times. During the visits, I took pictures of the environment and asked questions about the project.

Participant observation was also helpful for better understanding the physical, social, and cultural environment of the social innovation projects; the relationships among actors, artifacts, institutions, and contexts; and people's activities. Participant observation enabled me to develop a familiarity with the cultural and social milieu. The data collected in participant observations provide a context for me to understand data collected through other methods. In this study, participant observations were conducted

simultaneously with other methods. In participant observations, I took field notes and photos. Some field notes were written during participant observations and some were following the activity. What I experienced, learned through interaction with other individuals, and what I observed, were recorded in the notebook. After collecting participant observation data, I expanded the notes to make them into a descriptive narrative. Textual notes were then entered into computer files for later analysis.

4.2.2. Principles applied in data collection

During the process of data collection, I mainly applied two principles: triangulation and case study database. By applying these principles, Yin believes that the benefits from the sources of evidence can be maximized and the validity and reliability can be constructed (Yin, 2014).

Triangulation

The use of multiple sources of evidence is a major strength of case study data collection (Yin, 2014). It is very advanced in developing the “converging lines of inquiry” (Yin, 2014, p.120). Thus, more convincing and accurate findings can be facilitated.

In this study, as presented in previous sections, multiple sources of data were collected to corroborate the same findings. It helped to strengthen the validity of this case study. Moreover, by using different methods in data collection, methodological triangulation increased the confidence that this case study had interpreted the reality accurately.

Case study database

The case study database is “a separate and orderly compilation of all the data from a case study” (Yin, 2014, p.123). It includes different forms of data, such as narrative information, documents, and photos. The goal of managing the data is to ensure its quality and accessibility for analysis after the study is complete (Miles et al., 2014).

For the interview data collected in this study, I created folders named “Interviews”. For the data in forms of documents and photos, I created folders named “Documents” and “Photos”. In each folder, there are subfolders labeled by cases. All

these folders were ordered for later retrieve and analysis. Besides, an annotated bibliography of the documents was created to serve as an index of the documentations for later inspection. If a document was relevant to specific interviews, I also made additional notes.

4.3. The analysis of case study evidence

"Data analysis consists of examining, categorizing, tabulating, testing, or otherwise recombining evidence, to produce empirically based findings" (Yin, 2014, p.132). Yin proposed four general strategies in analyzing case study evidence. They are: follow the theoretical propositions, work data from the ground up, use a descriptive framework, and check on rival explanations.

In the data corpus of this study, there were mainly two forms of collected data: words and photos. In terms of practical techniques and skills, words were focused as the basic medium and analyzed through coding. Photos were analyzed through memoing. Below I present more details about how I coded the collected data.

4.3.1. Data processing and preparation

"Raw data (scribbled field notes, recordings) must be processed before they are available for analysis" (Miles et al., 2014, p.71). In this study, the recording of each interview was transcribed into text, which is a smooth summary of the participant's main ideas. Field notes were converted into formatted write-ups. These refined texts were prepared for the first cycle coding.

4.3.2. First cycle codes and coding

A code is defined as "a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data" (Saldaña, 2013, p.3). Through coding, qualitative researchers create a "critical link" between individual datum and their interpretations of it (Charmaz, 2014). Miles et al. believe that coding deeply reflects and deeply analyzes the meaning of the collected data (Miles et al., 2014). In coding, codes are used to recapture and group data chunks with similar meanings. In this way, researchers are able to

efficiently find and gather them in regarding to a particular theme. Further analysis and conclusions are then built on these clusterings (Miles et al., 2014).

In this study, I followed Saldaña's strategies by conducting coding in two major stages: first cycle and second cycle coding. In the first cycle coding, I assigned codes to the data segments through provisional coding, descriptive coding, and in vivo coding approaches. The ways each method was applied is described below. As the results of first cycle coding, revised codes and improved definitions of codes were made.

Creating codes

The coding process in this study is both deductive and inductive. In terms of the deductive coding, a "start list" of codes was developed prior to the fieldwork. This start list of codes was created based on the theoretical propositions, which were from my original research design. Relying on theoretical propositions is thought to guide the case study analysis and "yield analytic priorities" (Yin, 2014, p.136).

Provisional coding

The provisional coding method is suitable for qualitative studies that build on existing research and conceptual frameworks (Miles et al., 2014). In data analysis of this study, I began coding with the initial list of codes. In the process of provisional coding, I modified and expanded the list by including new codes.

In addition to deductive coding, inductive coding is conducted; that is, working data from the "ground up" (Yin, 2014, p.136). In inductive coding, codes that emerged during data collection and analysis were created. Moreover, it provided opportunities for me to revise the initial list of codes. More significantly, it uncovered rival perspectives for this study. During inductive coding, I applied the following methods. They are descriptive coding and in vivo coding.

Descriptive coding

Descriptive coding is used to generate a set of topics in the data for later retrieving and clustering (Miles et al., 2014). Each descriptive code is created as a summary of the main topic of a passage. Descriptive codes are believed to be suitable for describing social environments rather than social actions. In this study, I applied the

descriptive coding method especially for composing a detailed narrative of the context of the social innovation project.

In vivo coding

A very popular coding method, in vivo coding creates codes by borrowing the words or phrases in participants' own language (Miles et al., 2014). These codes usually suggest the culture of the group studied. In the analysis process, I selected words and phrases that repeatedly appeared in the data and put them in quotation marks to make them look different from the codes I generated. This method was applied to help me understand the inner culture or beliefs of the groups.

Revising codes

After applying the above inductive coding methods, I revised the code list. For example, some codes were broken into sub codes when too much data had the same code. The principles applied in creating and revising the codes are to keep "conceptual and structural unity" (Miles et al., 2014, p.82). Miles et al. said that codes should be relevant to one another in a "coherent" way and have some "sense of belonging" maintained (Miles et al., 2014, p.82).

4.3.3. Second cycle coding

In the first cycle coding, segments of data were preliminarily summarized. Codes were assigned to data chunks. In the second cycle coding, these summaries were clustered into a smaller number of categories. Pattern codes were used to identify these emergent categories or themes. They are "more meaningful and parsimonious units of analysis" (Miles et al., 2014, p.86) than the first cycle codes. Therefore, pattern codes are meta-code.

Specifically, first, the most encouraging codes were grouped to generate pattern codes. Analytic memos were written up to articulate my further reflections of the emergent themes. Second, I also kept it open to create new pattern codes, especially for the data that were interesting and surprising. Third, rival explanations were checked. Pattern codes were invented for them.

4.3.4. Analytic memoing

Along with the coding process, memos and notes were written when I had some interpretations and reflections of certain parts of the data. These memos and notes served as a "tentative connection" (Yin, 2014, p.136) among my original questions, the data, the interpretations of the data, and some conclusions. Miles et al. describe that analytic memos are not limited to narrative summaries of the data but to pull them into "higher level analytic meaning" (Miles et al., 2014, p.95). Thus, I used analytic memos in my analysis process as the draft of my self-reflection, which my final reports were based on.

4.3.5. Propositions development

By constructing the relationships among the pattern codes, higher level analytic meanings for assertion, proposition, or hypothesis are developed (Miles et al., 2014, p.73).

In addition to coding and memoing, as my study proceeded, propositions were also systematized and developed to reflect the findings. Miles et al. define proposition as "a statement that puts forth a conditional event – an if-then or why-because proposal that gets closer to prediction or theory" (Miles et al., 2014, p.100). In this study, propositions included descriptive facts and higher level meanings. They were revised as my fieldwork continued. Finally, I organized these propositions into a sequential outline format which helped to tell the story of my analysis.

4.3.6. Within-case analysis

The basic aim of within-case analysis is to describe, understand, and explain the facts that happened in a case (Miles et al., 2014).

Developing a case description

The original purpose of this multiple-case study is a descriptive one. In the analysis of each case, a descriptive framework was used to organize the analysis and "assumes that data were collected about each topic in the first place" (Yin, 2014, p.140).

This descriptive framework comes from the initial review of the literature and plausible rival explanations that were produced in the analysis process.

4.3.7. Cross-case analysis

Through cross-case analysis, processes and outcomes across many cases can be generated. Miles et al. argue that studying cross-case can help researchers to understand “how cases are qualified by local conditions, and thus to develop more sophisticated descriptions and more powerful explanations” (Miles et al., 2014, p.101).

Case-oriented approach

A case-oriented approach considers each case as a whole. It emphasizes the deep understandings of internal relations, causes and effects within the cases. Then, similarities and comparisons among cases are investigated for developing more general explanations. Because it focuses more on each case, case-oriented analysis is good to apply when the number of cases is small. The patterns found are usually “specific, concrete, historically grounded” (Miles et al., 2014, p.102). However, a case-oriented approach often results in findings that are very “particularistic” (Miles et al., 2014, p.102) and hard to generalize to other cases or contexts.

Variable-oriented approach

When the research is guided by a concept or theory from the start, the variable-oriented approach is suitable to be applied. It emphasizes more the variables instead of cases. Thus, variable-oriented analysis uses components of the theory as the “building blocks”. It is especially good to use when the number of cases is large and to discover the relationships among variables. However, its findings can easily become too general. Details of each case and the comparisons among cases often become obscured behind the broad patterns.

Mixed approach: stacking comparable cases

In the cross-case analysis of this study, I integrated case-oriented and variable-oriented strategies, which is a mixed strategy called “stacking comparable cases” (Miles et al., 2014, p.103).

Using this mixed strategy, first I wrote up each of my cases, using a “more or less standard set of variables” which was the outline format that I created in developing the propositions. Such categories “had been one of several outcomes of interest in the original study” (Yin, 2014, p.165). Synchronously, I added the uniqueness as it emerges into the report of each case. Second, I analyzed each of my cases in depth. During this step, each case was well understood. The crosscutting variables (the meta-pattern codes) evolved and changed. Finally, I created a “meta-matrix” that includes multiple columns and rows. It was then condensed to assist in the systematic comparison across the cases. The matrix allowed my analysis to “prone whether different cases appear to share similar qualities and deserve to be considered instances (replications) of the same type of general case” (Yin, 2014, p.166).

4.4. Validity and reliability

There are four types of tests that are commonly applied to improve the quality of case study research: construct validity, internal validity, external validity, and reliability (Yin, 2014). Because internal validity is only used for explanatory and causal studies rather than descriptive ones, in this research it will not be discussed. Below I present the tasks that I accomplished for increasing the construct validity, external validity and reliability when doing this case study.

Yin defines construct validity as ”identifying correct operational measures for the concepts being studied” (Yin, 2016, p.46). To increase the construct validity of this research, I applied three tactics. First, multiple sources of evidence were collected in data collection. Besides interviews, data from participant and direct observations and documents were collected. Second, “a chain of evidence” was established during the data collection; for example, when an interviewee mentioned they created a “Memorandum of Understanding” with their partner. The document was required and collected. Its relations to the protocol questions and original study question were recorded. Third, the draft of each case study report was sent to and reviewed by the key informants.

External validity concerns the generalizability of a study’s findings (Yin, 2016). To strive for external validity, in the research design phase of this study, I identified the appropriate theory and propositions as the groundwork of this research. Specifically, the

literature of the infrastructuring theory was reviewed and analyzed to serve as the theoretical support of this study. Moreover, replication logic was used in this multiple-case study design.

Reliability is concerned with “whether the process of the study is consistent, reasonably stable over time and across researchers and methods” (Miles et al., 2014, p.312). Its goal is to reduce the biases and errors in a research (Yin, 2014). To increase the reliability of this study, I used a case study protocol to document the case study research procedures. Also, a case study database was established and maintained through the process of this case study.

4.5. Summary

In this chapter, I presented the details about the data collection and data analysis in this study. The types of data sources are in-depth interviews, documentation, direct observations, and participant observations. I also described the preparatory work conducted before the formal fieldwork. It includes developing case study protocol, running pilot studies, and screening the final cases. Based on the lessons learned from the pilot studies, the revised case study protocol guiding the data collection consisted of four major steps: in-depth interviews, documents collections, direct observations, and participant observations. After that, I articulated the data analysis process. During with-in case analysis, at a micro level, I applied first cycle and second cycle coding strategies. Then, a descriptive framework was used to organize the analysis in each case. In the cross-case analysis, a strategy called “stacking comparable cases” was used to look for cross-case patterns. Finally, the strategies used to construct validity, external validity and reliability of this study were described.

In the next three chapters, I will present the collected evidence, the analysis process, findings, and reflective analysis for each case study.

Chapter 5.

Inner City Farms Case Report

In this chapter, I present the case report that resulted from studying the Inner City Farms project. The report includes three sections. In the first section, I provide a brief description of the project Inner City Farms. In addition, evidence obtained, as well as the analysis process, are articulated. In the second section, I provide the detailed findings from data analysis. Specifically, the theory of infrastructuring in relation to the theoretical framework of publics is applied to describe the collective design process of this project. Detailed evidence is also presented in this section. Finally, in the third section, I develop higher-level analytic reflections for the characteristics of the design process in the Inner City Farms project that could be supported by interaction designers.

5.1. Inner City Farms insight

5.1.1. Case description

Inner City Farms manages urban farms in the City of Vancouver. Farmers grow different types of vegetables on land provided by citizens. Usually the land is yard space that people are not using. Farmers take out the grass and build vegetable gardens. In aggregate, they manage the spaces as their farms. Therefore, it is a local and sustainable food project, which serves as an alternative to the dominant food paradigm in the city.

Farmers distribute food with a program of community-supported agriculture (CSA). CSA is an economic model that enables food consumers to connect to food producers directly. Customers buy membership at the beginning of the season. Every week in the growing season in the City of Vancouver, Inner City Farms provides customers with a share of the harvest. On the farmers' side, CSA protects them from market uncertainty and allows a personal link to the food eaters. For consumers, CSA provides them chances to meet the food producers and make their food more transparent. Compared to the industrialized food system, CSA offers consumers fresh and safe food and creates healthy communities in urban areas.

In 2009, the Inner City Farms project started from a small project garden shared between friends. The original goal of their communal effort was to bring people and their food closer. The belief of the members of Inner City Farms is that food is holistically healthy to eat, and ecologically and socially just. By using back yards and other urban spaces to grow food, farmers hope to support the development of a true sustainable food system with many others worldwide.

Currently, Inner City Farms has around 10 yard-based farms and a big farm in southern Vancouver. None of the farmland is owned by Inner City Farms. All of the land is offered by individuals who believe Inner City Farms can make positive contributions to the city. Therefore, the farmers understand the farms as working spaces instead of their land. They define themselves as responsible stewards of the land.

Inner City Farms largely relies on community collaborations. It includes many passionate volunteers – mostly students – who provide their energy and experience. Volunteers who work for Inner City Farm have various degrees of gardening experience. They share knowledge, food and space together. In their growing process, farmers follow sustainable gardening methods. They use no pesticides, herbicides or synthetic fertilizers. Vegetables are hand-harvested and shared with the community, which includes families, local restaurants and other community members. Members who share the food also gather to meet with farmers, learn about how their food was grown, share experiences and cooking recipes, and also have opportunities to pick up fresh vegetables in the farm by themselves.

5.1.2. Source of evidence

In studying the project of Inner City Farms, multiple types of data were collected, including interviews, documents, and direct and participant observations. I present the details of the collected evidence below.

In-depth interviews

I interviewed seven participants in studying Inner City Farms. Participants involved are described by using a role-ordered matrix.

Table 5.1. Participants interviewed in studying Inner City Farms

Participant name	Role	Description
Tony	Original funder and head farmer of Inner City Farms	One of the five original funders; the first head farmer of Inner City Farms.
Simon	Full-time farmer of Inner City Farms	Joined as an intern farmer and became an associate farmer in 2016; works as a full-time farmer in 2017, teaching interns and managing the farms; has a degree in plant bioscience and likes farming.
Kingsley	Board director of Inner City Farms	Used to work in a café which was a CSA member of Inner City Farms; became a board director last year and her work is doing administration, interviewing interns and dealing with restaurants.
Ray	Land provider of Inner City Farms	Has provided his yard as farmland for Inner City Farms since five years ago. He has built a great relationship with the farmers and convinced several neighbors to provide their yards.
Evin	Designer	A designer and has known Tony since elementary school. He has been approached by Tony to design the logo and posters and named as "the head of art department" of the Inner City Farms.
Richard	Head brewer of Luppolo	One of the owners and head brewers of Luppolo, a young and creative brewery company. He knows one of the funders of Inner City Farms. They had a great relationship with each other.
Scott	Lead brewer of Luppolo	Scott is one of the lead brewers of Luppolo. He does much brewing and recipe design.

Documents

In studying Inner City Farms, documents mentioned in the interviews were provided by participants. Other online resources related to the projects were also collected as additional documents. In the table, I list and briefly describe the documents.

Table 5.2. Documents Collected in studying Inner City Farms

Document name	Source	Description
Inner City Farms systems map	Tony	A map that presents the relations and figures of Inner City Farms system based on its status in 2014.
Inner City Farms systems map legend	Tony	Detailed description of the systems presented in the map
Logo and poster	Evin	The logo and poster designed for Inner City Farms
Photo of basement greenhouse	Inner City Farms Facebook page	A photo that presents Tony using his basement for seedling
CSA and Internship post	Inner City Farms Website	A post that describes its intern activities and CSA program

In Appendix A, I present part of the collected documents in studying Inner City Farms project.

Direct and participant observations

In direct observations, I visited several farms built in people's yards in studying the project. During the visit, I asked questions of the owners of the land and took photos for the yards.

Figure 5.1. Private yards used as farmland.

In addition, I volunteered as a short-term intern for Inner City Farms in the growing season of 2017. The volunteering is still ongoing at the time of writing. As an intern farmer, I went to the farms with the farmers and did farming work together. During the farming, I also asked questions and took photos. After each participant observation activity, I recorded what I experienced, learned through interaction with other individuals, and what I observed. After that, I expanded the notes to make them into a descriptive narrative. Textual notes were then entered into computer files for later analysis.

The following is an example of the expanded field notes that I created after one participant observation activity.

> *I received an email on the night of May 6th, 2017 from Tony. It is an invitation to farm on the Southland site on the next day as a "Sunday Funday" event. I replied and expressed my willing to join.*
>
> *On the next morning, which was on Sunday, May 7th, 2017, Tony drove the Inner City Farms truck and picked up me and another volunteer, his mother-in-law. The truck is not big. Only four persons can sit in it. We then go to Tony's house to get some baby plants and put in the back of truck. We then together went to the Southland farm. When we arrived, another volunteer was there already.*
>
> *It is a big farmland in a neighborhood where there are many horse ranches. I was told that this area is an agriculture-reserved area in Vancouver. There is a greenhouse on the farm and several gardening tools at the corners. Several vegetables were already planted. One volunteer was asked to water those vegetables. Watering cans were provided to her.*

Figure 5.2. Southland big farm.

Tony's mother-in-law and I were asked to weed one section of the land. We used the hoe and a bucket during our work. Tony also showed us the compost place where we could dump the removed weeds.

Figure 5.3. The section after weeding (left) and compost place(right).

After about two hours, another volunteer came in to work with us. She was a volunteer in 2014. Tony said that he usually sent messages about volunteering work not only to the new volunteers but also the previous volunteers. Many people would love to come back and help farming.

There was no bathroom close by. Tony drove us to a nursery place where we can use the bathroom. He also introduced us to the environment of the neighborhood on our way. At noon, we stopped farming and together sit in the shade to have lunch. All the volunteers and Tony shared the food and chatted casually. After that, Tony used his truck to drive me to a subway station. On our way, Tony shared that he is now sending out flyers about the new CSA memberships this year. He thinks the farming is like gambling, which is unstable because of the unanticipated weather. He

also talked about how the program did not make much profit. Tony is trying to get more people to join their CSA program this year.

5.1.3. Analysis of Inner City Farms evidence

In the process of data analysis, I follow the steps described in Chapter 4. How each step was applied is elaborated in the following paragraphs.

Data processing and preparation

Recording of each interview was transcribed into text. The following example is taken from an interview transcript from the head farmer describing the internship program of Inner City Farms. All of the transcripts were imported to Nvivo for later coding process.

> XW: [20:26.922] For the volunteers, what do they usually do in the project? Are they farming?
>
> Tony: [20:32.456] The main volunteering program we have is called "Urban Farming Internship." We offer people opportunities to learn how to grow food here in Vancouver. They spend one or two days a week with us for the whole season. Normally they are young people who are interested in food growing and never really done it but are curious about it. Or who recognized that there is a sustainable angle and they want to work towards to more sustainable future. In Inner City Farms, they have a concrete place to put that energy, so there are a lot of people worried about it and don't really know what to do. This is one thing that you can do this and they can have an option. So, we get a lot of students and a lot of young people that are interested in a sustainable future. And they want to learn how to grow food. The idea for us is that at the end of the season, they can use their experience as a stepping-stone into professional farming if that's what they want to do. Certainly, they should have the skills to have their own gardens at their own house for their rest of lives. Our role is the teachers of the internship. We don't give them any money. They are the volunteers. But we were very hopeful they will come away with: for one, they will meet a bunch of other people who are doing the same thing, so there is usually quite a connection as a social network, but also, they will have the skills necessarily for building a garden and maintain it in the future. They will know how to do that after the season with us. So, that's the goal.

First cycle codes and coding

The theory of infrastructuring in relation to the theoretical framework of publics was used as the analyzing tool in this doctoral work to describe the collective process in community-based projects. In the process of infrastructuring, publics "first articulate

issues, then build out attachments, and finally intergrading newly created resources for contending with issues" (Le Dantec, 2016, p.6). As described in Chapter 4, I began with three master codes – issues, publics, and attachments. Below, I present the codes that were created by using three methods in the first cycle coding. They are provisional coding, descriptive coding, and in vivo coding.

Provisional coding

In the process of provisional coding, the start list of codes is:

Table 5.3. Start list of codes

Master code	Definition
Issues	Issues are a set of social conditions.
Publics	A public is a particular configuration of people affected by the issues.
Attachments	Attachments are the relations through which sociotechnical resources participate actively with each other. Sociotechnical resources include actors, artifacts, and institutions and other categories might be included. Central to the relations is the interplay between "dependency on" and "commitment to".

In addition to deductive coding, I also conducted inductive coding through descriptive coding, and in vivo coding. Codes created in inductive coding are listed below.

Descriptive coding

Descriptive coding method was applied especially for composing a detailed narrative of the context of the Inner City Farms. Codes created through this method are:

Table 5.4. Codes created through descriptive coding

Created Codes
City Supports
City Restricts
City is Influenced

In vivo coding

Some words and phrases were borrowed from participants' language and used as in vivo codes to express the culture of Inner City Farms. Codes created through in vivo coding include are, for example:

Table 5.5. Codes created through in vivo coding

Created Codes
“Handshake agreement”
“Vegetables as our gift”

Revising codes

In order to ensure codes have certain conceptual unity, I revised the codes and organized them into groups.

Table 5.6. Revised codes

Revised Codes
Issues
Publics
Attachments
“Handshake agreement”
“Vegetables as our gift”
City Supports
City Restricts
City is Influenced

Second cycle codes and coding

Pattern codes were created as below:

Table 5.7. Pattern codes

Master code	Sub-codes
Issues	N/A
Publics	N/A
Attachments	Commitments to Dependencies on Informality
Local situations	City supports City restricts City is influenced

Analytic memoing

During the coding process, I wrote memos when I had reflections or interpretations on certain data. The following is an example of an analytic memo that I created.

> *The ownership of the land causes interesting facts. The land is owned by landowner, but used by Inner City Farms. How long it can be used is not sure. Greenhouse thus cannot be built in yards. In addition, landowners want the land to be more maintained in winter. However, they cannot change anything because it is the farmers who can manage the yards.*

Above I descripted the analysis steps used in the case study of Inner City Farms. Below, I present the detailed findings from analyzing the case.

5.2. Collective design process of Inner City Farms

In this section, I present the findings from studying the case Inner City Farms. By using the theoretical of infrastructuring in relation to the theoretical framework of publics (Le Dantec, 2016), I describe the project through issues, publics, attachments, and the work of infrastructuring that have emerged in it. My goal is to understand the collective design process and surface the characteristics of this process that interaction designers can support.

5.2.1. Issues

Issues are a set of social conditions. It is the basic element to form a public. Issues are evolving. The shape of issues changes as different actors become involved.

In the collective design process of Inner City Farms projects, the publics have to contend with a variety of issues. The issues are constantly evolving, which bring both new challenges and opportunities to the publics. In this research, I mainly present three issues that are identified in the project of Inner City Farms. They are volunteering issue, unaffordability of additional resources, and using private land in the city. Each of these issues is elaborated below.

Volunteering issue

Being a business organization in Canada, the farmers are not allowed to recruit volunteers to participate in the project. It is not legal. Thus, legitimizing the volunteering becomes a big problem for initial involved farmers. Interviewees Tony and Kingsley, board members of Inner City Farms, described that legitimizing their volunteers is their biggest concern because it allows them to have more people to continually grow the project:

> Overwhelmingly, the Inner City Farms is volunteer run. Under the employment law in Canada, you cannot volunteer for business... So, we knew that we already have lots of volunteers. We want to legitimize the volunteering. (Tony)

> The biggest thing is that it legitimizes our volunteering. Volunteers are a huge part of what we do because it takes a lot of people to run the program we are doing. So, we can have more people to continue to grow. (Kingsley)

The second issue in terms of volunteers is their diverse background and levels of knowledge of farming. Many interns are beginners without knowing much about farming. The professional farmers have to teach new interns every year. This becomes a constant challenge to farmers because teaching new people every year reduces the work efficiency of the whole group. As Simon described, because the project is growing every year, having new and unprofessional interns actually cannot meet their increasing development demand.

> Most interns are new every year. We have to teach them. After one year, they've gone. In the next year, we have to teach new people, like a cycle. I find that Inner City Farms project is growing, but people stay the same. Every time they are new. (Simon)

> So, it is almost all beginners. Every year we start with nobody really knows about anything. (Tony)

The third challenge related to volunteers is that it is often hard to coordinate with their different time availability. Volunteers have their own priorities and life events. For example, as Simon mentioned, many interns who are students have to go to school in September. Their leaving brings a big challenge to farmers especially when it is a busy season.

> Most interns are students from universities. We usually start our seasons in May to end of November. But from September, the school

> starts. So, they left and started their work. This is a kind of problem. (Simon)

> It is not always easy because different people have different standards, have different priorities. They have to work in other jobs to make their money and they want to go camping and they want to do this and that. (Tony)

The departures of some volunteers who provide professional capacities also cause problems. For example, there was no one taking care of the website and the Facebook page of Inner City Farms after the woman who created and managed them moved away.

In addition, not all volunteers find themselves passionate about farming. They might stop or quit after several trials. This again is a challenge for the farmers.

> Sometimes, they love it, and they get super interested in it. Sometimes, they learned that it is not for them. Some people may come from even not knowing much about growing at all. This is a constant challenge for us. (Kingsley)

In summary, on one hand, farmers heavily rely on the volunteers to work for them and thus need to legitimize the volunteering. On the other hand, because of the overwhelming dependence, volunteers cause problems for the farmers. Their lack of professional skills and knowledge of farming as well as various priorities for other events become constant challenges for farmers.

Cannot afford to purchase additional resources

Another problem is that farmers cannot afford additional facilities they want to have, such as a greenhouse and an additional truck. In past years, they have not generated enough income to purchase those resources, but only enough to allow the project to survive.

> If we had way more money, it will be a lot easier to solve some of the problems on the ground. We really need a greenhouse, oh, let's build one greenhouse. But a greenhouse is very expensive. And we cannot afford a truck. (Tony)

Lack of vehicles becomes a significant problem to the project Inner City Farms. With only one truck, not many interns are allowed to go farming each time, because there is no more room in the truck. Also, all farmers and volunteers have to go to one

place at a time. Therefore, the lack of vehicles reduces the working efficiency of the group.

> If we have another vehicle, so that we could make more interns have more trying to do it over the year. (Kingsley)

> We only have one truck. There is no more room for the interns. If we have more interns, we have to buy another truck. For now, we do farming together, one time one place. (Simon)

Moreover, the truck has to be used for delivering several days a week instead of being used for farming, which again reduces the farming time on the land. This sometimes also causes the problem that landowners complain about the weeds in their yards.

> We do deliver vegetables to the restaurants twice a week because we can only put five shares in our truck. So, two different days we do delivery to restaurants. One day for family share. That's why we need another car… Some places need weeding, so sometimes the landowners complain about it. We don't have many vehicles to get there. We do only one place a day. (Simon)

Using private yards in city

Working on people's private yards inside the city is not easy. There are conflicts between people who own the land and the farmers who use the land to grow food. Farming inside the urban area is very different from farming on rural farms.

First, the ownership of the land causes problems for farmers. Because it is not their land, farmers cannot build a greenhouse there. One interviewee commented on their difficulty over deciding the building of a greenhouse on people's yard. They were worried that the landowner may not want the land to be used by the farmers in future. This will be a problem for the farmers especially because a greenhouse is costly to build.

> Because it is not our land, we cannot set a greenhouse there. A greenhouse will be there for many years, but at some point, the landowner may not want to let us go there anymore. That will be a big problem. (Simon)

Second, growing vegetables in people's private yards is different from growing in rural areas. Landowners want their yards to look beautiful even in the winter season. For example, one landowner said he and his wife prefer their yard to look nicer in winter.

But they cannot do anything because the yard is now managed and used by Inner City Farms.

> It is not so nice looking right now. When it is not a farm in the winter, it would be better to make it a bit nicer… We are not allowed to remove those things. Tony is totally in charge. Once it starts growing, it starts to look nice. But most farms, when it is winter, it does not look so nice. In the city, that is probably more a problem than in a real farm. (Ray)

The following photo was taken when I visited Ray's yard. It shows that the yard does not look very nice in winter.

Figure 5.4. Ray's yard in winter.

In this section, I presented the evolved issues found in studying the case Inner City Farms. They are volunteering issues, hard to afford facilities, and usage of private yards in urban area. Of course, the issues presented above are very challenging and most of them are not easily solvable. However, publics creatively contend with these issues by identifying and marshalling their existing resources (actors, organizations, and artifacts) as well as involving other external resources.

Below, I first rearticulated the publics who are affected by the above issues, then I articulate the attachments – the commitments and dependencies – that form as public forms in respond to their shared issues. Through the existing and newly built attachments, multiple resources are integrated, which I will describe in detail in the section 5.2.4: The work of infrastructuring.

5.2.2. Publics

A public is a particular configuration of people affected by the issues. It is dynamic and contingent with the presence and evolution of issues.

The initial actors involved in the project of Inner City Farms are five friends who are concerned about the healthy and fresh food they and their families eat every day. They had the idea to utilize the useless yards inside the city as their farmlands. That is how the landowners became involved. With the development of the project, more people start to get involved, such as other professional farmers and volunteers. In this section, based on the articulation of issues above, I highlight the publics driven by those issues.

Regarding the problem of legitimizing volunteers, the affected actors include farmers and volunteers who contribute their energy and time for free to the project. On the one hand, farmers were not allowed to recruit many volunteers to work on the farms. On the other hand, volunteers who are interested in farming were not able to join the farming group.

The constituencies around the issue of lack of vehicles are farmers, volunteers, and landowners. As previously articulated, farmers and volunteers can only go to one place to do the farming work on a day because there is only one truck for carrying the tools and people. It is hard for the farmers and volunteers to go to every farmland very often. Sometimes, the landowners could be affected because their land might not be maintained very well.

In terms of the issue of using but not owning the land in the city, the affected actors are farmers. They feel hard to decide to build greenhouses on landowners' yards because people could stop providing the land the next year.

Next, I will articulate the attachments formed around the issues.

5.2.3. Attachments

Attachments express the affective commitments and dependencies between the actors, artifacts, and institutions contending with a set of shared issues. They are the

"organizing force" that makes actors, institutions, and artifacts affected by an issue to gather and take actions toward a common end.

In this project, to deal with the issues emerged, a variety of sociotechnical resources are gathered to increase the capacity of the publics. At the time of this study, the resources integrated include farmers, volunteers, hired professional farmers, landowners, yards, and Southland farm. There are also newly identified resources during the study. A cooler space was integrated recently after the brewing company was articulated as a new attachment.

In this section, I present the "commitments" and "dependencies" among the actors, institutions, and artifacts entangled in contending with a set of shared issues presented above.

Commitments to

Volunteers commit to contribute their time and energy to the farmers. They play an important part for the running of the project. Some volunteers also provide other skills, such as website building and graphic design. New hired professional farmers make commitment to provide their skills and time. Landowners commit to provide their yards to the farmers and volunteers for growing food. The brewing company Luppolo commits to the farmers to offer its cooler space as inventory space for the vegetables and give the CSA share boxes to the families when they come to pick up.

Farmers commit to provide the farming hands-on opportunities to the volunteers and educate about professional farming knowledge and skills. They commit to maintain and manage the yards of landowners.

Dependencies on

The most important resource in this project is the lands that are used for growing food. Farmers are dependent on landowners' yards to grow food in the city. They rely on volunteers, newly and previously enlisted, to make the project run well. There is too much work to do if only farmers work on the farms. In addition, farmers rely on the volunteers who offer useful skills, such as website building and graphic design, to make the project run even better. To work more efficiently and get more farming work done fast, farmers are also dependent on newly hired professional farmers who serve as

complementary labor. To plant the seedlings and extend the growing season, farmers and volunteers are dependent on the greenhouses. As presented before, farmers and volunteers are dependent on the vehicle to go to the farmlands and deliver CSA boxes to the families and restaurants. This year, they started to rely on Luppolo to distribute its vegetables to families. Moreover, farmers are dependent on the food systems and culture in the city to sustain them for a long time. They also rely on educational programs in universities to educate more people about the sustainable food system.

With respect to volunteers, they are dependent on the farmers to have the opportunity to experience the farming work. Volunteers, as intern farmers, rely on the farmers to learn farming skills and knowledge. Landowners rely on the farmers and volunteers to manage and maintain their yards. Families and restaurants are dependent on farmers and volunteers to obtain local fresh vegetables. With the newly integrated cooler inventory space, families will rely on Luppolo to obtain their weekly CSA shares.

Informality and unreliability in commitments and dependencies

In all the above articulated “commitments” and “dependencies”, there can be discovered informality. It is found that “handshake agreements” are made between the farmers and the landowners, the chefs from the restaurants, and other organizations (e.g., Luppolo). Rather than signing formal contracts, almost all the relations are built on trust and friendship.

First, for example, the brewer from Luppolo commented that there was just a verbal agreement between Luppolo and the farm and they believe and trust their relations will continue.

> All is just verbal. Just a handshake. If he didn't trust me, he might be worried that I one day might say "sorry you cannot keep the boxes anymore” and he will be in trouble to try to find the space. But he knows me, we hang out a few times and there is something in the world we can trust. So, just a verbal agreement, and I said I would do it and he trusts that will continue. (Richard)

In a similar manner, there is no formal contract with the landowners either, Tony said.

> We just have a meeting, a tea or coffee and talk and walk in the yard together and discuss the vision and the possible and not possible from my side. And at the end, we know we like each other and we are likely

> to do it. And it is just handshake agreements. Basically, we say we don't want to take it over less than a year and for sure to give us three years. (Tony)

Relations built on trust reflect the positive nature of this project. Informality creates the respect and flexibility between the farm with other actors and organizations. It helps neutralize people's hesitations in trying a new form of relation, for example letting others use their own yard to grow food, which is an adventure that needs some leeway for possible later regret. It might also work better for some organizations that are busy dealing with complex processes. For example, restaurants might be too busy to provide exact answers or sign formal contracts. But they are happy to receive the local and freshly harvested vegetables for another year.

However, informal relations, often verbal and casual agreements, are not always reliable, and even sometimes influence the project. The most obvious examples are the informal relations with the landowners. Because there is no formal contract or commitment on the number of years for the land to be used, the farmers have to stop farming on the land when the owner changes his or her idea or the house is sold. In the interview, the farmer described an interesting example of this situation:

> One story is that the guy is super into it. He owned the house and the front and back yards. That was a great farm we built there. His girlfriend was a happy lady and she loved it. Then, he and his girlfriend broke up. And he got a new girlfriend. She didn't like it at all. So, we have to stop. (Tony)

It costs much effort for the farmers to change a yard to a farm. Having to stop farming in the well-established farms is not a desirable experience for the farmers at all. More importantly, because of the existing unreliability, the farmers often find it hard to decide whether to build a greenhouse in a yard, because the landowner may stop providing the yard the next year. One of the farmers commented on the struggle over building greenhouses on people's yards.

> A greenhouse will be there for many years, but at some point, the landowner may not want to let us go there anymore. That will be a big problem. So, it is hard to set the greenhouse in the farm place. It is hard to decide. (Simon)

Therefore, the effects of the informal relations are positive and negative. Respect, flexibility, mutual trust and friendship are embodied and supported by this informality. However, it cannot be ignored that some levels of unreliability are caused.

In this section, I presented the attachments through articulating the “commitment to” and “dependency on” in the relations between actors, artifacts, and institutions entangled in contending with the issues. Specifically, in this project, the relations are usually informal ones built on trust and friendship. They are very flexible and unstable.

5.2.4. The work of infrastructuring

Infrastructuring is a process that a public identifies and marshals sociotechnical resources via attachments to contend with issues.

Above I described the issues around which publics formed and attachments that express the commitments and dependencies between the actors, artifacts, and organizations in contending with the articulated issues. The network of sociotechnical resources is established to alter the publics’ ability to act to the issues. In this section, I present the work of infrastructuring, in which social and technical resources are integrated through the network of attachments to contend with the issues.

More precisely, the infrastructuring work emerged in studying the project includes: infrastructuring the organization, infrastructuring the delivery system, infrastructuring the lands, infrastructuring the nursery system, infrastructuring professional skills, and infrastructuring to support farmers. Below, I articulate each of the infrastructuring work in detail.

Infrastructuring the organization

In response to the issue of legitimizing volunteers, last year, the farmers decided to shift the organization from a business corporation to a non-profit organization, which means no part of the organization’ profit is distributed to its members or directors.

As two participants commented, this change not only allows them to have more people, but also opens the door for them to access more grants and funding as well as more public land in the city, such as schoolyards.

> We have been a small business. All of our money is from the selling of shares. So that basically only allows us to run the farm. But now we are non-profit, so, hopefully we can have grants and funding that could be issued sometimes. (Kingsley)

> We have changed to a non-profit organization. One benefit is that we can get more access to land in the city, like schoolyards. (Simon)

With more volunteers, a wide range of capacities can be approached. For example, the Facebook and website pages, which lack updates because of the departure of the woman who maintained them, can be maintained by the help of volunteers.

This infrastructuring work is a modification of the existing relation between the Inner City Farms organization and the farmers who are inside members. The relation is changed to augment the ability of the public to act. More precisely, farmers can enlist volunteers into the project to have more support in doing farming work. In addition, volunteers are able to join and learn from the farmers.

Infrastructuring the delivery system

In order to contend with the issue of the lack of vehicles for farming and delivering, the farmers created a new CSA delivery system this year. Instead of delivering CSA share boxes to all families, they set up a pick-up site for families to get their weekly share. As one interviewee described, the reset of the CSA delivery system saves the farmers more time. Moreover, the only vehicle can be used for more actual farming.

> We usually do delivery on the weekend but it wastes our time, because we also farm on the weekend. So this year, we changed our CSA delivery system. We set it as a pick-up site. So, people go there anytime and pick up their share. It is good for us, because it saves our time and we can take a rest on the weekend. It is also for our customers because the produce is always in the fridge, so it keeps them fresh. (Simon)

To keep the vegetables fresh and to offer a convenience for the customers, a cooler space is needed to realize the new delivery system. Because there is no inventory space for the Inner City Farms, the farmers have to reach out to fill this resource gap. This thus creates an opportunity for creating a new attachment. Luppolo, a young brewery company, provides its cooler space and agrees to be one of the pick-up sites for the new Inner City Farms' CSA delivery system. As a return, farmers offer Luppolo fresh hops and local fruits for making local beers. The brewers expressed that they had a great relationship with the farmers and are happy to help them out. In addition, they

believe the CSA shareholders who come every week to pick up the vegetables may also increase their beer market. Thus, it is believed that the collaboration is win-win.

> We did collaboration last September, before we were open. That was just a small batch of brew with the fresh hops harvested from Inner City Farms. They are going to use our cooler space for a little while and they are also going to try to provide us with different fruits. (Scott)

> But also, it helps us a little bit, because there are 60 people that maybe don't know we exist. And they have to come here to pick up their CSA. Maybe while they are here they'll have a beer or to tell their friends about us. So, it helps us in terms of a marketing sense. (Richard)

> It is good for us, because it saves our time and we can take a rest on the weekend. It is also for our customers because the produce is always in the fridge, so it keeps them fresh. (Simon)

Figure 5.5. Luppolo's cooler space (left) and front side of it (right).

In this infrastructuring work, the cooler space of Luppolo was integrated to enable the farmers' ability to keep the vegetables fresh and simultaneously confront the issue of lack of vehicles. With the change to the pick-up site, the truck can be used more for farming rather than delivering vegetables. Moreover, the integration of the cooler space creates benefits for Luppolo. It obtains fresh hops from the farmers and more visitors that might increase its marketing.

Infrastructuring the land resources

In order to respond to the lack of vehicles, the farmers also adapted their principles of selecting land: 1) they prefer to select yards located close to each other; 2) instead of individual private yards of people's houses, they prefer big farmlands. Through modifying the principles to select farmlands, the farmers aim to reduce the time in driving

and save more time for farming. It would be nice to have all yards involved to grow food, however, as one participant expressed, they don't have enough capacity to do that, especially after the involvement of the big farmland.

> With the big farmland, we now have more land than before. But we have to give up some of the properties over phone calls… Beginning it is wonderful. It will be so cool to see food grown in everyone's land. We just don't have the capacity to do that right now. (Kingsley)

> We had around 15-20 spots to grow vegetables in the city. And we had a big farmland in the west of Vancouver. In 2015, we doubled the big farm. It is a huge change! Now, we have the big farm and other farmlands are too far. So, we are planning to gather the small farms at one place. So, we can drive not so crazy. (Simon)

In this infrastructuring work, the land resources are examined and marshalled to mitigate the issue of lack of vehicles. Some lands were given up to avoid the issue becomes more serious.

Infrastructuring nursery system

As articulated earlier, it is hard to build greenhouses in the private yards of landowners. However, greenhouse is very desired by the farmers. To make their nursery system, a greenhouse was built in the big farmland.

Figure 5.6. The greenhouse built on the big Southland Farm.

In addition, Tony's basement is also appropriated for cultivating seedlings.

> Building greenhouse is good for extending the season. Now, we don't have a proper nursery, just now we grow the seedlings in Tony's basement. It is one of the things we need. (Simon)

In this way, the head farmer's personal space is appropriated and used for Inner City Farms.

In this example of infrastructuring work, the resource is identified and appropriated to increase the farmers' capacity to confront the issue.

Infrastructuring professional skills

The vegetables are used as a trade or a gift to exchange resources the farmers need. Specifically, people who would love to contribute but don't have time to do extra farming can provide something else that the farm needs. For instance, one participant described that a woman built a website for the farms and got vegetable shares from the farms. Similarly, the farms received help from an accountant and gave him vegetables as a reward.

> Yes, we have vegetables. That is what we can offer. For example, the woman built our website. She and her husband had a website company. And they identified that "hey, do you guys need a website?" "Yes, we do." We don't have enough money to buy a website and we'd be happy to give you a couple of years' membership for free… One of my friends, her brother-in-law is an accountant. That's how we met him, they just helped us and we trade to give him the vegetables. (Tony)

One designer friend of the farm designed the logo and poster for the farms and obtained a year of CSA shares as a gift.

> The farm approached me to do the logo… I have designed the poster they are going to use this year. Last year I had a share. It was a gift from the ICF for all of the work we have done. We made a lot of salads. (Evin)

Figure 5.7. The logo and poster designed for Inner City Farms
Note: Images created by participant. Used with permission.

The designer also said that he was wondering whether to draw a set of paintings for the houses that have inner city farms in their yards. More interestingly, he and farmers were planning to write songs together and creating an Inner City Farms album. People got involved with the farm because they are interested and passionate about the farm. Thus, they are willing to contribute their energy and expertise and become active actors in the infrastructure of Inner City Farms.

In this infrastructuring work, resources are used to increase the farmers' capacities to obtain alternative professional skills. Specifically, vegetables are identified and used as something that can exchange with professional skills.

Landowner: infrastructuring to support farmers

Landowners appreciate the work done by the farmers. For example, one of the landowners said that the farmers also helped him to protect his house when his family is away for holidays. To celebrate their friendship, he bought the farmers beer on summer days and built a chair for the farmers, with the head farmer's name carved in it.

> In the summer, we live in the cottage in the U.S.... Sometimes I got home and the gardeners were here. I talked to them, the fantastic people. And being away from home, it is better to have people around your house. It is less likely people will break in to your house…

> Sometimes, if it is a hot day, and I see they are hard working, I might bring out some beer. So, totally mutual trust. (Ray)

Figure 5.8. A chair built by Ray to celebrate his friendship with farmers.

A water timer was installed in Ray's yard so that the farmers do not need to drive to irrigate the land every day in summer. He also built outdoor water taps for the convenience of the farmers.

Figure 5.9. The tap installed by Ray and the water timer used for irrigation.

This infrastructuring work done by landowner is to celebrate his relation with the farmers and volunteers and augment the farmers' capacities in managing the lands.

To sum up, diverse social and material resources are identified and marshalled in the design process of Inner City Farms project. By applying the theoretical framework of infrastructuring, inner work of the Inner City Farms project was described. Specifically, in these infrastructuring processes, the publics redefined the issues (e.g., infrastructuring the delivery system), mitigated the issues (e.g., infrastructuring the lands), modified the existing relations (e.g., infrastructuring the organization), and identified and marshalled

resources (e.g., infrastructuring the nursery system, infrastructuring to support farmers, and infrastructuring professional skills) to increase the ability in the design process.

5.2.5. Local situations

Above, I have described the process of Inner City Farms project by applying the theory of infrastructuring in relation to the framework publics. Specifically, the publics, the issues, and attachments to diverse social and material resources upon which they draw were presented. It approved that the framework provides a very practical conceptual lens for me to understand and describe the underlying process of Inner City Farms project.

However, it is also found that several aspects that are considered to play important roles in the project are not sufficiently articulated through the framework. More precisely, the infrastructuring theory supports the description of inner works in the collective design process of project very well; however, it does not (or may not explicitly) provide a scaffold for understanding the impacts brought by the local situations – the social, cultural and political environment – into the collective design process of Inner City Farms project.

In this section of this case report, I present the influence of the local situations – the social, political, and cultural condition in the city of Vancouver – which loom over the infrastructuring process of Inner City Farms project.

In this project, the city plays several roles. Specifically, the city of Vancouver which has a goal of becoming the Greenest City in 2020, strongly supports urban farming. It adjusts existing policies and creates new ones to help urban farming succeed in Vancouver and also keeps it regulated. For example, the city recently implemented an urban farming license. On the one hand, it clarifies regulations and policies for urban farming organizations. On the other hand, it legitimates the existence of urban farming organizations in the city of Vancouver.

> Once the policy is written, it is much harder to say no one is allowed to do this. It is on the books. It is a thing legitimated in our city. (Tony)

When Inner City Farms operated as a commercial business before 2016, the city also changed the policies to allow for this new category of business, which is running CSA programs by farming on private yards of citizens.

> We were a commercial business on residential land. So in the city, there is no category for this. But take a look at the policy, you will see it is pretty straightforward now. They really allow for what we are doing for existence. Initially, it was not allowed. Now, they changed. (Tony)

The policy catches up what the urban farming groups are doing. It tries to standardize but not to stop their operations.

> We told them what we were doing. And then they tried to shift the policy in a way that is standardized but would not impact the operations to the point where we have to shut down. (Tony)

Besides policies, the City provides a variety of grants and funding to support the development of urban farming projects, which is thought to be a great support to urban farmers.

> In terms of funding, you know that a good thing living in Vancouver is that government is very concerned about supporting the sustainability thing. (Kingsley)

In addition to the city government, the culinary culture of Vancouver helps the design process of the Inner City Farms very much. A large number of people living in Vancouver appreciate sustainable ways of growing food. Moreover, many chefs and restaurants value local fresh food. Thus, this unique culinary culture in Vancouver largely promotes the development of the project.

> Initially, we thought that finding spaces would be hardest thing. Not at all. It is super easy. I think it is a reflective of Vancouver. There are a lot of people that are align with our values. Food grown in a way that they believe in something they already think about, value and wants… Vancouver was a city where lots of chefs want to serve local sustainable fresh food. And the story behind the food is important for them, too. (Tony)

However, back yards for farming are becoming less and less available now in the city of Vancouver, which is a foreseen issue for the future design of Inner City Farms project.

> You see there is much more density happened in Vancouver. So, one of the things that are happening is that back yards are disappearing. That will affect us in a long term. (Tony)

In summary, the local situations impact the project, which is believed to be important to recognize. The theoretical framework is a good way to account for the inner

work of the project. However, it may not sufficiently provide a ready way to support the understanding of the interactions between the project as a whole and the environment where it develops.

5.2.6. Summary

In this section, by applying the theory of infrastructuring, I reported the process of the Inner City Farms project. Specifically, the issues, publics, the attachments, and the work of infrastructuring in this project were articulated. Six examples of infrastructuring work that emerged in studying the project are presented, which include infrastructuring the organization, infrastructuring the delivery system, infrastructuring the land resources, infrastructuring the nursery system, infrastructuring professional skills, and infrastructuring to support farmers. It is important to notice that the infrastructuring work uncovered by this study is only a part of the collective design process of the project. There definitely is more infrastructuring work that occurred during this project which is beyond this doctoral work. However, it is believed the articulated six infrastructuring works helps me in answering the research question.

5.3. Characteristics of the design process in Inner City Farms project

Above I have described the underlying infrastructuring works of the Inner City Farms project. As previously articulated in this dissertation, infrastructuring is a process that a public identifies and marshals sociotechnical resources to contend with social issues. In this part of the chapter, I will further reflect on the infrastructuring work that emerged in this project and analyze the characteristics of the design process in Inner City Farms project.

5.3.1. Dynamic and heterogeneous

The constitution of the publics formed in the design process is dynamic. In Inner City Farms projects, it is found that actors in different period of the design process of this project are different. For example, at the beginning, the public is composed of five friends. Landowners were integrated to provide yards as farmlands. Then volunteers became involved. Additional professional farmers were enlisted in the later design

process. Hence, the publics, who are the designers in the collective design process, keep changing and evolving.

Along with the dynamism is the heterogeneous characteristic of the publics. As articulated earlier, the enrolment of the individuals brings to the public additional capabilities, such as professional skills (e.g., graphic design) or resources (e.g., the land and cooler space). However, because of the fluidity of the formulation, some skills may get lost when the public is reformed. For example, the website design ability got lost when the IT woman left.

The publics who take design acts to confront the issues are dynamic. Its formulation is fluid. Moreover, the capabilities of the publics to take design actions in the process are changing and unstable.

5.3.2. Creative and resourceful

The actors engaged in the design process of Inner City Farms project are creative and resourceful in response to the evolving issues.

In Inner City Farms project, creativity and resourcefulness manifest in different ways. Actors use their creativity to develop vision for what the project could be. For example, using private yard as farming land to grow food for urban residents is a very creative project idea. Setting Luppolo as a pick-up site is also creative. In addition, creativity is present in the practical way actors are able to see different resources and appropriate them for different purposes. For example, a basement is creatively repurposed as a greenhouse for seedlings.

Resourcefulness is also present in the design process of Inner City Farms project. Publics see the network of resources as design resources that can be used for further design acts. For example, vegetables are used to trade for necessities. Volunteers are identified as website caretakers. It is the resourcefulness of actors that makes the project keep developing and growing for almost eight years.

In the design process, creativity and resourcefulness manifest in the multiple design strategies the actors used. In fact, they combine and alternate between different practices of design to contend with the issues. For example, in contending with the issue

of lack of vehicles, on the one hand, the actors set a pick-up site to free their time for more farming work. On the other hand, they reallocated the small yards to make them become close to each other so that they don't have to drive far when farming. The creativity and resourcefulness lead to the actors' ability to imagine alternative ways for reusing their present obvious resources and the potential functionalities of the resources less visible in their networks.

5.3.3. Mutual benefits as a key design principle

Mutualism is a key principle in the design process of Inner City Farms project. It is believed to be an important factor that makes the project develop continually and successfully.

In design process, the publics try their best to make all individuals benefit from the project, which is beyond the relation between provider and consumer. This stems directly from the main qualities of being creative and resourceful. In the design process, for example, farmers use landowners' yards to grow food and landowners do not need to do the lawn maintenance work. Farmers use the cooler space of the brewing company and the brewery can get more visitors so that it may sell more beer. It is mutually beneficial. More importantly, the vegetable shares, which are normally used as products for the customers, are seen as a gift that can be given to actors who make contributions in the design process of the project.

In addition, what mutualism also brings is the visibility and durability of resources that can be used in the project. This is because the win-win model it creates positively strengthens the created attachment so that the social and material resources integrated in the design process through the attachment can naturally become visible and be used for a long time.

In summary, in the design process, actors creatively view their resources and envisage the benefits they could make to others with these resources. By mutualism, actors, artifacts, and institutions that are integrated in the design process could appear and sustain for a long time.

5.3.4. Sociotechnical resources and relations as design resources

In the design process of Inner City Farms project, social and material resources and the relations among them are understood to be resources for further design acts by the publics in their projects.

The publics see the actors, artifacts, and institutions within the present attachments as resources for further design acts. For example, the volunteer was asked to maintain the Facebook page and website. The basement was used as greenhouse for seedlings. The CSA boxes are used as a gift for obtaining alternative resources that are needed for further design actions. Therefore, social and material resources are adopted and appropriated as design resources for design actions.

In addition, sociotechnical relations are seen as powerful design resources. For example, in the design process, multiple relations are created as informal. The informal relations help neutralize people's hesitations in trying a new form of relation, for example letting others use their own yard to grow food.

In summary, the publics see the social and material resources and relations as design resources that can be adopted and appropriated for their future design acts.

5.3.5. Open-ended design process

In the design process of Inner City Farms project, it was observed that the process is ongoing and open-ended. In fact, the open-ended quality of the design process constantly supports the creativity and design actions of the public.

First, the outcomes of a design action serve as a catalyst to promote another design iteration. The shape of issues evolves as different resources become involved. For example, the involvement of the big farmlands caused the reallocation of the small individual yards. The organization has to be changed to non-profit after many volunteers become involved. The outcome of the designing is always a "beta version" that will be changed.

Second, the design process is open-ended also recognized through the dynamic formulation of the publics. In the work of infrastructuring, actors are free to decide

whether, when, and how to join and leave. Other ideas can be added in to the design process freely. For example, the graphic designer plans to write songs and create an Inner City Farms album. The landowner builds a chair for the farmers. Current publics of the project can revise the designs and thus makes the project openended.

Third, as the work of infrastructuring keeps ongoing, the network of resources is growing, which support the publics' future design actions. The resources could include, but are not limited to, materials, tools, services, and individuals. The new integrated resources increase the publics' capacities to design and act.

In summary, the evolving issues, dynamic publics, and involved attachments together allow the design process of the Inner City Farms project to be open-ended and ongoing.

5.3.6. The whole design process as a piece of local infrastructuring

The final reflection with respect to the design process of this project relates to the local infrastructure in which the project is contextualized. The infrastructuring work of the project is not independent, or enclosed. The whole design process impacts and is impacted by the design process of local infrastructure in which the project is situated.

On the one hand, as articulated in the previous section, the city creates policies to allow and support the design process of the project. In addition, the culture in Vancouver also largely promotes the infrastructuring process of Inner City Farms development. The landowners, families and chefs who appreciate the value of local food make the project keep running.

On the other hand, the design process of this project impacts the local situation. It encourages and drives the innovation of the city. Specifically, policy was updated and adjusted. The design process of this project also supports sustainable food cultures that the city of Vancouver is making effort for.

In summary, the design process of Inner City Farms project is impacted by and influences the design process of local infrastructure in the city. The design process of this project could be understood as an element or a step for reaching the design goal of the city, which is on a larger political and social level.

5.4. Summary

Summing up, in this chapter, I presented the case study report of Inner City Farms. First, I introduced the project and described the data collection and analysis process employed in studying it. Second, I elaborated the detailed findings by applying the theory of infrastructuring in relation to the theoretical framework of publics. I also proposed that, in addition to the inner works, it is important to recognize the local situations in describing the collective design process of Inner City Farms project. Finally, I proposed the characteristics of the design process of this project. Specifically, the characteristics are:

- Publics as dynamic and heterogeneous designers
- Creative and resourceful
- Mutual benefits as the key design principle
- Sociotechnical resources and relations as design resources
- Open-ended design process
- The whole process as a piece of local infrastructuring

In the next chapter, I will present the case report from studying the project of Vancouver Tool Library.

Chapter 6.

Vancouver Tool Library Case Report

In this chapter, I present the case report of Vancouver Tool Library. First, I briefly introduce the project Vancouver Tool Library. I also present evidence of the details collected about data analysis in this case. In the second section, findings from data analysis are described. Finally, I discuss the characteristics in the design process of Vancouver Tool Library.

6.1. Vancouver Tool Library insight

6.1.1. Case description

The Vancouver Tool Library is a non-profit community service cooperative in Vancouver. It was established in 2011. It provides tools for a variety of projects, such as everyday repair and gardening. As the library develops, its tool inventory is growing quickly. Currently, the Vancouver Tool Library offers over 2,000 tools to its 1,800 members. Members of Vancouver Tool Library can rent tools by paying a membership fee. In addition to tools, the Vancouver Tool Library provides diverse workshops, such as making wine racks, zippered pouch sewing, and sustainable home building.

The goal of the Vancouver Tool Library project is to contribute to a more sustainable life style. It aims to enable its community to access a rich collection of tools without having to buy or rent them. It also helps individuals to save money and space that would otherwise be invested in tools. It has the benefit to the community of reducing waste. Furthermore, it connects neighbours and supports community building.

The individuals who are running the Vancouver Tool Library are almost entirely volunteers. There is only one paid staff. Board of Directors, volunteers, and members keep Vancouver Tool Library moving forward. Currently, the Board of Directors consists of seven individuals who are responsible for strategic planning, budgeting, and volunteer recruitment. Coordinators were recently set up to help Directors with specific projects.

Volunteers help manage the shop, maintain tools, and assist with workshops and other events.

They believe that the library is an initiative that fosters the process of building vibrant neighbourhoods in the city.

6.1.2. Source of evidence

In this case study, evidence from interviews, documents, and direct and participant observations was collected. Below, I present the detailed information about the collected data.

In-depth interviews

I interviewed seven participants while studying the Vancouver Tool Library case. Participants involved are described by using a role-ordered matrix.

Table 6.1. Participants interviewed

Participant name	Role	Description
James	The general manager of Vancouver Tool Library	The only paid staff. Besides daily affairs, James helped the tool library build partnerships with similar organizations where his friends work.
Paul	One of the Directors and tool coordinator of Vancouver Tool Library	Paul joined as a member of the Vancouver Tool Library in 2012. He currently also acts as a tool coordinator who maintains and purchases the tools. Sometimes, he leads workshops or does shifts as shop volunteer.
Gary	One of the Directors of Vancouver Tool Library	Gary joined the Vancouver Tool Library as a member in 2014. He goes to monthly meetings with the board to discuss problems and make decisions. He also does some shop volunteer shifts every month.
David	The volunteer manager of Vancouver Tool Library	David is the volunteer manager and a key holder. He does two shifts every month. He also trains volunteers and helps in workshops.
Kali	Workshop facilitator	Kali likes teaching people carpentry. He connected with Vancouver Tool Library several months ago and together held a series of workshops on sustainable home building.
Rex	One of the Directors of Vancouver Hack Space	Rex is a board member and volunteer with the Vancouver Hack Space. He prepared the setting and assisted in the workshop of Vancouver Tool Library.
Bruce	The general manager of myTurn company	Bruce provides the software platform to allow the tool library to more easily offer the primary tool lending service. He also did training about the platform.

Documents

Documents mentioned by interviewees were collected. Other online resources related to Vancouver Tool Library were also collected as additional documents. In the table, I list and briefly describe those documents.

Table 6.2. Documents collected in studying Vancouver Tool Library

Document name	Source	Description
New Member Flyer	Paul	A document that introduces the basic rules of being a member of Vancouver Tool Library, such as loan period and late fees, holds and extensions, and workshops
Cooperative Agreement	Paul	An agreement that lists the responsibilities and rights of members
Rules & Borrowing Policies	Paul	A document that lists the policies of borrowing and using the tools from Vancouver Tool Library
Membership Form & Waiver	Paul	A form that members have to sign to affirm that they have read, understand, and agree to abide by the rules and policies
Memorandum of Understanding	James	An agreement between Vancouver Tool Library and Wood Shop about the use of the Wood Shop work space for Vancouver Tool Library executing workshops
New Shop Volunteer Orientation Package	James	A document that is provided to new volunteers. It includes waiver forms that volunteers have to sign and useful information about the tool library. It also describes the volunteer position very clearly.

In Appendix B, I present the detailed content of the collected documents in studying Vancouver Tool Library project.

Direct and participant observations

In direct observations, I visited the tool library several times. During my visit, I asked questions of the volunteers of the tool library and took pictures of the environment of the tool library.

Figure 6.1. The environment and interior of Vancouver Tool Library.

In addition, I participated in two workshops held by the Vancouver Tool Library in April 2017. In the workshops, I observed the challenges that occurred and how they were resolved. Artifacts, individuals, and organizations included in the workshops were also observed. I also took notes and photos during the workshops. After the workshops, I expanded my field notes and inputted them into computer files.

The following is an example of the expanded field notes that I wrote up after I participated in one workshop.

> *The workshop was supposed to be held in the backyard of the Vancouver Tool Library. However, two days before the workshop, an email from James, the general manager, said that it would be switched to the Vancouver Hack Space because it was going to rain.*
>
> *On April 8th, 2017, I went to the Vancouver Hack Space for the workshop, the second one of the series named "Sustainable Home Building and Retrofits." The workshop was a hands-on workshop about installing windows and doors. Detailed information was posted online and quoted in below.*

*"**Part 2- Installing Windows and Doors***
Saturday, April 8th, 12pm-3pm
Vancouver Tool Library, 3448 Commercial St.

Determine if your windows and doors need replacement, and learn the basics of installing windows and doors, replacing weather stripping and preventing air ingress from around your windows. Learn the difference between poor quality and quality doors and windows, and steps for re-installation once they are removed. We will discuss how to prevent water ingress, and creating a proper seal around your windows. We will review window glazing, single glazed, double and triple glazed as well as review the steps for building a window frame and how to install a window and or door. Learn how to check for air leaks, and install caulking and sealants to cut down on air infiltration.

This is a hands-on workshop and participants should expect to use some tools. Please dress appropriately; no loose clothing or dangly jewellery and wear closed-toed shoes."

I arrived early and met the instructor Kali in the working space of Vancouver Hack Space. Kali told me that the workshop would be held in the loading bay. He was setting up the tools and materials there, because the working space is too small to have eight people.

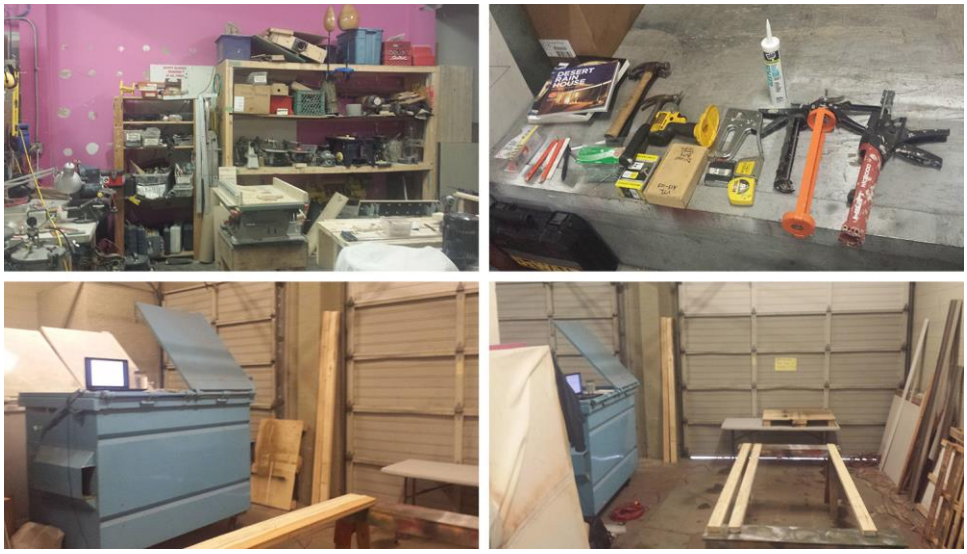


Figure 6.2. The settings of the workshop at Vancouver Hack Space.

Kail set his laptop on top of the recycle bin and put a big table close to the gate. Then, a mitre saw was set on the table. He also brought a window and several pieces of wood.

Figure 6.3. Laptop on the bin (left) and the mitre saw (right).

The mitre saw did not work well. Its power switch had been lost. Kali immediately contacted Rex, who is from Vancouver Hack Space.

Before the workshop started, all participants were asked to sign the Vancouver Tool Library waiver. After that, Kali gave a presentation on sustainable homes and the installation of windows.

Figure 6.4. Kali is giving his presentation (left) and the window frame we were going to build (right).

During the presentation, Rex came in and fixed the saw. He also left the waivers from Vancouver Hack Space and asked us to sign them.

After the presentation, we started to use tools and materials to really build the window frame. The knowledge of how to use tools, select materials, and make the frame was shared by Kali. Participants together then built the frame and installed the window.

Figure 6.5. We were builiding the window frame together.

After the building, all the participants were invited to tour the Vancouver Hack Space. Rex introduced the people working there. Cool projects and machines were also shown.

6.1.3. Analysis of Vancouver Tool Library evidence

In the process of data analysis, I also follow the steps described in Chapter 4. Similar as the analysis process described in Inner City Farms case report, I first did data processing and preparation. Interview recordings were transcribed and imported into Nvivo for coding process.

In the coding process of the Vancouver Tool Library case, I applied the pattern codes created in the Inner City Farms case as my start list of codes in analysing data collected in this case. Therefore, the codes in provisional coding step are:

Table 6.3. Provisional codes

Master code	Sub-codes
Issues	N/A
Publics	N/A
Attachments	Commitments to Dependencies on Informality
Local situations	City supports City restricts City is influenced

The analysis process is built on the analysis result of Inner City Farms case. Thus, it is more direct and takes less time in analyzing the data collected in Vancouver

Tool Library project. Below, I present the collective design process of this case. After that, I propose a higher-level reflection and articulate the characteristics of this process.

6.2. Collective design process of Vancouver Tool Library

In this section, I present the findings from studying the case Vancouver Tool Library. By using the theoretical of infrastructuring in relation to the theoretical framework publics (Le Dantec, 2016), I describe the project through its confronted issues, constituted publics, formed attachments, and the emerged work of infrastructuring in the project. Again, my goal is to understand the collective design process and describe the characteristics of this process that can be supported by interaction designers. I utilize the same descriptive framework as the one developed in describing the process of Inner City Farms project.

6.2.1. Issues

Issues are a set of social conditions. Issues are a base element needed to constitute a public.

From the data analysis, there are three critical issues that emerged in the collective design of Vancouver Tool Library project. They are volunteering issues, unaffordability of additional resources, and lending and maintaining tools as a library. The formation of these issues determines the actors that get involved in the design process which are articulated in later section.

Volunteering issues

The tool library is a volunteer-run cooperative. Except for its manager, the only paid staff, all the board members, coordinators and shop volunteers contribute their time and energy for free. However, mostly relying on its volunteers brings problems to the development of the tool library.

First, the time availability of volunteers varies. Balancing personal life and time contributed to the library is not easy, especially for those who have full-time jobs. When much time is asked to put into the tool library, the result is that many volunteers are burned out and quit their roles in the library. Therefore, finding the delicate balance

between keeping the tool library running smoothly and not letting people burn out is very important. One interviewee commented that many of the prior board members were burned out because of too much work.

> We had a lot of burn out within the board prior to our recent board been voted in. People were just too stressed, because they are doing both the strategic planning and taking on ground level projects. Being a volunteer position, that was just too much. (Gary)

Another common problem within volunteer-run organizations is that it is difficult to coordinate people's time, which was a problem for the Vancouver Tool Library. Sometimes shop volunteer forgot their shift or were not very engaged. This caused the problem that the tool library was not open when people visited there for renting tools.

> They are all doing good. Just occasionally not being able to make a shift or forgetting that you were working. (David)

> Sometimes, people were really engaged. Sometimes people were not showing up. (Paul)

Third, because volunteers have diverse levels of skills and experiences, it becomes hard again to coordinate them. For example, one interviewee described that they wanted to use Google Calendar to schedule volunteers. However, some volunteers do not own Google accounts.

> We use Google Calendar to schedule all of our volunteers, but you need to have a Gmail account to access a Google calendar. Not all of our volunteers have it. (James)

Moreover, the diverse levels of skills and experience of volunteers means that members who come to rent tools may not receive a consistent and quality service from the tool library. For example, members sometimes have to wait longer when the volunteer is not very familiar with the digital inventory system.

> Sometimes we get large line ups. New volunteers will get very stressed because you want to go fast but we need to hand enter in the code for the tools. That can take a while. (David)

Fourth, the decision-making process of the tool library and its responses to other partners are very slow and inconsistent since all board members are volunteers who cannot put much of their time into the tool library. The slow decision-making process impedes the launch of some projects. For example, project coordinators who have great

project ideas have to wait for a long time to get the projects approved. Therefore, several projects were stopped. As one board member described, one coordinator struggled with the slow and inconsistent decision-making on her mobile tool library project. However, he believes moving slowly is important for the tool library because of its insufficient ability to take risks.

> The board only meets once a month. I think it can be tough for coordinators especially when they have a specific project in mind and they have to wait for a whole month before they get approval for the next decision. Inconsistency in the timeline makes it pretty tough on her, which is unfortunate. But at the same time I think, it is important to move slowly especially as a cooperative organization like this. (Gary)

Another interviewee, from the organization that provides the digital inventory system, also expressed that it is hard to get timely responses from the tool library and he thinks this situation is very common in volunteer-based organizations.

> Often volunteer-run organizations, maybe only one or two people like paid manager. They are typically super busy. So, if something really critical, I think sometime it is challenging to get an answer to a question. We understand that. (Bruce)

Lastly, people are concerned about the fluidity of the volunteers in Vancouver Tool Library. They think frequent turnover means much unwritten knowledge is lost. Much of the information or experience about the tool library was not written down. When there is a turnover in the board, some knowledge is lost. The following quotes show that board members worry about the lost undocumented experiences and the future process of the tool library if they left.

> Have a sustainable process that is bigger than the people, because I am not going to be in the tool library forever. So, what is the process that leaves us? (Paul)

> We may go forward without knowing that there are certain barriers out there where the previous board may have also tried that. They may have lessons learned from that process and we were missing out those lessons because we don't have folks who have been there for that. And moving to the next year, we are going to have new members on the board. So, that is an ongoing challenge. (Gary)

Cannot afford additional resources

The second issue is that volunteers do not have sufficient money to afford all the resources they need, such as professional service for developing its safety policy, a full-time manager, a larger space, or good quality tools and materials. The revenue they generated only allows the library to survive, but is unable to meet its development needs.

First, because of a tight budget, the volunteers cannot afford the experts who can help them in making policies. For example, one interviewee described that they could not pay for the professional services when they developed the “safer spaces policy”.

> In developing the safer spaces policy, somebody in town, her job is helping organizations to develop safer spaces policy, but she is quite expensive. We would love to use that resource, but we cannot really. We cannot afford it. (James)

In addition to professionals, volunteers cannot pay the manager as a full-time staff even it really wants to have the manager to work more hours. Many participants expressed that they would prefer to pay more to the manager who is actually overloaded with work for the tool library.

> We would like to have James to work full time with us, but we cannot afford to do that. (Paul)

> We are constantly to free up our manager’s time, because he is paid pretty thin right now. (Gary)

Second, volunteers cannot afford a bigger space. This has become a major challenge. As a library, the restricted space limits its capacity to store a larger amount of tools. As the tool coordinator expressed, they want to buy some tools but do not have space to fit all of them.

> There are other tools we want to afford, but we have constraints on space. We don't have enough room to fit all the tools we may want to buy. (Paul)

In addition, the limited space makes it difficult for the volunteers to run workshops with a big group of participants or provide a workspace for members to work on their projects. One participant described his desire to have a larger space for people to do projects and run workshops.

> It would be a dream to have a really large space where we can have people drop in and work on projects. But right now, you just don't have the space to house people's work. We can do workshops but we have very limited numbers of people that can do it. (David)

Third, because it does not have enough money to buy many new tools, volunteers have insufficient tools to meet the increasing needs of its steadily growing membership. Similarly, the cost of the materials for workshops is a constant challenge.

> It would be nice to have new tools. We do have a budget for that but it is limited to very few tools. (Gary)

> We want to get a pressure washer, which is a popular tool in spring. But it is expensive to buy. And they don't last very long. I think we work in the financial constraints. In workshops, we can buy the materials we need but it costs more money. (Paul)

In the tool library, most of the tools are donated. Therefore, the tools have a wide range of quality. Some of them are very old. Likewise, the materials are often donated and recycled. Their quality is very diverse as well. As an organization providing services for renting tools, the tool library faces the challenge to offer good quality tools and materials.

> We have a lot of older tools, which are donated. They are tired and broken. It would be nice to have new tools. We do have a budget to that but it is limited to very few tools. (Gary)

> Sometimes you can get wood for free, but it takes time to get it. It also takes time to get it ready for workshops. You can get free wood but maybe it has nails in it. (James)

Lending tools as business

Lending tools is challenging per se. Different from books, tools have diverse shapes, functions, materials, and components. Maintaining a variety of tools requires much knowledge. Moreover, organizing and managing tools in an efficient way is not easy.

First, being a group that lends tools and encourages people to learn to use tools, volunteers face the challenge that tools may get broken intentionally or unintentionally. One participant described that not all members value the shared tools. He is fine with the situation in which tools are broken because of unintentional misuse by beginner users,

but he thinks members who intentionally use their tools in a careless way would be a problem for the tool library.

> I have someone come in and say 'do you have this thickness planer? I got this wood. It is really dirty and I don't want to run it into my planer but I want to run it through your planer.' So, he is placing less value on our tools than his own personal tools. We encourage people who are new to the tools and who don't know tools to come in and just have a go, because we believe one way people learn is by doing. We want to support that. We also hope they use tools as intended. Because we have to repair that tool whether they were intentioned or not. Of course, tools get broken. Those challenges are just the nature of the business. (Paul)

The second challenge of being a tool library is about organizing and managing its tool inventory. On the one hand, organizing tools in an efficient way so that volunteers can quickly find each tool is difficult. On the other hand, the digital system the library is now using does not always correctly reflect the tool inventory in the physical space.

In the physical tool inventory, when a new tool arrives, it is assigned with a code and labeled by Sharpie or by the code being carved into the tool. However, not all the tools are big enough to write a code on, for example the wrenches. There are also tools that come in a set. It is hard to really make sure each piece of it is returned. The following quote describes the participant's question about managing the small tools and those in sets.

> The wrenches are small and big and there are a lot of them. In theory, every single wrench should have an ID. There is another problem, that things are in a set, and a set has many different parts. So, when they come back, we get all our parts back. If we don't, how do we know and we end up with an incomplete set that doesn't actually meet the needs, but it was not obvious that it doesn't work. (Paul)

Figure 6.6. The tools that have different size (left) and come in set (right).

Moreover, many codes are worn out or even disappear after a period of time. Almost all interviewees expressed worries about the coding system used in their tool management and tracking.

> I wish there was a better way to keep in track of our tools, because often the code we write on our tools disappears over time or some tools get put into our inventory without a code. (James)

> Something we have talked about but we have not come up with a feasible solution yet is a better labeling system. There are painting tools, paint trays, rollers, and brushes. The code will be covered by the paint. We tried carving them but the paint then filled the carve. It is pretty tough. (Gary)

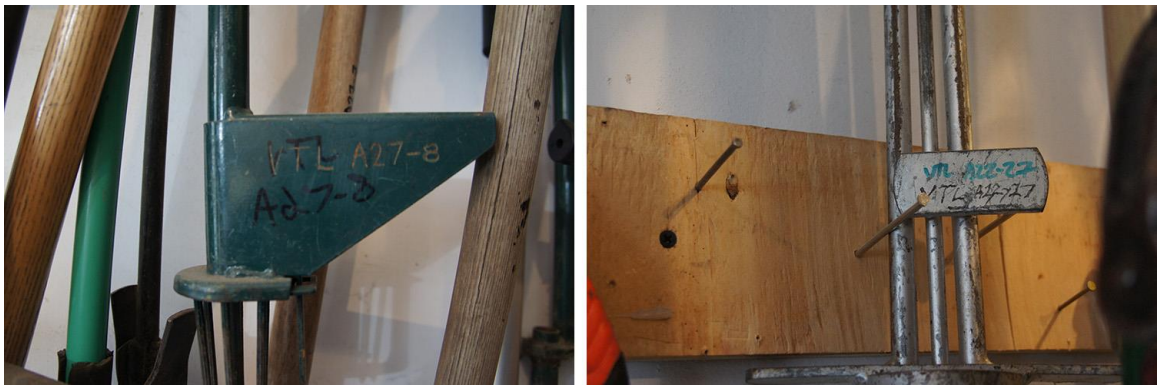


Figure 6.7. Codes on tools.

The third challenge in lending tools relates to the digital system – myTurn – which was uniquely created for the tool library to track and manage tools.

The digital system used for tracking tools is not synchronously updated. The asynchronous issue brings challenges to both the volunteers and the customers of the tool library. For example, participants described that sometimes tools listed as available in the online system may be under repair or otherwise not physically available.

> Our inventory is extremely varied. Some tools are checked in but not. Because often the times, either the tool is in repair, or has been lost, that inventory online has not been updated. So, that is challenging. (David)

> If somebody looked online and found the paint roller is in and wanted to rent it out, but it's actually gone. We just didn't have the code for it when it rented out. (Gary)

In addition, participants also expressed their expectation to have a more efficient way in using the digital system. Scanning, instead of manually inputting the code into the system, would be more appreciated.

> If there is a way to scan a barcode, that would be easier. (David)

> Ideally, we can just scan them and the system automatically does its thing. Right now, we have a manual system and we manually come up with ID. (Paul)

Another shortage of the digital system is that it lacks the financial record of renting tools.

> Another one is myTurn. It has some limitations. MyTurn meets our basic needs. But there are definitely a lot of issues with the software. It is not good at recording the financial side of everything. (James)

Above I presented the issues confronted in the project of Vancouver Tool Library. The issues provide a "point of entry" (Le Dantec, 2016, p. 34) for articulating how different actors and artifacts and institutions are enrolled in the dynamic and complex collective design process in the Vancouver Tool Library project. In the following sections, I articulate the publics affected by the issues and then present the attachments involved in contending with these issues.

6.2.2. Publics

A public is a group of people who are influenced by a specific set of conditions.

As articulated above, the individuals involved in Vancouver Tool Library project include volunteers (board members, coordinators, and shop volunteers), members who share the tools, partners of this project (e.g., Bruce from myTurn and Rex from Vancouver Hack Space). In response to diverse issues, actors affected form different federations thus publics are constituted. In this section, I present the publics that are formed in contending with the issues articulated above.

Individuals influenced by the volunteering issues include board members, coordinators, shop volunteers, members, the manager, and partners. Specifically, many board members were burned out because of the large amount of work in the project. Members are influenced when shop volunteers forget their shift or not familiar with the

digital system. The manager finds it difficult to schedule volunteers because not all of them have access to Google Calendar. For partners and coordinators, it is hard for them to receive timely responses from the board members because of their slow decision-making process.

In terms of the issue of lacking revenue, affected actors include volunteers, the manager, and members. More precisely, volunteers are difficult to pay for professional services in developing their policies or purchase new tools and materials. Members do not always have good quality of tools to rent. The manager is not paid enough to match his overloaded work.

Because of the limited space, volunteers find it difficult to store a larger amount of tools or run workshops in the tool library. Members do not have a workspace in the tool library to work on their projects.

When tools are broken intentionally or unintentionally, the affected individuals include volunteers and members. Specially, tool coordinators have to repair the broken tools and members can not rent the broken tools for a period.

In terms of the challenge in organizing the tool inventory, volunteers and members are affected again. It is hard for volunteers to track or find the tools efficiently. Members may not able to rent the tools they want to use.

Regarding the shortage of myTurn, volunteers are influenced because the digital system lacks the financial record of renting tools. Members feel also difficult to clearly know which tools are available.

6.2.3. Attachments

Attachments are important because they build out the collective capacities to act on issues. Attachments are the relations through which actors, artifacts, and institutions participate actively with each other. Central to the relations is the interplay between "dependency on" and "commitment to".

In the design process of this project, various social and material resources are integrated to enable the publics to act in response to the issues. From the collected data, it was found that the resources enrolled include volunteers, workshop facilitators,

donated tools, recycled materials, paper notes, YouTube videos, financial software, Wood Shop, Vancouver Hack Space, Vancouver Public Library, and other similar local organizations.

Below, I present the “commitments” and “dependencies” among the enrolled sociotechnical resources in contending with a set of shared issues articulated above.

Commitments to

Similar to the Inner City Farms project, volunteers play a critical role in this project. They commit to contribute their skills, time, and knowledge. Volunteers are responsible for providing quality tool sharing service to the members and managing and maintaining the tool inventory. Specifically, volunteers on board commit to make broader level strategies and bigger pictures. Coordinators are responsible for specific tasks. For example, the tool coordinator commits to maintain and manage the tools. In addition, shop volunteers commit to rent tools to the members when they come to the tool library.

Members commit to use the tools safely and return the tools after using them. The manager commits to work for 25 hours every week in the tool library for the volunteers and members. Workshop facilitators make commitments to lead the workshops and teach skills to the members who participate.

Wood Shop, Vancouver Public Library, and Vancouver Hack Space commit to provide workshop space to volunteers and members of the tool library. The technical company commits to provide software myTurn and related services to volunteers to use in managing and tracking the tools.

Dependencies on

The most important resource in this project is the tools. Volunteers are dependent on the donors to increase the tool inventory. They also rely on online platform (e.g., Craigslist) to gain cheap or free materials for the workshops. Volunteers are also dependent on the space for storing the tools. They rely on shelves which were recently created for organizing the tools in the physical space. To manage and track the tools, volunteers are dependent on the digital software myTurn. To record the financial side of renting tools, volunteers rely on free software named Vend. In addition, they also rely on YouTube videos and manual books to repair their tools.

To have enough space to run workshops, volunteers and members are dependent on Wood Shop, Vancouver Public Library, and Vancouver Hack Space. Volunteers rely on facilitators who teach skills to members in workshops. They rely on local similar organizations to learn their organization structure and policies.

Members rely on the volunteers to rent the tools. They also rely on volunteers and workshop facilitators to learn about using tools.

Informality and formality

Above I have presented the "commitments" and "dependencies" among the actors, artifacts, and institutions enrolled in this project. In the analysis, it is also found different levels of informality (or formality) in those relations. It is also interesting to find that some relations were informal at the beginning but then developed to be more formal and standard. In this part, I present the details about the informality and formality of the relations.

First, since safety is a main concern of Vancouver Tool Library, individuals have to sign waivers when they register membership. Participants in the workshops are also required to sign the waivers for safety concerns. As an interviewee expressed, they believe the waivers are necessary because it is hard to know what members will do with the tools after they bring them home.

> We want people be safe. That is our main concern. They have to sign because we don't know what they will be doing with the tools when they got home. (Paul)

> That means people may take tools out even they don't have much experience in using it. We want people be safe. That is our main concern. (James)

When new members join, they are asked to sign some official forms. The following are such forms, including the "Cooperative Agreement", "Rules and Borrowing Policies", and "Membership Form and Waiver" (see Document 2, 3 and 4 in Appendix B)

Second, except for formal contracts for safety issues, many relations are very informal, such as partnerships with other organizations. As one participant commented, these relationships are usually built on mutual benefits and friendship. In the collaborations, they help and learn from each other.

> Many partnerships are really informal, like friends. For example, "Another space", which is doing art therapy. We helped them to build a little library. We lend them tools and helped them design it… There is nothing written down, sometimes it is just spoken. If we lend tools to an event, for example. You know "please bring tools back on Sunday when your event is done". It is nice to work like that, because keeping it less formal keeps it a little bit more friendly and nicer. There is benefit to both I think. (James)

In addition to mutual benefits and friendship building, keeping informal relations also help make tasks be completed quickly. One interviewee, Rex, who is from Vancouver Hack Space[1], commented that the informal relations reflect the culture of the hack space, which is to get projects and ideas done quickly.

> There is nothing official. It is entirely based on the ideas of having things that we like this idea and let's go for it. So, there is no formal agreement of collaboration. It does work pretty well. I think it reflects its culture right now. You got a bunch of people who prefer to get things done quickly opposed to actually being formal. (Rex)

However, there are disadvantages to keeping relations informal. Sometimes, the informality makes communications unclear or collaborations unreliable. For example, one interviewee, who was the workshop facilitator, described an unexpected situation that happened in the real workshop. That is, the tools provided are different from the ones in the list that he sent to the manager. Specifically, the button on the mitre saw was broken which almost made him cancel the workshop.

> For that workshop, the biggest problem is not having a solid saw tool. That was really close to the point where I would just completely cancel that portion of the workshop. With that button, there was so much unreliability. You want make people to feel safe… There was actually a big list of tools that I supposed to have there… I said something in a certain way and maybe James did not understand it or he did not ask or he forgot. I didn't double check enough. So, it is extremely informal. (Kali)

[1] https://vanhack.ca/wp/ Vancouver Hack Space provides physical space where people can work on personal projects and collaborate and learn with each other. It includes members with various skills, which includes 3D printer, laser cutting, programing, etc. As a friend of Vancouver Tool Library, it provides workspace for Vancouver Tool Library to hold workshops.

Figure 6.8. The Mitre Saw's button was lost and replaced with a piece of pencil

In summary, besides formal contracts necessary for safety issues, most relations the tool library built with other individuals and organizations are very informal. The informal relations were built on friendship and mutual benefit. However, when informal agreements did not always work well, the volunteers also made adjustments to develop the relation into a more formal one. In this case, the attachments are formed anew. Hence, diverse formality of relations is found. Relations are not stable; they are developing and evolving.

In this section, attachments in Vancouver Tool Library project were presented. Specifically, "commitments to" and "dependencies on" among actors, artifacts, and institutions entangled in contending with the issues were articulated. In addition, the informality and formality commingled in these "commitments to" and "dependencies on" were described.

6.2.4. The work of infrastructuring

"Infrastructuring is the work of integrating sociotechnical resources – via existing and newly articulated attachments – that enable adoption and appropriation beyond the initial scope of the design space" (Le Dantec, 2016, p.26).

In the above sections, issues, the publics formed around, and attachments in this project were described. In this section, I describe the work of infrastructuring emerged in

this project. More precisely, the infrastructuring work emerged in studying this project includes: infrastructuring the organization, infrastructuring the space, infrastructuring the tools, infrastructuring for workshop places, infrastructuring for more reliable relations, infrastructuring for professional knowledge, and infrastructuring the tool management system. Below, I articulate each of the infrastructuring work in detail.

Infrastructuring the organization

To avoid volunteers being burned out, positions of coordinators were created to reduce the workload of board members. With this organizational restructuring, many practical works of the board members can be split and shared. This change has helped relieve part of the volunteering issue of the tool library. As one participant commented, the restructuring also saves much of the manager's time so that he can focus more on other important tasks.

> People were just too stressed… And that was where the restructuring happened for the past year where we created these coordinator positions and assigned them all the ground level projects. That freed off much time for the directors to focus on broader level strategies and making bigger pictures. It shifted a lot what our manager's position was, too. Before restructuring, our manager was quite all over the places. (Gary)

Infrastructuring the space

In order to have more space for tools, shelves and sections were created to better organize them. It is also interesting to find that there is a section named "sick bay" to store the tools that need repair.

Figure 6.9. Shelves and sections created for organizing tools and the Sick Bay (right).

With the built shelves and clear sections, more tools can be included in the tool library. One participant also described that tools can be found more easily now.

> We created the wall for all the clamps to make them very organized… Having a more organized shop has let us be more efficient. Because we organize in terms of our space, you can get them easily. (Paul)

While observing the space, two interesting and creative installations for storing tools were introduced by the participants. They are the pulley system and the French Cleat. These designs show the creativity of actors in using the resources.

> We made a pulley system for the lawn tool, which is only popular in summer. We also applied a system, which is quite adjustable, called French Cleat. You can add or remove one very easily. (Paul)

Figure 6.10. The pulley system (left) and French Cleat system (right).

To create more space for tools and keep the inventory updated, actors of the tool library started doing a garage sale in spring. As one participant commented, the garage sale also brings more revenue for the tool library.

> The other big change was every year now we do a garage sale where we get rid of old tools. We actually also make money from it and make space on our shelves. We had that these two years. (Paul)

Infrastructuring the tools

In last year, volunteers made a change in its price for renting tools. Repricing the tools helps increase the revenue for the tool library. Moreover, the new charging rule encourages people to return the tools on time.

> We changed our ways of lending out tools, which actually helps to bring more money for us. Besides actual rentals, late fees as well. We now charge late fees for folks that cannot bring tools back on time. (Gary)

> Recently just last summer, we changed the fees to $1 a day to encourage people to return the tools. So, we didn't need to buy many tools because they become more available. (Paul)

In addition to the price, physical tools were also modified. For example, one participant described that when a tool is often broken or hard to repair, he puts a note on the tool to remind people to use it carefully.

> We have a tool called a thickness planer. It is sharp and turns very fast. And they break very easily. To avoid the planer tool getting broken too often, we have notices on the tool saying please don't do this thing. (Paul)

Figure 6.11. Note was put on the tool to remind people to use it carefully.

Infrastructuring for workshop places

As discussed before, the tool library has limited space to hold all of its workshops. Volunteers then externalized the space resource to other partners, such as Wood Shop, Vancouver Hack Space, and Vancouver Public Library.

> We are actively reaching out to different organizations and folks to come in. For example, the wood shop, they do workshops and also made customer products with salvaged material. They let us use their space to host workshops. (Gary)

As a participant observer, I took part in two workshops of the tool library. One was held in a meeting room of a branch of Vancouver Public Library. The other one was conducted in the loading bay of Vancouver Hack Space.

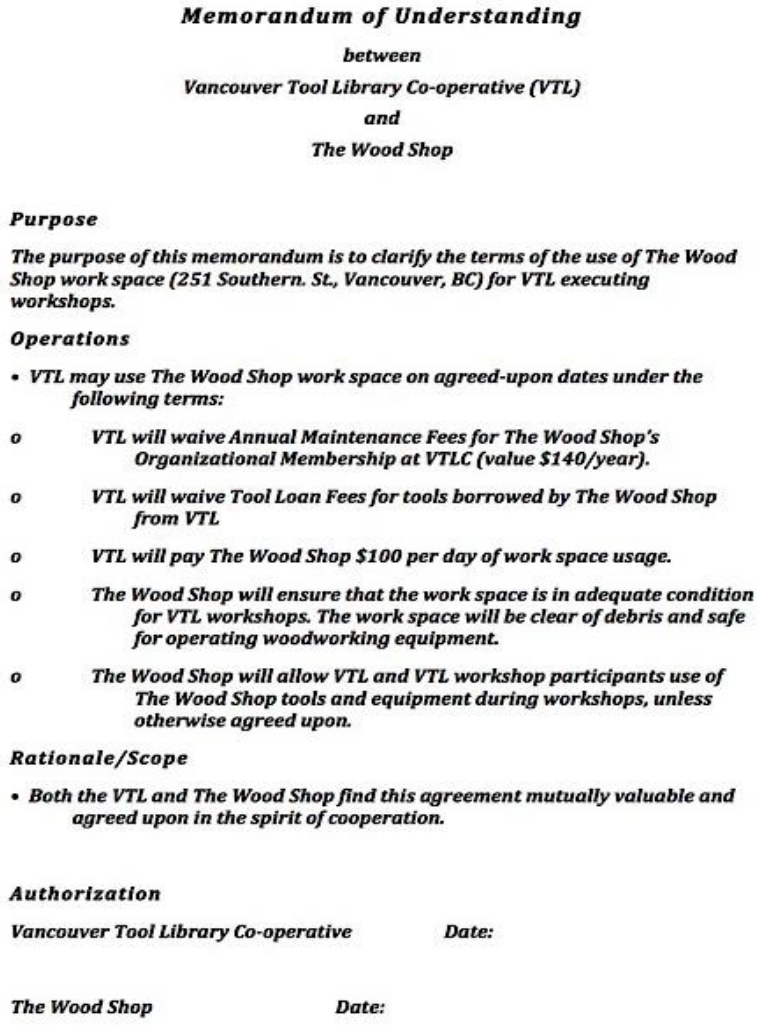
Figure 6.12. A workshop held in Vancouver Public Library (left) and in Vancouver Hack Space (right).

One interesting strategy the tool library adopted is that it uses its membership or physical tools as a “trade” to get the resources it needs. For example, to use the space of the Wood Shop for workshops, the tool library offers free organizational membership and waives the tool loan fees for tools borrowed by the Wood Shop.

Infrastructuring for more reliable relations

It is found that relations built with partners are changing. As previously described, most of the relations are very informal. However, sometimes, informal relations bring unreliability and unintelligibility. From data analysis, it was found that when actors identified an informal relation that often causes problems, they rebuilt the relation so that the problems were solved. In this way, an informal relation evolved into a more formal one. For example, as one participant described, there was only a verbal agreement between Vancouver Tool Library and the Wood Shop at the beginning. However, then they found they had to develop a Memorandum of Understanding (MOU) to clarify their collaboration. The MOU, including the responsibilities of Vancouver Tool Library and the space provider, specialized and clarifies the rules about their collaboration.

> We hadn’t really made a formal agreement, so it was not really communicated what we were expecting from this partnership. But to solve the problem, we came up with a kind of contract and we both agreed to, we both signed. (James)



Memorandum of Understanding

between

Vancouver Tool Library Co-operative (VTL)

and

The Wood Shop

Purpose

The purpose of this memorandum is to clarify the terms of the use of The Wood Shop work space (251 Southern. St., Vancouver, BC) for VTL executing workshops.

Operations

- ***VTL may use The Wood Shop work space on agreed-upon dates under the following terms:***
  - ***VTL will waive Annual Maintenance Fees for The Wood Shop's Organizational Membership at VTLC (value $140/year).***
  - ***VTL will waive Tool Loan Fees for tools borrowed by The Wood Shop from VTL***
  - ***VTL will pay The Wood Shop $100 per day of work space usage.***
  - ***The Wood Shop will ensure that the work space is in adequate condition for VTL workshops. The work space will be clear of debris and safe for operating woodworking equipment.***
  - ***The Wood Shop will allow VTL and VTL workshop participants use of The Wood Shop tools and equipment during workshops, unless otherwise agreed upon.***

Rationale/Scope

- ***Both the VTL and The Wood Shop find this agreement mutually valuable and agreed upon in the spirit of cooperation.***

Authorization

Vancouver Tool Library Co-operative ***Date:***

The Wood Shop ***Date:***

Figure 6.13. Memorandum of Understanding between Wood Shop and Vancouver Tool Library

In addition to the more formal relations redeveloped with other organizations, a more standardized orientation book was developed for future involved shop volunteers. It explicitly lists the expectation from the shop volunteers. It also lists the benefits and expectations future shop volunteers can have. In this way, the present volunteers aim to clarify the responsibilities of future shop volunteers and provide more consistent services to the customers.

> Our Volunteer Handbook got beefed up recently. When I started, there was not any handbook. But now, it is a full PDF package of all the questions and answers. You want everybody be able to do the same thing, because there were subtle variations, such as how people doing cash out or adding tools to the inventory. Now, the handbook is really helpful to produce consistency. (David)

Infrastructuring for the professional knowledge

Local organizations are approached because of their informational resources. For example, one interviewee described that they refer to local organizations to develop governing structures and policies. With these resources, the tool library could develop their policies without paying for the professional services.

> The BC Cooperative Association, we use them for guidance for governance. Also, other local organizations that have similar governance structures, we examine their structure and borrow from what they are doing. Or examine their policy posts or mandate to help us to inform our decisions. (James)

Furthermore, volunteers identify and involve much online knowledge to maintain tools. For example, YouTube is a great resource for them for repairing tools, as one interviewee described.

> Youtube is a huge resource for us, for fixing tools or diagnosing tools. There are always Youtube videos that explain how to do it. If there is something wrong with the tools, then try to figure out what's wrong with it. (James)

Infrastructuring the tool management system

Volunteers and the manager had to find other software to meet their financial needs since myTurn did not provide financial functions when it was integrated. That is the reason why they use the software program Vend for their finance and accounting.

> Myturn meets our basic needs. But there are definitely a lot of issues with the software. It is not good at recording the financial side of everything. So that's why we have the second software Vend to do financial tasks. (James)

To sum up, by applying the theoretical framework publics and the theory of infrastructuring, the underlying design process of Vancouver Tool Library project is described. Specifically, it includes: infrastructuring the organization, infrastructuring the space, infrastructuring the tools, infrastructuring for workshop places, infrastructuring for more reliable relations, infrastructuring for professional knowledge, and infrastructuring the tool management system.

6.2.5. Local situations

The local situations play a role in the infrastructuring processes of Vancouver Tool Library. In this part of the report, I elaborate the impacts made by the city of Vancouver to the project.

On the one hand, the City of Vancouver supports the development of the tool library, which helps the community to reduce waste and become more sustainable. At the beginning of the tool library, the City provided Neighbourhood Small Grants to help build it.

> Earlier on, the City of Vancouver was really very helpful. They gave us some money to start. (James)

On the other hand, Vancouver, as a desirable city to live in, becomes an increasingly dense and expensive place. This causes challenges to the project. Almost all participants expressed their worries that the current location of the tool library is not stable.

> Vancouver is an expensive place to live. The same is true if we want to rent the space. We rent this space. This is sort of big picture in terms of the organization as a whole, is we have house instability. A big block of condos has gone up and an apartment has gone up next to us. There is used to be a shop like this or other retail space. Now, it is expensive condos. (Paul)

> We pay for the rent for our space. The rent is expensive and it goes up every year. Right now, we are on a monthly lease. There is not a lot of stability of our space. (Gary)

> We have been looking for space, but just the rent, especially you want to be in a central area. (David)

Hence, although the City of Vancouver supports the development of the tool library, finding a big and stable space is becoming very challenging now in Vancouver, which is a risk for the development of the Vancouver Tool Library.

6.2.6. Summary

In this section, I presented the findings from studying the design process in Vancouver Tool Library project by using the infrastructuring theory in relation to the theoretical framework publics. Specifically, to contend with the evolved issues, the actors

creatively adjust the existing resources and relations in the present infrastructure and actively reach out to identify and integrate other resources that can increase their capacities to deal with the issues. Seven examples of infrastructuring work that emerged in studying the project were presented. Again, it is important to notice that the infrastructuring work uncovered by this study is only a part of the collective design process of the project. There definitely are more examples of infrastructuring work occurred of this project which is beyond this doctoral work.

Next, I will present my further reflections on the findings and discuss the characteristics of the design process in the project of Vancouver Tool Library.

6.3. Characteristics of the design process in Vancouver Tool Library project

In this part of the chapter, I further discuss the findings from the case study of the Vancouver Tool Library. Similar to the reflections developed in Inner City Farms project, I will further reflect on the infrastructuring work emerged in this project and analyze the characteristics of the design process in Vancouver Tool Library project.

6.3.1. Fluid and flexible

In this volunteer-based project, the formulation of the public is very fluid and dynamic. The actors who participate in design activities in different period of the process are different. For example, board members of Vancouver Tool Library are changing every year. As articulated in last section, the fluidity of the publics causes problem. Because much experience and knowledge about the tool library was not written down, some knowledge gets lost.

The public itself is very flexible in response to issues that emerge in the project. For example, positions of coordinators were created to reduce the workload of board members. With this authoritative restructuring, much practical work of the board members can be shared.

In summary, the formulation of the publics who take part in the design process is not stable. Actors join and leave the project. However, the inner organizational structure

is very flexible, which is easily adjustable to augment the capabilities of the group in the design process of Vancouver Tool Library project.

6.3.2. Creative and resourceful

In many of the infrastructuring work presented above, publics who engage in the practices of designing could be described as creative and resourceful. In the design process, creativity and resourcefulness demonstrate in multiple ways.

First, publics use their creativity in developing vision for what the project could further be. For example, at first, the tool library was thought as a place for storing and sharing tools. Then, actors think about holding workshops to teach people how to use diverse tools. They also creatively started doing garage sales in order to save more space for new tools and keep the inventory updated. The actors are able to creatively generate new ideas or strategies in designing and shaping the project.

Second, creativity is also present in the practical ways publics are able to identify multiple artifacts and appropriate them for their own purposes. For example, French Cleat and the pulley system are creative designs that were made to help organize the tools more efficiently. The “sick bay” is also a creative design to store the broken tools. The creative thinking allows the publics to identify the elements or aspects in their infrastructure that can be changed to better deal with the issues they confronted.

Third, in addition to creativity, resourcefulness is present in the design process of Vancouver Tool Library project. In the work of infrastructuring, publics are aware of the different resources present in their attachments. For example, recycled wood and drawers are repurposed for making shelves. Digital tools, such as YouTube videos and Vend, are also enrolled to complement their capabilities. They also create new attachments to include the resources they did not previously have. For instance, workspace from other organizations are identified and integrated as places that can be used for workshops. Thus, publics adopt and appropriate the resources through their present and newly built attachments as their design resources.

In the design process, creativity and resourcefulness manifest in the multiple design strategies the actors used in dealing with the different issues. On the one hand, publics reduce the factors that cause the problems. For example, they get rid of old tools

to save space to mitigate the issue of imitated space. On the other hand, publics increase their capacity to confront the result of the issues. For instance, they built the shelves so that more tools can be stored in the space. They also use space from others so that to augment the ability in contending with the issue of limited space.

6.3.3. Mutual benefits as a key design principle

In the Vancouver Tool Library project, mutual benefits are also found as a salient principle in the collective design process. The design process of the project is dependent on multiple social relations.

Throughout the project can be found mutual benefits as a critical principle in the work of infrastructuring. This is particularly obvious in creating new attachments. For instance, Wood Shop that provides its workspace as the place for the workshops was offered a free organizational membership of the tool library. Vancouver Hack Space, where I went for a workshop as a participant observer, could have more visitors and advertise its projects and space. Besides, volunteers who contribute their time working in the tool library can be waived their membership fee as well. Therefore, in the work of infrastructuring, the line between the service provider and consumer is seemingly blurring. All the actors and institutions involved in the project make contributions and gain benefits from each other.

Additionally, mutual benefits provide fertile ground for cultivating friendship that helps to strengthen and maintain the constituted relations in the design process. It thus consolidates the resources that can be used for future design act. Thus, a durable (although dynamic) infrastructure is formed in supporting the further design acts of publics.

Finally, in creating the mutual benefits, mutual respect is also found. Actors involved appreciate the understanding and respect between each other. For example, when tools get broken unintentionally, volunteers know that it happens to beginner users and they are willing to support and encourage them. When the mitre saw was broken in the workshop, participants, facilitators, and the volunteers all understood and accommodated that unexpected situation. The collective design process thus allows for trail and error. Individuals respect each other and benefit each other.

In summary, the collective design process creates mutual benefits and relies on this quality for following design acts. In creating the mutual benefits with all the actors and institutions involved, virtuous relations were built and strengthened which support the formation of the network of resources that can be used for publics' future design acts.

6.3.4. Sociotechnical relations and resources as design resources

The design resources involved in the design process are diverse. Sociotechnical relations and resources are understood to be resources for further design acts by publics who can adapt and appropriate them to respond to issues.

In the design process, publics see the social and material resources in the attachments as resources for further design acts. Examples include: volunteers are involved in fixing tools, leading workshops, or preparing materials; YouTube videos are used as guide in repairing tools. The capabilities of those social and technical resources are often what allow publics to see them as supports for design actions.

In addition, the informal relations built in the infrastructure enable publics to adjust or rebuild them in responding issues. When the informal relations cause problems such as lack of clarity and reliability, they were adjusted or reformed. For example, a MOU was created to clarify the obligations of both the tool library and Wood Shop. In a similar manner, a volunteer handbook was made to standardize and clarify the tasks of the volunteers. Therefore, the informal relations built in the design process allow publics to adapt them so that to act better in future design process.

To summarize, in the process of infrastructuring, publics see sociotechnical resources as well as relations as resources for further design acts.

6.3.5. Open-ended design process

The design process of Vancouver Tool Library is very open-ended. It will keep changing because the result of a design action in the process is just a beta version. The Vancouver Tool Library project illustrates this point very well because when new issues emerge, publics will be reshaped, attachments will be adjusted or created, and the shape of the infrastructure will change. As different individuals, artifacts, and institutions

become involved or shuffled, the shape of the issues changes, which will trigger a new round of infrastructuring process. The design process thus is openended and unfinished.

In addition, the open-ended nature of the design process sometimes reduces the creativity of the publics. When the improvement of a situation would take too much effort, publics might just leave the problem there for future publics. This is often because the changes would cost too much time or money, or even trigger retraining of the volunteers. For example, volunteers did not change the labelling system even though they are not very satisfied with it. Similarly, they clung to an old version of myTurn to avoid the retraining of the volunteers, although they think the old version could not meet all of their needs. Therefore, the open-ended nature sometimes dilutes the creativity of publics especially when they find the issues they confront embroil multiple aspects of the current infrastructure or the envisioned design acts would cost too much of their present capabilities.

Finally, the open-ended nature also increases the cautiousness of publics. For example, the publics make slow and careful decisions on spending their money in the design process. Some creative ideas have to be given up. By acting in a cautious way, the publics want to make sure their project can sustain for a long time.

In summary, this open-ended quality of design process, on the one hand, allows publics to envisage a variety of possibilities that can be considered for the future design process. However, on the other hand, this quality raises the concerns or worries of the publics with their design decisions.

6.3.6. The whole project as a thread of local infrastructuring

The design process of Vancouver Tool Library is impacted by the environment where it locates. Specifically, the infrastructuring work of the city also causes changes and challenges for the design process of Vancouver Tool Library.

On the one hand, as described earlier, City of Vancouver promotes the project by offering grants because the project fits with the city’s goal of being the greenest city in 2020. Publics thus received supports in designing the project. The whole project serves as a demonstration in reducing Vancouver’s ecological footprint.

On the other hand, the increasing density and real estate development in that area where the tool library is located make the existence and development of the project more and more instable.

Therefore, the infrastructuring process of the project is understood as a thread of the infrastructuring process of the city. The latter provides an environment for the ongoing design of the former in terms of policies and spaces.

6.4. Summary

In this chapter, I first introduced the Vancouver Tool Library project and briefly described my data collection and analysis process. After that, in the main body of the chapter, I presented the detailed findings about the collective design process of the project by using the theory of infrastructuring. Seven examples of infrastructuring work were presented. They are infrastructuring the organization, infrastructuring the space, infrastructuring the tools, infrastructuring for workshop places, infrastructuring for more reliable relations, infrastructuring for professional knowledge, and infrastructuring the tool management system.

Finally, I developed further reflections on the findings and discussed the characteristics of the design process in this project. The characteristics are fluid and flexible, creative and resourceful, mutual benefits as a key design principle, sociotechnical relations and resources as design resources, openended design process, and the whole project as a thread of local infrastructuring.

In the next chapter, I will present the case report from studying the project of Woodland Community Garden.

Chapter 7.

Woodland Community Garden Case Report

In this chapter, I report on the case study of Woodland Community Garden project. Similarly to my previous two case reports, I first provide the case description and articulate the data collection and analysis process in studying the project. Then, I present the findings from data analysis in detail by applying the theory of infrastructuring in relation to the framework of publics. In the final section, I provide my further reflective analysis on those findings and discuss the characteristics of the design process in this project.

7.1. Woodland Community Garden insight

7.1.1. Case description

The Woodland Community Garden initiative was established in 2012 by a group of community volunteers. It is located in Woodland Park, a lively place in east Vancouver. The garden provides community residents with an opportunity to engage in gardening activities and socially interact with one another. The construction of the garden began in June 2013. A local community gardening group, with CityStudio[2], consisting of students from architecture, landscape architecture, human geography, industrial design and communication design, together with City of Vancouver Park Board planners designed garden master plans as well as built the garden's main structures, including the raised beds, fences and the tool shed.

Now, the community garden is run by the Woodland community volunteers. There are 77 individual plots and common areas. There are also some special plots managed by other organizations. For example, Grandview Woodland Food Connection, which works with other senior groups and schools, manages the intergenerational

[2] http://citystudiovancouver.com/ As described in its website, CityStudio is "an innovation hub where City staff and students, and community co-create experimental projects to make Vancouver more sustainable, livable and joyful."

garden plot that is named Le Chou. DIGA, a physical disabilities independent gardening association, also has some plots in the garden.

Members who garden in individual plots have to renew their plots every year by signing the membership agreement. In every spring, there is an annual general meeting in which gardeners discuss issues and make discussions together. Work parties and workshops are periodically held in the garden.

7.1.2. Source of evidence

In this case study, evidences from interviews, documents, and direct and participant observations were collected. Below, I present the details about them.

In-depth interviews

I interviewed nine participants in studying the case Woodland Community Garden. They are described in the following matrix.

Table 7.1. Participants interviewed

Participant name	Role	Description
Caroline	One of the organizing committee members of Woodland Community Garden	As a member of the organizing committee, Caroline takes responsibility for administration work. She is also a researcher on urban farming and community gardens.
Terry	The leader of the common areas team of Woodland Community Garden	Terry works for a construction company. He has been a member of Woodland Community Garden since the very beginning. Now, he is the leader of common areas.
George	A previous member of Woodland Community Garden	George was a member of Woodland Community Garden until 2015. He participated in the building process of the garden.
Laura	Vancouver Park Board staff	Being a Park Board staff person, Laura participated in the building process of Woodland Community Garden.
Jeffery	Vancouver Park Board staff	Jeffery deals with the issues come up in the garden that require the Park Board to work on or investigate some different options.
Luis	The community developer from Grandview Food Network Connections	Luis works as a community developer. He helped build the Le Chou program, in which seniors and youths garden together. He cares a lot about vulnerability.
Ben	A CityStudio student	Ben was an architect student and helped community gardeners with the design. After the class ended, he, Susan, and another student worked for six months to finish the shed building.
Susan	A previous member of Woodland Community Garden	Susan is an architect and she loves gardening. She lived very close to the park and built the shed with Ben.
Steven	The Woodland Park caretaker	Steven doesn't like the Woodland Community Garden because he thinks it increases the number of drinkers and drug users in the park.

Documents

Documents mentioned by interviewees were collected. In the table below, I listed and briefly described those documents.

Table 7.2. Documents collected in studying Woodland Community Garden

Document name	Source	Description
Woodland Community Garden construction book	Terry	A set of illustrations of the master plan of the garden, including the plot locations and water taps locations
Shed package	Ben	A package of design files and photos of the tool shed
Board of Parks and Recreation report	Website of City of Vancouver	A report describes the proposed plan for building a community garden in Woodland Park as well as the result of public consultation
Woodland Community Garden Club Constitution and Membership Requirements	Caroline	A file includes "Woodland Community Garden Membership Requirements", "Teams and Suggested Responsibilities", and "Team Meetings Structure and Governance"
Rezoning policy for sustainable large developments	Jeffery	An official document describes the requirements associated with rezoning of large development sites and the Greenest City 2020 goals and targets

In Appendix C, I present the detailed content of the collected documents in studying Woodland Community Garden project.

Direct and participant observations

I visited the Woodland Community Garden several times. During my visit, I asked questions of the volunteers of the garden and took pictures of its environment.

Figure 7.1. The environment of Woodland Community Garden

As a participant observer, I took part in the work parties of the community garden. In the work parties, I took notes and photos. I also asked questions of the community gardeners.

7.1.3. Analysis of Woodland Community Garden evidence

Similar to the analysis process described in Inner City Farms and Vancouver Tool Library case reports, I first did data processing and preparation. Interview recordings were transcribed and imported into Nvivo for coding process.

Pattern codes developed in Vancouver Tool Library case study were applied as the start list of codes in this case study. In the first cycle coding process, descriptive and in vivo coding methods were applied again as in this case. Then, pattern codes were created as below:

Table 7.3. Provisional codes

Master code	Sub-codes
Issues	N/A
Publics	N/A
Attachments	Commitments to Dependencies on Informality and formality
Local situations	City supports City restricts City is influenced

Below, I present the detailed design process from analyzing this case. After that, I propose my reflective analysis based on the findings and discuss the qualities of the design process in the Woodland Community Garden project.

7.2. Findings

In this section, I describe the collective design process of Woodland Community Garden by applying the theory of infrastructuring in relation to the theoretical framework of publics (Le Dantec, 2016).

7.2.1. Issues

Issues are a set of social conditions. The shape of issues changes as different actors become involved.

In the design process of Woodland Community Garden project, four significant issues have emerged. They are issues related to its volunteer-based organization, finding resources to build and develop, using public land as gardening place, and involving multiple social groups. Below, I present the details of these issues that are found from the data analysis.

Volunteering issues

As described above, Woodland Community Garden is a volunteer-run garden started in 2012. It is located in Woodland Public Park in the city of Vancouver. Garden members, who are mostly from the Woodland neighbourhood, build, organize, and maintain the garden through collective effort. However, mostly relying on volunteers causes a variety of challenges to its development process.

First, the levels of skills of volunteers are quite diverse, which means that organizing the gardening group in an efficient way is very difficult. For example, not all members feel comfortable using apps or receive group emails. One participant described that one of the members suggested using Slack for group communications, but not everyone wanted to try it.

> We use Google Groups, which people don't like because they get too many messages… One person came to the meeting and brought up the idea of using Slack. Some people really like it but I have never heard of it. Other people didn't want to use it. Other people don't use email at all. There is such a range that people are confortable with technology. (Caroline)

Second, different time availability and skills of volunteers causes an uneven labor problem. The garden relies on volunteers being motivated and altruistic. It is too hard to track how much time people put into the garden. Some volunteers take too many tasks and sometimes are burned out, while some members contribute little time to the volunteering work, partly because of their daily jobs.

> What happens in the garden is that 10% of the people do most of the work. It takes us so long to track down people, figure out how many hours they volunteered. That is just a headache. (Caroline)

> Many people they just want to come in and have a garden. They don't actually have a skill set that allows them to be social and communal to work together. (George)

> The first year when I was involved in the common areas is that I figured out that is too much work for one person. You get burned out. (Terry)

Third, relying on volunteers means the decision-making process is very slow and unclear. In the group, reaching a consensus with a large number of members is very hard. It is not clear if members' suggestions influenced the group's decisions or not. The decisions of the groups are very vague.

> It is very hard to reach a consensus when you deal with 77 people when everyone comes to the meeting. I don't know whether we decided to use Slack. I am on it but nobody really communicated on it. So, I don't know what is happening. (Caroline)

Fourth, many volunteers, including the ones on the organizing committee, lack professional communication and organizing skills. One interviewee, a member of the administration committee of the garden, described that the lack of organizational skills is one of the biggest issues for the community garden. She commented that gardeners are less able to solve the conflicts in managing themselves.

> People have gardening skills but not necessarily organizational skills. One thing that happens to our garden is the conflict management. If people have conflicts between themselves, how we could manage?... You know, I have never organized a garden before. (Caroline)

Individuals realized that when people leave the gardening group, the related knowledge and skills is lost. In other words, knowledge and skills get diluted when there is a turnover in the group. How to sustain the knowledge of the group becomes a challenge.

> When somebody in the organization had a baby, you know she is not around; she was there since the beginning of the garden. The rest of us don't know what is going on. So, we lost a lot of capacity that way. A lot of people who started the garden have moved on. So, that is just lost and that is the real struggle because we whenever inventing the wheel's been already done, or we don't know where is everything is. (Caroline)

Finding resources for building and developing the garden

The second prominent issue is to find resources to build and develop the physical garden. The resources include the materials, tools, and labor.

The gardeners have to continually apply for funding to purchase the materials and tools beyond the ones they received in the building process of the garden. Recently, the gardeners applied for funding to build a greenhouse for the garden. People who can write proposals are needed.

> One of our new members is very active. She actually wrote up a couple of proposals for funding for different projects, like the small greenhouse. The idea is that you can have a starter from the seeds and you can put them in the plot to grow faster. It also can be used to extend the season. (Terry)

With the increasing number of community gardens established, the ongoing support of maintaining the gardens brings challenges to the community garden groups but also to the city. The following quote shows that city staff worries about the sustainable support to the gardening groups.

> How about ongoing maintenance and resourcing for these gardens? We don't really have a stable fund that we can go. A lot of gardens need to be repaired after certain amount of time. (Jeffery)

In addition, as articulated above, the limited time and skill ability brings challenges for building and developing the garden.

Using public land as gardening place

Another issue in the design process of Woodland Community Garden project is related to the public parkland that is used for gardening. Locating on public space causes multiple conflicts and problems for the gardeners and their neighbours.

First, the produce of the individual plots and the installations of the garden sometimes were stolen or vandalized. Because the garden is public, sometimes dogs and wild animals enter into the garden and dig up and break the gardening beds. There is also vandalism caused by people. For example, the tool shed was broken into several times. The picnic table and trellis of the garden were lost. It is not allowed by the city to build a fence around the community garden. As one interviewee from the City Park Board commented, the community garden is a unique section of public space in the city.

> We try to integrate the designs in certain ways but we also recognize that is a part of being a public community garden. It is an odd place. We don’t have the same thing as that. (Laura)

How to include everyone in the garden but also protect individual plots becomes a problem that is hard to deal with in the community garden.

The second issue of having a community garden on public land is that it attracts people who drink and take drugs to go there, which causes safety issues to the neighbourhood. In the garden, there is an area originally designed based on an idea of outdoor classroom. A bench was built for gardeners and neighbours to sit on. However, it is attracting people who take drugs and alcohol into the garden. As participants described, the caretaker of the park wrote an email to the group about his safety concern in the park. He suggested gardeners remove the bench. However, not all gardeners agreed with that suggestion since they think seniors would have no place to sit down if the bench got removed.

> The caretaker feels the garden is a place people can hide to do things like drug or drinking. Everything else is flat. You can see everything... It is an ongoing issue. If the bench is taken out, where could older people sit there? (Caroline)

Figure 7.2. The bench inside the Woodland Community Garden.

However, the caretaker feels that the garden space itself is a problem because it brings many social problems into the park area. He believes these problems affect the children and families who live there. In his opinion, the garden should be removed.

> This community garden brings more needles and a lot more alcohol. There were drinkers hiding in the community garden because it is very dark and there is a big bench. I found homeless live in the compost bins. It is much worse… In my opinion, the garden has to go. (Steven)

Third, there exist conflicts between community gardeners and other groups that use the park space, for example, the baseball field users. Although the distance between the garden and the baseball field has been carefully calculated before the garden was built, sometimes, the balls come into the garden and hit gardeners.

> In the summer, teams play there. But the balls come into the garden and can actually hit people's heads. Different users use that space, who get priority and how can you stop people from hitting balls to the garden? (Caroline)

> I think that baseball field is designed for little kids to play. That is not always the case. It increases the number of balls that fly in because these fields are being used by adults. (Jeffery)

In addition, some neighbors are concerned that the community garden would divide the park. In that way, they would be unable to pass through the park directly.

Lastly, because it is located in a public park, the building of the garden is constricted by the existing water pipelines and electricity power structure. Fortunately, there are water pipelines in the area where the garden was proposed to be. However, there is not electricity outlet in that area. Moreover, telecommunication cables are located under the garden, which brings challenges in designing and building the garden.

Involving diverse social groups in the community gardening

Being a community garden, Woodland Community Garden aims to involve and welcome diverse social groups, such as youth, seniors, people with disabilities, newcomers, and individuals from different cultures. However, reaching these groups and building programs for them are not easy in the garden. Although the garden did a great job in involving diverse groups, it still faces challenges with pluralism and comprehensiveness.

For example, very interestingly, there was a senior who does not speak English and is not a member of the community garden who started to build a small bed and bring pots to grow food around the garden. She would like to grow but was not able to join as a community gardening member because of the language barrier.

> If you go there you will see someone added a little bed… There is an old woman. She has gone to the garden a lot. I don't think she speaks English at all. She uses the garden and puts stuff down there. She is not formally a member of the garden. (Terry)

Figure 7.3. A little bed built outside of the garden.

The surface of the garden was not well designed for disabled people to access easily. The following quote is a reflection of Laura, who is from the Park Board and participated in the building of Woodland Community Garden.

> This is a garden that has been programmed around accessibility, but there was a problem with the materials we used for the surfacing in the pathway that were not successful as we want to be. (Laura)

One interviewee, who is a community developer, emphasized the importance of community garden to involve more social groups to communicate with and understand them.

> I really pushed them to do more out reach. Otherwise you will just get the same demographic. You need to meet with groups and find different ways to invite people to work with you. Dedicate a few boxes to specific communities. They don't come to meetings. But eventually, they will come to you. (Luis)

Another concern is how the Woodland Community Garden can meet the high demand of the community neighborhoods. As participants are introduced, there is a very long waiting list of people who want to participate in growing in the garden. However, the space is really limited. As one interviewee commented, developing enough gardening space for the growing community becomes a challenge.

> There is high demand for this very small amount of spaces. There is a perception over time that you have same people in the spaces and we are not doing enough to grow these spaces or develop more. So, even the woodland is there, the garden plot was there. Within a certain distance as we started putting more housing in the city, how do you maintain enough park space. (Jeffery)

In this section, I articulated the issues emerged in the design process of Woodland Community Garden project. The issues are volunteering issues, finding

resources to build and develop the garden, using public land as gardening space, and inclusion of diverse social groups. Many of the issues are thorny problems. However, the actors and organizations involved proactively tried to deal with them. In solving those problems, they connected with a wide range of resources to increase their capacities. In the following sections, I articulate the publics affected by the issues and then present the attachments involved in contending with the issues. After that, I describe the details of their identifications, adaptions, and integrations of diverse resources in the design process of Woodland Community Garden.

7.2.2. Publics

A public is a particular configuration of people affected by the issues. It is dynamic and contingent with the presence and evolution of issues.

Above I have presented the issues that emerged in the design process of Woodland Community Garden project. Actors affected by the articulated issues include gardeners, City Park Board planners, the park caretaker, neighbours, baseball team players, and the staff from the telecommunication company. In this section, I describe the publics that are formed in dealing with each of the conditions presented above.

In the process of building the physical garden in the public parkland, affected actors include community volunteers, the food-marketing businesswoman, the park caretaker, planners from Park Board, other users of the park (e.g., baseball players and other neighbours), and staff from telecommunication company. Specifically, volunteers desired to build the garden in the park. The food-marketing businesswoman wanted to fund a social and non-profit project in the garden. Planners would like to support and regulate the building process. The park caretaker is an opponent because he believes the garden causes problems in the neighborhood. Neighbors and other users of the park are affected because the garden would influence their normal movement area. The staff from the telecommunication company is affected because the garden may block their access to the underground cables.

After the physical garden was created, individuals influenced by the volunteering issues include the gardeners themselves. Specifically, the gardeners who contribute

much of their time in organizing the group and maintaining the garden space are affected. They feel hard to organize the group or burned out because of too much work.

In addition, the vandalism and theft problems affect all the gardeners. The problem of drug users and drinkers in the garden impact the gardeners, the park caretaker, and neighbourhood families.

7.2.3. Attachments

Attachments are the relations through which sociotechnical resources participate actively with each other. Sociotechnical resources include actors, artifacts, and institutions, and other categories might be included. Central to the relations is the interplay between "dependency on" and "commitment to".

In the collective design process of Woodland Community Garden project, a variety of social and material resources are integrated to enable the publics to act. From the collected data, it was found that the sociotechnical resources integrated include community members in Woodland neighborhood, CityStudio students, donated materials, and physical and digital tools, etc. Below, I present the "commitments" and "dependencies" among the enrolled sociotechnical resources in contending with a set of shared issues articulated earlier.

Commitments to

Planners from the Park Board commit to support the gardeners to design and build the garden and get approvals from the city. The community developer commit to the food-market businesswoman and gardeners to bring seniors and youths to the garden. CityStudio students commit to build the shed, beds, and fence for the gardeners. Gardeners commit to build the garden in a way that does not influence neighbors and the staff of the telecommunication company.

Gardeners are responsible for taking care of their own plots as well as the common areas in the garden. They commit to contribute their time and energy in designing the garden. Specifically, volunteers on the administrative group commit to organize the members and renew their membership. Gardeners on the common area team commit to maintain and manage the common area. In addition, gardeners commit

to provide free gardening beds to special groups, such as seniors, youths, and disabilities.

Dependencies on

In the building process, gardeners rely on the planners from the Park Board to get approvals from the City and build the garden. They are dependent on the CityStudio students who build the tool shed, garden beds, and the fence. The food-market businesswoman relied on the community developer to create the non-profit project in the garden. Seniors, youths, and disabilities are dependent on the garden to have free beds to grow vegetables.

After it was created, gardeners are dependent on themselves to maintain and manage the garden and the community group. Gardeners are dependent on a set of digital tools in organizing the gardening group (e.g., Google Groups). They are also dependent on the physical tools to build and maintain the physical garden.

Informality and formality

In these “commitments” and “dependencies” among the actors, artifacts, and institutions enrolled in this project, diverse formal and informal relations are found. It is found that some relations were informal at the beginning but then developed to be more formal and standard. It is also interesting to observe that some formal relations turned out to be fuzzy and less formal in the real operations of the community garden. Below, I will describe the informality and formality of the relations found in the design process of Woodland Community Garden project.

The relation between the planners from Park Board and volunteers of Woodland Community Garden is very formal. There are a policy and guidelines that the garden should follow in designing the garden. For example, tall fences or gates are not allowed in the community garden. Paths should be widely open to not block people who walk through. Gardeners have to leave four to six feet space from the street.

However, in the actual operation, some formal rules become fuzzy. There emerged activities caused by un-acknowledgement of the rules. For example, the old woman who does not speak English built a bed in the off-limits area. She might not know

the formal agreement between the garden and the city but would like to have a piece of land to grow some vegetables the same as others.

A similar fuzziness of the formal agreement occurs in the internal membership policy. It is required that every member should contribute eight hours every year in the garden besides on his or her own plot. Everyone signs the agreement. However, as participant described, not all members followed the policy.

> Every member is required to do 8 hours of work in the garden per year, not in their own plot. I know lots of people who don't do that. There is really core group of between 10-20 people who really makes the garden function. (Terry)

The infrastructuring process of Woodland Community Garden, which is based on the very loosely organized neighborhood group and a public park area that everyone has the right to use, presents a kind of accommodation to the community it is surrounded. In the infrastructuring process, formality is less important than relationship building.

In addition to formal relations, there are informal agreements made between Woodland Community Garden and other actors or organizations. For example, there were only verbal agreements between the gardeners and the students or the community developer. Once a relationship is developed, the projects went on well. One interviewee also commented that the informal relation brings much freedom.

> We had a lot of freedom with our creativity what could we do. They were really trusting. (Ben)

However, trust building takes time. In this case, gardeners were sceptical of what the students were doing, because the shed was outside of what they were envisioning. It was garden member Susan, who built a shed before and was trusted by the gardeners, who helped communications between the students and the gardeners. It was she who eventually helped students gain trust from the gardeners.

Being informal also means not being reliable sometimes. For example, Luis expressed his worry about the usage of Le Chou in future.

> Maybe we should get an agreement. I want to make sure it is protected always for people who don't have money. That is not given to some private person to garden. (Luis)

In this section, attachments in Woodland Community Garden project were presented. Specifically, “commitments to” and “dependencies on” among actors, artifacts, and institutions entangled in contending with the issues were articulated. In addition, the informality and formality commingled in these “commitments to” and “dependencies on” were presented.

7.2.4. The work of infrastructuring

Infrastructuring is a process that a public identifies and marshals sociotechnical resources via attachments to contend with issues.

Based on the articulated issues, publics, and attachments, in this section, I describe the work of infrastructuring emerged in this project. Specifically, examples of the infrastructuring work emerged in studying this project include: infrastructuring the professionals and the materials, infrastructuring the garden design, infrastructuring the organization, and infrastructuring the digital and non-digital tools. Below, I articulate each of the infrastructuring work in detail.

Infrastructuring the professionals and the materials

In the initial building process of Woodland Community Garden, multiple professionals were involved.

First, as previously mentioned, the planners of Park Board were involved as a strong support to the community members. They removed all the grass, laid down the gravel, installed the initial plumbing, helped members to finalize the designs, and facilitated the public consultation. In addition, the planners helped the members to obtain necessary approvals.

> Because there are many different layers that you have to talk to differently, like park operational staff who manage the garden, you have to talk to the park development staff, planning staff, and plumbers and there is a whole list of people eternally just inside the city that have to assign to it, from a design and construction view. (Laura)

As described above, a woman who ran a food marketing business wanted to fund a social and non-profit project in Woodland Community Garden. She was then suggested to connect to Luis, the community developer of the Grandview Food Network.

They together built the intergenerational garden Le Chou. In Le Chou project, Luis helped organize and integrate seniors from the adult day care center he used to work in, and the kids of some schools. With his supports, the woman realized the Le Chou program and the garden had more social groups involved.

> She didn't know anyone. So, I partnered with them. I used to manage an adult day center and worked with seniors. And I was working through food. So, I connected with the seniors group and some of the schools with the young kids. (Luis)

In addition, CityStudio's students were included in building the garden as part of their course projects. As one gardener commented, the students provided consistent labors in designing and building of the garden. With their help, the building process of the garden was largely promoted.

> We could have done that but not that enough people have that much time and are able to concentrate so fast. You suddenly have a large resource of labor and they are full-time as opposed to you have a community volunteer organization. (Susan)

The students also brought in their family members and tools in building the garden. Therefore, the resources and actors entangled were actually extended.

> They called their families to help. To get the wood, you have to have a big truck. One student's brother had a truck and we got his help. So, actually the volunteer's part goes beyond the actual people involved because they bring their resources to the project. (Susan)

With the students' help, the fence, the shed, as well as the Le Chou gardening beds were built in the garden.

Figure 7.4. Le Chou bed (left), garden fence (middle), and the tool shed (right) built by CityStudio students.

In terms of materials, members received donated soil and discounted wood in building the garden through members' social networks.

> There was a woman who worked in a landscape company and got all the soil as a donation which is over $2000 I think. In terms of the wood, we source them from the place called Sunbury. I talked to them and said "we are a community garden. Could you give us a bit of deal?" They gave us a very nice price. (Terry)

> They can do it as a tax benefit, so it does not hurt them at all. People want something to happen. They would push that thing into happen. (George)

Infrastructuring the garden design

Because of building on developed parkland that already has structures built before, the design of the garden has to be compromised or adjusted to make sure it fits with and does not impact the previously built structures.

For example, the garden's layout was redesigned to allow two wide paths that people would be able to walk through. This adjustment was to solve the concern raised by community neighbours. As one participant commented, the adjustment is a way to ensure that the garden is open and for the public, not only for the gardeners.

> We have to make the middle of it feel really open and permeable, so people could walk through. That was part of the design of that garden. It was a different design that it had to have the feel that the space is open for the whole community and not just for gardeners. (Laura)

Figure 7.5. Wide paths designed to enable neighbors to walk through the garden.

As mentioned earlier, under this area, there are telecommunication cables. The layout of the garden has to allow the staff of the company to access and maintain those cables. Thus, the design of the garden saves the manhole and reserves the space for parking the company's truck.

Figure 7.6. Areas that are saved to allow staff from telecommunication company to access to the cables.

> When we designed the garden, there were waterline and TELUS cables run through there. They need access to these manhole covers. So, we leave them uncovered and enough room for its truck. (Terry)

Similarly, trees growing in that area are required to be saved when building the garden beds.

Figure 7.7. Trees in the park are saved in building the garden.

Besides adjusting designs to fit to previous structures, some designs are carefully considered to benefit the gardeners. For example, in building the shed, a unique shape was designed to allow the maximum amount of sunshine for garden beds in summer. Moreover, because of there is no electric power, the shape was designed to allow light to come in:

> The unique shape is driven from trying to design a structure that doesn't cast any shadows on any of the surrounding garden beds during the summer time. The shape also allows the light to come in. There is no electricity in the shed. (Ben)

Moreover, the wood was charred instead of painted to protect the soil of the garden and preserve the wood.

> And the other feature is that they don't want to use any chemicals because the chemical of paint can reach the soil. So, that's why we did the charred cedar, which is a natural way of preserving the wood. (Ben)

Besides the shed, common areas were later built to help solve the theft problem of the garden. As one participant said, they took the strategy to have food growing outside of the garden in common areas to allow people to take food there instead of taking from individuals' plots.

Figure 7.8. Common areas were built to reduce the theft problem.

Gardeners also added a thick piece of wood behind the door of the shed to protect it from being broken easily. It is found that the piece of wood was also used for hanging small tools.

Figure 7.9. A thick piece of wood was installed behind the shed door.

Infrastructuring the organization

The organization was restructured to solve some volunteering problems. By creating teams and positions of team coordinators, gardeners tried to clarify the tasks

and responsibilities. Therefore, things can actually be done. In the following quote, one interviewee describes the recent change in the garden group.

> We just created the coordinators last week. The organizing committee is three people. There is a compost committee and a team leader. And a common areas team and they have a leader. And the finance committee and they have a leader. (Caroline)

In addition, membership agreements were created to clarify gardeners' responsibilities (see Document 4 in Appendix C).

> We decided that we would get everybody when they renewed their plots to sign a piece of paper to say I agree to do this. Once we had the agreements that were a little better because people actually had committed. But until we had that, it was a bit loose. (George)

Third, with the recognition of the limited space in Woodland Community Garden for intergenerational programs, the community developer changed the users of the Le Chou bed from a large youth group to a smaller senior group and a low-income family. This change was made because he found children like to explore large space, while Le Chou is too small to allow that.

> We did collaboration with another organizations called Cameras 4 Change. It was a non-profit that provides cameras to children so that they could learn how to use cameras. They came in the garden to take pictures. I came to realize that what is really important especially engaging youth is that they have to be really excited about the space. Le Chou garden, I just felt that we did enough. Now there is one group, a Latin American senior group. So, they garden there. There is another family which has a child in a wheelchair. (Luis)

Infrastructuring the digital and non-digital tools

Gardeners changed the tools they used in the development of the garden and the group. For example, because of no power outlet, the gardeners changed many of their tools into cordless ones. Moreover, gardeners think about using Slack to substitute for Google Groups.

> Now, we are trying to figure out different ways of communicating. We use Google Groups, which people don't like because they get too many messages. There is a program called Slack that we are looking at. (Caroline)

To save time and reduce the manual irrigation work, the gardeners integrated an automatic irrigation system in the common area. This also helps avoid the situations of no watering or repeated watering.

> We have a drip irrigation system. We have a timer and there is a line that connects to the water. The timer is on and turns the water on and it drips every four hours every other day. The system is more efficient. The plants get regular watering. (Terry)

> Inside the shed, there is a timer. What I did is that I drilled a hole and I put the timer inside. (George)

Figure 7.10. The irrigation system for common areas.

In summary, in the development process of the Woodland Community Garden project, community members actively adapted themselves. Diverse resources were identified and integrated in the design process. Through applying the theoretical framework publics and the theory of infrastructuring, the underlying process of Woodland Community Garden project was described. Specifically, it includes: infrastructuring the professionals and the materials, infrastructuring the garden design, infrastructuring the organization, and infrastructuring the digital and non-digital tools.

7.2.5. Local situations

The local situations influence in the design process of Woodland Community Garden. In this part of the report, I highlight the impacts made by the city of Vancouver to the project.

First, the previous structures established in the local area influence the design process of the garden. As mentioned earlier, for example, the size and layout of the garden has to be adjusted to fit to the water supplies and keep a certain distance from

the baseball field. In this way, the physical settings of the local area impacted the designing and building process of the garden.

Second, the City of Vancouver participated very much in the process. It encouraged the gardening of community members. The city wants the gardeners to be successful.

> Understanding ok maybe the policy does not actually cover each instance, what can we do at that point to make sure that we faithfully support these gardens despite what the policies might outline. (Jeffery)

Specifically, it tries to involved more community groups to participate in community gardening activities.

> City really wants to have that spaces, not just individual plots, because they are concerned about privatizing public land. The city is trying to encourage more communal gardening versus individual plot gardening. (Caroline)

Third, which is very specific in this case, the City intentionally became involved and learned from the Woodland community group. One participant described that from late 1980 to 2012, Park Board took on community garden applications case by case. There was no process for handling people's applications. Woodland Community Garden was one of the first batch of community gardens that staff of Park Board was involved in the key process to learn how the process would go and figured out the approvals and policies needed. The City was at a stage of trying to create a system for the following development of community gardens in the city. Woodland Community Garden's process informed the City's practices that it conducted later. In that process, the City is the shaper of both practice and policy. For example, one interviewee described that the City started to put partnerships into the policy after the Le Chou project of Woodland Community Garden.

> One of the things they did earlier on is they developed a collaboration with Le Chou, to generate gardening collaboration. I think them doing that really in some way enabled us to encourage that kind of programing to be a part of new gardens. Because before they were fairly typical allotment gardens, we were okay with community gardens that just had plots that individuals would have responsibility. But a lot of gardens came after the end of policy in our practice was looking for those programing partnerships. So that was moving beyond just allotment gardens. Woodland Community Garden was the first one that really did a good job of that. (Laura)

Furthermore, with respect to the popularity of community gardens in Vancouver, the City recently added community gardening area in redevelopment and rezoning policies, which helps offload the pressure of public places.

> The other piece of policy was added very recently was certain sites and building densities have to put their own community gardens. It is a redevelopment and rezoning policy piece now. The idea is that the developers have to take the responsibility for providing that mandate to their residents. (Laura)

The following texts are an excerpt from the new developed rezoning policy, which explicitly requires the applicants to support the sustainable food system of the city.

> *"Food assets are defined as resources, facilities, services or spaces that are available to residents of the city (either at the citywide or neighborhood scale) and which are used to support the city's sustainable food system. In order to meet the requirements, applicants are required to provide a detailed description of how a minimum of three food system assets from the following list will be included and delivered in the development:*
>
> - *Community gardens / community orchards*
> - *Edible landscaping*
> - *Community kitchen*
> - *Community food market*
> - *On-site organics management*
> - *Facilities to support neighborhood food networks*
>
> *In lieu of three food assets, the City may also consider a contribution to a broader scope, citywide food processing/storage/distribution infrastructure/operation and would assess this on a case-by-case basis. The applicant must outline why the three on-site food assets." (Rezoning policy for sustainable large developments, p. 5)*

Therefore, at a higher level of infrastructuring, the City was enlightened by the design process of community gardening groups and adjusted itself to meet the needs of citizens.

7.2.6. Summary

In this section, I presented the findings from studying the design process in project of Woodland Community Garden by using the infrastructuring theory in relation to the theoretical framework of publics. Specifically, to contend with the evolved issues, the actors creatively adjust the present resources and relations and actively create new attachments so that to integrate additional resources that can increase their capacities for further design acts.

In the next section, I will present my further reflections on the presented infrastructuring work and discuss the characteristics of the design process in the project of Woodland Community Garden.

7.3. Characteristics of the design process in Woodland Community Garden project

7.3.1. Dynamic and flexible

From the above presented infrastructuring work, it is observed that the constituents of the publics are dynamic and changing.

First, in different time slices of the project, there can be found different actors involved. For example, at the beginning of the project, planners from Park Board were intensively involved. But after the garden was built, they left the project. Similarly, students from CityStudio were involved to build the shed. However, after the shed was built, students were not engaged in the design process any more. Thus, actors participating in the design process are different in different time in the project.

In addition, the community gardening group that resulted from the project is very flexible in its organizational structure. The gardeners constitute the nearby residents who grow food in the garden, organize and manage themselves. They reshape the organizational structure in response to the problems that emerged. For example, teams and coordinators were created to clarify the responsibilities and make tasks be actually done. Hence, the organizational structure of the community gardening group is very flexible.

7.3.2. Creative and resourceful

In the design process, people identify and utilize diverse resources to contend with the issues they have in the project. In all the infrastructuring work I presented above, actors could be described as creative and resourceful.

In the design process of Woodland Community Garden project, creativity and resourcefulness manifest in multiple ways. First, publics apply their creativity in a conceptual way in generating ideas for what the garden could further be. For example, using the otherwise unused land in the park for building a community garden is such a creative idea. Also, using the garden as an educational space for children is very imaginative.

In addition, creativity is present in the practical ways publics are able to understand different resources and adopt them for their own purposes. For example, the door of the shed is used for hanging small gardening tools. Building common areas around the garden is understood as a way to reduce theft issues. Many gardening plots were divided into half to increase the number of individuals who can participate in the garden. In the design process, the creativity allows the publics to see the resources in the infrastructure and use them as ready-to-hand support for them to conduct further design acts.

Finally, resourcefulness is also present in the design process of Woodland Community Garden project. In the infrastructuring work, publics are sensitive of a wide verity of social and technical resources. The social resources include, for example, planners from Park Board, the community developer, students, and local residents. They are interpreted as resources that could be involved to increase the capabilities of the publics in design actions. Material and technical resources have been involved include donated materials, irrigations systems, Google Groups, etc. Thus, publics identify and marshal various resources as their design resources for future design.

7.3.3. Benefit the whole community as a critical design principle

In the design process of Woodland Community Garden, benefiting the whole community is observed as a critical design principle. In the articulated infrastructuring work, much of the integrations are based on the recognition of the values underlying the

community gardening activity, which is the social inclusion, community building, and improving the quality of life for the whole community.

The shared values of social inclusion and community building become the basis and impetus of the relationship built inside the publics and between the publics and other attachments. For example, the companies that provided free soil and discounted wood materials are willing to support this community-based project. The community developer joined the project when he saw the garden could be a great place for the seniors who live close. The architect was interested in contributing her skill and participated in the building because she cared the community she lived in. And there are also people who become part of the community garden group because they love meeting with neighbours. Therefore, benefiting the whole community, based on which the project is designed, plays an important role in “adhering” diverse social and material resources into the design process.

7.3.4. Sociotechnical relations and resources as design resources

In the design process of Woodland Community Garden project, diverse resources are understood as design resources by publics for further design acts.

First, publics see the social and material resources in the attachments as resources for further design acts. For instance, the shed for tools is seen as a secure place for installing the timer of the irrigation system. The plots are understood as resources that can be divided to allow more gardeners. The community developer was understood as a person who could bring social groups and create the program for the garden project. The capabilities of those sociotechnical resources are what enable publics to see them as supports for further design actions.

In addition, the relations built in the infrastructure enable publics to adjust or rebuild them in responding issues. For example, a membership policy was created to clarify the responsibility of gardeners to work for the garden. The structure of the organization was reformed to ensure garden work got done. Therefore, the relations built in the design process allow publics to adjust or reform them so that to act better in future design process.

To sum up, in the design process, publics see sociotechnical resources as well as the built relations in the infrastructures as design resources for future actions.

7.3.5. Open-ended design process

In the design process of Woodland Community Garden project, it was found that changes are ongoing. This makes the project very open-ended and never finished. The actors in different time bring their ideas and make ameliorating changes to the project. For example, in the work party I participated, gardeners installed an irrigation system for the other half of the common areas. They are also planning to build a greenhouse in the garden. The open-ended quality thus supports creativity of the publics in their design acts.

Figure 7.11. Building irrigation system for the other half of common areas in a work party.

The open-ended nature of the design process also helps uncover the elements that are hard to be changed. For example, although actors are not very satisfied with Google Groups, they found it is hard to give it up completely or replace it with another software (e.g., Slack). This is because many of their communications and records are in Google Groups. It will cost much time to reset everything in the new software. Some information would be lost if they make the change. In this way, the open-ended nature reduces the creativity and resourcefulness of publics. When they recognize the issues they confront would cost much of their time and energy to deal with, or they hesitate whether or not should contend with that issue, the open-ended nature enables the publics to pend their design acts.

Therefore, in the open-ended design process, changes are incremental and continuing. However, the open-ended nature also reduces the creativity and resourcefulness of publics in responding issues that are difficult to deal with.

7.3.6. The whole project as a thread of local infrastructuring

Very similar to Inner City Farms project, the Woodland Community Garden project developed as a piece of the sustainable food infrastructure that the city started building in recent years. The city learns and adjusts its policies to further support the project. It also acts as a “butt joint” between the project and other sections of the city, such as park development staff, planning staff, and plumbers.

On the other hand, the infrastructuring process of the project is shaped by the city. Specifically, it has to be adapted to fit to the local social, cultural, and physical conditions. The design of the garden has to be adjusted to keep the former structure still working. As presented in last section, in the work of infrastructuring the garden design, publics constantly adjust the design plan to make sure the garden fits with the existed structures.

The act of infrastructuring, as Le Dantec described it, is “the process by which a public internalizes those issues and attachments and operationalizes them as sociotechnical capabilities for contending with present and future conditions” (Le Dantec, 2016, p.28). As illustrated by the Woodland Community Garden project, publics incorporate the conditions and design the garden (as a whole) to fit to the infrastructuring work of the city.

7.4. Summary

In this chapter, I described the design process of Woodland Community Garden project by using the theoretical framework of publics and its aspect of infrastructuring. Specifically, examples of infrastructuring work presented are infrastructuring the professionals and the materials, infrastructuring the garden design, infrastructuring the organization, and infrastructuring the digital and non-digital tools. The impacts of local situations on the design process of this project were also articulated. Based on the presented infrastructuring work, I also discussed the qualities of the design process in this project.

In this part of the dissertation, I have described the design process of three community-based projects and discussed the characteristics in them. In the next chapter, I will present my cross-case analysis and generate outcomes across the three cases. The goal is to further understand the qualities in the infrastructuring process and develop “more sophisticated descriptions and more powerful explanations” (Miles et al., 2014, p.101).

Chapter 8.

Discussion

In this chapter, based on the analysis of the findings from chapter 5 to 7, I first explicitly articulate the effectiveness of the theory of infrastructuring in describing the design process of community-based social innovation projects. After that, I propose the characteristics of the design process and discuss the implication of the findings of this study for interaction design. I conclude this chapter with the limitations of this doctoral study.

8.1. Effectiveness of the theory of infrastructuring

Chapter 5, 6, and 7, when taken together, form my answer to the first research question: *How does the theory of infrastructuring in relation to the theoretical framework of publics (Le Dantec, 2016) effectively describe the collective design of community-based social innovation projects in an urban Canadian city?*

In this multiple-case study, the three projects provide impressive evidence that the concept of infrastructuring from the framework of publics can effectively describe the collective design of community-based social innovation projects.

In all cases, we can find issues have emerged and evolved, which constantly drives the design process of actors. Affected individuals identify and adopt diverse sociotechnical resources via their existing or newly created attachments to contend with the issues. The theory of infrastructuring and the theoretical framework of publics provide an analytical tool in understanding the complex and dynamic process that occurred in community-based projects. It is encouraging to see the effectiveness of these concepts in describing the lively design process.

However, the findings from studying the three projects also provide thoughtful evidence that the framework could be more effective. Here, I emphasize the totality of the design process, not merely the details of it. Local situations, in which higher-level of infrastructuring work is in progress (the ongoing design process of the urban city in this

study), are a necessary ingredient for comprehensively understanding community-based projects, especially those initiated and developed for social innovation.

Therefore, the study validates and provides supporting evidence for the effectiveness of the theory of infrastructuring in describing the dynamic design process of social innovation projects in community contexts. Simultaneously, it uncovers the limitation of the theory and points to the aspects of the theory that could be improved.

In the next section, I attempt to address my second research question: *Based on the theory of infrastructuring, what are the characteristics of the design process in community-based social innovation projects that can be supported by interaction designers?*

8.2. Characteristics of the design process

In this section, I present the outcomes of the cross-case analysis of this study. As described in Chapter 4, I employed the strategy “stacking comparable cases” (Miles et al., 2014, p.103) in this analysis process. Specifically, I first created a “meta-matrix” by stacking the case-level displays and conducted the systematic comparison across them. I then generated the qualities that are considered as replications and articulated and elucidated them explicitly in a narrative way.

The meta-matrix was developed to support the systematic comparison across the three projects. It served as a tool that enabled me to obtain an overview of the three cases.

Table 8.1. Meta-matrix: condensed case-level displays

Case	Inner City Farms	Vancouver Tool Library	Woodland Community Garden
Project type	CSA	Tool sharing	Community gardening
Resources reallocates	Private yards	Tools	Public parkland
Organizational structure	Board team, volunteers, but significantly depend on one person (centralized)	Board team, paid manager, coordinators, shop volunteers (hierarchical)	Gardeners themselves (flat)
Issues	• Volunteering issue • Unaffordability of additional resources • Using private land in the city	• Volunteering issues • Unaffordability of additional resources • Lending and maintaining tools as a library	• Volunteering issue • Finding resources • Using public land • Involving diverse groups
Infrastructuring Work	• Infrastructuring the organization • Infrastructuring the delivery system • Infrastructuring the lands • Infrastructuring the nursery system • Infrastructuring professional skills • Infrastructuring to support farmers	• Infrastructuring the organization • Infrastructuring the space • Infrastructuring the tools • Infrastructuring for workshop places • Infrastructuring for more reliable relations • Infrastructuring for professional knowledge • Infrastructuring the tool management system	• Infrastructuring the organization • Infrastructuring the professionals and the materials • Infrastructuring the garden design • Infrastructuring the digital and non-digital tools
Local situations	• City goal: local food • Food culture • Less backyard because of increasing density	• City goal: lighter footprint • Expensive place because of Increasing density	• City goal: local food • Drink and drugs problems in that area

Case	Inner City Farms	Vancouver Tool Library	Woodland Community Garden
Characteristics	• Publics as dynamic and heterogeneous designers • Creative and resourceful • Mutual benefits as the key design principle • Sociotechnical resources and relations as design resources • Open-ended design process • The whole project as a piece of local infrastructure	• Fluid and flexible • Creative and resourceful • Mutual benefits as a key design principle • Sociotechnical relations and resources as design resources • Open-ended design process • The whole project as a thread of local infrastructuring	• Dynamic and flexible • Creative and resourceful • Benefit the whole community as a critical design principle • Sociotechnical relations and resources as design resources • Open-ended design process • The whole project as a thread of local infrastructuring

Through my analysis and comparison of the three cases systematically, six themes were developed as the shared qualities of the design process in three projects.

8.2.1. Dynamic and heterogeneous

The publics formed in the design process of the social innovation projects are dynamic and heterogeneous social groups that respond to different issues. In fact, during the design process, the publics are very open to new actors and new ideas. In all of the three cases, we see that volunteers with diverse time availabilities and skills are heavily relied on.

In the Inner City Farms project, professional farmers, their families, friends and students are involved. Once the relations are built, in growing seasons, they are free to decide to join the farming or not. Previous volunteers also get invitations and are welcome to participate in farming activities. In terms of heterogeneousness, Inner City Farms volunteers are individuals with different levels of farming skills and experiences. Some volunteers are professional farmers (like Tony and Simon), while many students are newbie intern farmers who have very little farming experience. In this case, dynamism brings the project more passionate laborers and enables the spread of urban farming cultures. However, the heterogeneousness creates the challenge of the group being difficult to manage and coordinate.

Similarly, regarding the project of Vancouver Tool Library, individuals who are interested in using tools and making projects freely joined as members of the tool library. Actors can readily share their ideas by running workshops. They can also voluntarily join the board team or become coordinators. The tool library is thus open to all the citizens and their ideas. However, the uneven time availabilities and capacities cause problems such as being hard to coordinate, burning out, and inconsistent services.

In the third project, the garden is open to all the community members. With respect to the gardeners from diverse background, the project also face challenges, such as difficult to coordinate, unequal labor, burning out, and hard to reach consensus, etc.

Therefore, as described above, individuals participating in social innovation projects are not a predefined or homogeneous group. It is an ongoing changing organization of actors who are passionate about the project and unhandily balancing the project with their everyday life. Their departure may also cause valuable knowledge and experiences to be lost to the group.

8.2.2. Creative and resourceful

As presented in the three case reports, the design actors engaged in the design process of community-based project are creative and resourceful in response to the evolving issues. It is found that the creativity and resourcefulness manifest in different ways.

Actors are creative in developing visions for what the project could be. For example, a new delivery system was considered. Workshops were held to teach people how to use diverse tools. The physical garden space was designed to be an educational space for children, which is very creative.

In addition, creativity is present in the practical way actors are able to see different resources and appropriated them for different purposes. For example, a basement is creatively repurposed as greenhouse for seedlings. French Cleat and the pulley system were made to help efficiently organize the tools in the tool library. Common areas were built around the garden to mitigate theft issues.

Publics see the network of resources as design resources that can be used for further design acts. For example, vegetables are used to trade for necessities. Other organizations' workspaces are identified and integrated as place that can be used for workshops. Door of the shed is used for hanging small gardening tools.

The creativity and resourcefulness lead to the actors' ability to imagine alternative ways for using their resources.

8.2.3. Multiple ways of building relationships

In the design process of community-based projects, publics involve a variety of social and material resources through present or newly created attachments. As previously articulated, attachments are the relations through which sociotechnical resources participate actively with each other. Central to these relations is the interplay between "dependency on" and "commitment to". As presented in the three case studies, the majority of relations built between publics and the partners (other actors and institutions) are very informal. The informality creates flexibility and respect. However, it raises the problem of unreliability. Thus, it is important for publics to create and develop relations so that to make "dependency on" and "commitment to" become possible and sustainable in the design process of the projects. In the following paragraphs, I examine the strategies applied by publics to create and develop attachments in the processes of infrastructuring. In the infrastructuring work, publics combine and select between strategies in creating and maintaining relationships.

In the design process of community-based projects, swap is observed as a prominent strategy in building relations. In a swap, actors exchange one thing for another. In chapter 5 and 6, I described how farmers of Inner City Farms and volunteers of Vancouver Tool Library use their present resources to exchange for the social and material resources they need. Specifically, the farmers exchange fresh vegetables for professional's skills. The volunteers from the tool library use other organizations' space for workshops by offering them free membership.

In addition to swap, in the design process of community-based social innovation projects, I observed how a variety of mutual benefits emerge in creating the attachments. In the Inner City Farms project, one of the relations developed between farmers and

landowners is mutual benefit. Landowners provide their yards to farmers for free, while farmers manage and maintain the yards when the landowner is away. Gardeners of Woodland Community Garden get professional skills from the students, while students obtain practical experience in the project.

Another drive that emerged in the creation of attachments is the shared values. This is illustrated adequately in the Woodland Community Garden project in which many actors participated in building the garden for improving their community environment. For example, the community developer joined the project when he saw the garden could be a great place for the seniors who live close.

Finally, converging interests are also found in some creations of attachments. For example, in the project of Inner City Farms, student volunteers are interested to learn farming knowledge and the farmers like educating more people about sustainable food cultures. In the Vancouver Tool Library project, volunteers want to encourage more people to use tools and the workshop facilitators are interested to share their skills and projects to others. The woman from the food business desired to create an intergenerational program in the Woodland Community Garden and the community developer was interested to provide the seniors and children with gardening opportunities.

In summary, in the design process of community-based social innovation projects, publics create attachments through multiple ways, including swap, mutual benefits, shared values, and converging interests. Through these ways, diverse informal relations are created, which enable multiple social and technical resources become actively participated in the projects.

8.2.4. Sociotechnical resources and relations as design resources

In the design process of community-based project, social and material resources and the relations among them are understood to be resources for further design acts by the publics in design processes.

The publics see the actors, artifacts, and institutions within the present attachments as resources for further design acts. In the Inner City Farms project, for example, a volunteer was asked to maintain the Facebook page and website. The

basement was used as a greenhouse for seedlings. In the Vancouver Tool Library project, volunteers are involved in fixing tools, leading workshops, or preparing materials. YouTube videos are used as guide in repairing tools. In the project of Woodland Community Garden, the plots are understood as resources that can be divided to allow more gardeners. The community developer was integrated thus to create the intergenerational program as a part of the garden project.

In addition, sociotechnical relations are seen as powerful design resources. For example, in the design process, multiple relations are created as informal. The informal relations help neutralize people's hesitations in trying a new form of relation, for example letting others use their own yard to grow food. The relations are also adjusted or reformed to support public to act. For example, a MOU was created to clarify the obligations of both the tool library and Wood Shop. Similarly, in the project of Woodland Community Garden, membership policy was created to clarify the responsibility of gardeners. The reconfigurations of the social relations allow publics to act better in future design process.

In summary, the publics see the social and material resources and the relations as design resources that can be adopted and appropriated for their future design acts.

8.2.5. Open-ended design process

In the design process of Inner City Farms project, it was observed that the process is ongoing and open-ended. The outcome of the designing is always a "beta version" that will be changed.

The open-ended quality of the design process constantly encourages the creativity and design actions of the public. For example, in the Inner City Farms project, Luppolo was newly involved as a pick-up site for CSA members. Gardeners of Woodland Community Garden recently installed an irrigation system for the other half of the common areas. Volunteers in the tool library created the shelves and reorganized their space. Hence, actors constantly bring their ideas and make ameliorating changes to the project.

In addition, the open-ended nature of the design process sometimes reduces the creativity of the publics. This is especially obvious when the solution of an issue would

take too much effort or influence multiple elements of current built infrastructure. In this case, current publics might just leave the problem there for future publics to act to it. An obvious example is that volunteers in the Vancouver Tool Library project clung to an old version of myTurn to avoid retraining the volunteers, although they think the old version could not meet all of their needs. The open-ended nature sometimes dilutes the creativity of publics.

Therefore, in the open-ended design process, changes are incremental and continuing. However, the open-ended nature also reduces the creativity of publics in responding to issues that they are facing.

8.2.6. The whole design process as a thread of local infrastructuring

The design processes described in three projects are not enclosed. They impact and have been impacted by the ongoing process of local infrastructuring in which the projects are situated. In this work, I discuss the relations between the design process of the three projects and the city's infrastructuring work.

On the one hand, the design processes of the three projects are shaped by the ongoing design process of the City of Vancouver. The policies, cultures, and physical dynamics together affect the development of the social innovation projects to some extent. For instance, the city's Greenest City Action Plan largely supports the design process of the projects. The culture in Vancouver also plays an important role. For example, many citizens value local produced food so that they join the CSA program run by Inner City Farms. And as a thread of the city's infrastructuring, the design process of the projects is affected by the city's problems, such as gentrification, increasing density, and alcohol and drug problems.

On the other hand, the design process of the projects influences the infrastructuring of the city. Specifically, the projects portray the alternatives of how our living environment could be and enable the city to adjust its direction and further upgrade its way of working in moving to that visionary future. That is the reason why the city added new policies to allow and support the design process of these projects.

8.2.7. Summary

In this section, I presented the characteristics of the design process through my analysis and comparison of the three cases systematically. More specifically, six characterises were articulated. They are dynamic and heterogeneous, creative and resourceful, multiple ways of building relationships, sociotechnical resources and relations as design resources, open-ended design process, and the whole design process as a thread of local infrastructuring.

In the articulation of each characteristic, I decided not to present all the related evidence from the three cases, but only presented the most representative examples. Very detailed examples have been articulated in with-in case analysis in each case report, so I intentionally avoid the redundancy in the cross-case analysis. I believe this is the result of the strategy of “stacking comparable cases” (Miles et al., 2014, p.103) that was applied in this analysis process, which enables the cross-case analysis of this study to reach the right balance between very particularistic and too general.

8.3. Implications for interaction design

Scaffolded by the theory of infrastructuring, the work presented in chapter 5 to 7 as well as the above sections in this chapter present a detailed description of the design process in social innovation projects in community contexts. Based on these findings, in this section, I will propose some relevant design implications for interaction design in supporting the design process of such projects.

8.3.1. Design to support dynamic publics

In the design process, the publics are constantly changing in response to the evolved issues. However, the technologies they have applied in the design process are less fluid. We can see that the following joined actors usually have to learn and get familiar with the tools that are adopted by former actors. For example, new volunteers for the Vancouver Tool Library are required to learn how to use myTurn in renting out tools. Gardeners on the administrator team are using Google Groups and Google Drive because previous gardeners have used that and all the documents were already stored there. Sometimes, the tools that have been used also serve as a filter for future actors or

material resources. For instance, the previous manager who was not able to tackle the system finally had to leave the project. In this sense, when designing technologies for these publics, it is important to recognize that the designed technologies will influence future generations of publics in the design process of the project. The technology is not merely a tool that meets the needs of current publics, but will also plays a role in constituting a designated context for the design acts of publics in the future. Once the designed technologies start to function in the infrastructure and interact with others (actors or artifacts), the technology will impact the future infrastructuring work of the project. Therefore, I believe when designing technologies in response to the fluidity of publics, the designed technologies that are simple and easy to learn for new actors, thus not raising the threshold for participation, will be more successful.

In addition, we can see that there is a low motivation or willingness for changing or updating the tools that are being used in the design process. For example, many gardeners did not like changing to Slack even though they are not satisfied with Google Groups because all the documents were there. In a similar manner, volunteers did not like installing the updates of myTurn because that requires retraining. They feel it is challenging to make changes on these tools because this will bring them more work. Therefore, designers should recognize that any updates to existing systems that publics are using should be small. It takes time for the built infrastructure to digest the changes. Technologies that require little work for publics will be more successful. In their study of homeless non-profit organizations, Le Dantec and Edwards suggest that systems which play the role of coordinator could be designed as a way to reduce the cost of unskilled workers and turnover in the board members (Le Dantec & Edwards, 2008). My recommendation here is similar. These systems could help capture and document the organizational knowledge from one generation of publics to the next.

8.3.2. Mapping the network of resources

One significant characteristic of collective design process in community-based project is that various social and material resources are adopted as design resources. In fact, not only artifacts, but also individuals and organizations in local areas can serve as resources for further design acts of publics. This characteristic suggests a design opportunity for interaction designers to support the publics in sorting and identifying the

resources they could integrate into their future design process. This can happen in several ways. The most direct is to visualize the resources in their current relationships.

Today, there are various projects that deal with this direction. For instance, Kumu[3] (refers to “source of wisdom” in Hawaiian) is a platform to allow people to map their relationships proposed by two brothers, Jeff and Ryna Mohr in Oahu and Silicon Valley: “Kumu is a powerful data visualization platform that helps you organize complex information into interactive relationship maps.” The purpose of this platform is to create a context in which people can think. The starting point for this initiative was a simple motivation: “existing tools were overly academic and painful to use.” As a response, Kumu was developed as a simple tool to use and no technical background is required.

The tools designed to support publics in the sorting and identification of resources in present infrastructure should also be simple and direct. Moreover, as discussed in 8.3.1, the threshold for accepting new tools is very low. Therefore, interaction designers have to carefully think about how to integrate the designed tool into the current built infrastructure. One recommendation could be thinking about assembling the tool with the artifacts that the actors are already using. For example, would it be possible for such a system to automatically collect information from the email threads or Facebook posts related to the projects and generate the network of resources?

8.3.3. Design venues for exchanges and understandings

In the work of infrastructuring, publics not only identify resources that exist in their present infrastructure, but also integrate resources from newly created attachments, which are the new nodes that were not previously connected to their network. In section 8.2.3, I described how publics create the new attachments so that to access the resources desired for future design acts. Specifically, these strategies include swap, mutual benefits, shared values, and converging interests. These offer design opportunities for interaction designers in supporting the exchanges and understandings.

In terms of swap, a great example can be found is Swapsity[4]. Swapsity is a social enterprise that supports online and offline bartering in Canada. Its members embrace the

[3] Kumu.io

[4] http://www.swapsity.ca/

value of win-win exchanges and its online community gathers diverse resources including skills, services, and artifacts that are ready for exchanges. Marta Nowinska, who is the founder of Swapsity, writes: “everyone has valuable gifts and inner creativity to unleash and share.” The vision of Swapsity is to “help Canadians build a more collaborative and sustainable lifestyle through a peer-to-peer swapping community.” In terms of the social innovation projects, I encourage interaction designers to think about similar platforms that can be integrated by publics to exchange their resources with other necessaries. Because many relations are built as informal and based on mutual benefits, it is prudent to heed the advice of Voida et al. (Voida, Yao, & Korn, 2015). We need to consider how to support not merely the work structures but the social structures of publics so as to sustain their use.

In addition to online platforms, physical space could be created in neighbourhoods to support the actors in exchanges and understandings to connect with each other. A well-known example is the Malmö Living Lab[5] in Sweden, which has been “working with participatory design approached and social innovation in the city of Malmö.” The lab helps build a network of actors and organizations and connects them with neighbourhood residents. It facilitates continuous match-making process and emerging design opportunities. I propose that interaction designers who are interested in supporting social innovations think about endeavouring to realize the physical living lab operated in his or her neighbourhood or city.

8.3.4. Design of creative social and technical resources

In this section, I emphasize the characteristics of creativeness and resourcefulness of the publics and discuss about how these characteristics can inspire interaction designers in supporting the design process of community-based social innovation projects.

In designing process, we have seen the multiple ways in which social and material resources are adopted and appropriated. How publics interpret and use their resources is very creative. It is hard to actually predict the context in which the designed artifacts would be used. When designing artifacts or systems to support the collective

[5] http://medea.mah.se/malmo-living-labs/

design process, how should interaction designers embrace the creativeness and resourcefulness of the publics?

Individuals' resourcefulness and creativeness were recognized and discussed in previous interaction design literature (e.g. (Kim & Paulos, 2011; Roedl, Bardzell, & Bardzell, 2015; Wakkary, Desjardins, Hauser, & Maestri, 2013; Woodruff, Hasbrouck, & Augustin, 2008)). In these works, authors depict how people reuse, repair, and appropriate the artifacts around them. Particularly, in their paper, Wakkary and Tanenbaum named home dwellers as "everyday designers" to manifest people's capabilities in adapting the artifacts in their home (Wakkary & Tanenbaum, 2009). In addition to home dwellers, Asad and Le Dantec studied the civic activities of communities (Asad & Le Dantec, 2015). They suggest a move away from designing artifacts as solutions and propose flexibility and process as two approaches to support civic activities. By design toward flexibility, they want to "cultivate more of a possibility space to encourage creativity and interpretation" (p.1701). In terms of process, it refers to designs that "operate more like a platform than a single, deterministic service" (p.1701). These works are inspirational; however, they merely tackle technological artifacts and do not speculate on how the social resources (e.g., actors and institutions) or a network of resources would support creativity for publics. In the following paragraphs, I discuss two implications.

First, in terms of the social resources, such as human resources enrolled in the design process, I generate a research question: how can actors become creative resources for publics? Definitely, we cannot "design" humans as we design artifacts. However, we can design roles that actors can play in the design process. Actors hold a variety of skills that can each be spotlighted: tool-maintaining skills, gardening skills, teaching skills, and website developing skills, etc. Some are their professional skills and some are what they learned as hobbies. How can different roles be described and designed so that individuals can become active resources in the design process? In fact, in the three cases, we already see that publics are creating "jobs" to enable their use of human resources. For example, the coordinator positions are created in Vancouver Tool Library and Woodland Community Garden projects. The "head of art department" was created for Evin to spotlight his designer role in the project of Inner City Farms. This echoes Le Dantec's "Designing Publics" which partly refers to "how these publics come to be – the degree to which they are designed through intervention" (Le Dantec, 2016,

p.5). While the idea of designing artifacts to support creativity is being acknowledged and well developed by many researchers, I would argue for the notion of designing to support the descriptions of roles that can make individuals become creative resources to be resourcefully employed.

Second, in section 8.3.4, I described how the informality of social relations created in the design process of social innovation projects was important to allow for changes and reconfigurations to happen. However, not all of the relations are transparent or can be accessible to the actors. For example, many infrastructures of the city are hidden, such as built politics or waterline structures and ongoing development plans. Considering the gap between the infrastructuring process of the project and the infrastructuring process of the local area, how transparent and accessible can those aspects of local area be for publics? How can publics perceive and comprehend those elements in their local environment? Interaction designers could consider making the invisible local situations become visible.

8.3.5. Design (and research) through infrastructuring

In this section, I discuss different positions interaction designers can play in supporting social innovation projects in community contexts. This reflects my roles in this study: a researcher and an actor.

As articulated in section 8.2.5, the design process of these projects is open-ended. Each project keeps changing and evolving. In this study, although interviews and participant observations help uncover the design process, I argue that it would be very valuable for interaction designers who are interested in these projects to get involved for a long time. This echoes to the methodology “autobiographical design” that was proposed by Neustaedters and Sengers (Neustaedter & Sengers, 2012). By studying the design process from a first person perspective and for a long time, abundant and detailed data could be collected.

Another implication in the move toward conducting research through the work of infrastructuring is related to research through design. Research through design is a method that allows design researchers to explore design opportunities and challenges through engaging in the process of designing artifacts (Gaver, 2012; Zimmerman,

Forlizzi, & Evenson, 2007). A number of researchers have conducted research through design to explore research questions with their designed artifacts (e.g., (Gaver et al., 2015; Lim, Kim, Jo, & Woo, 2013)). Yet in the spirit of infrastructuring, a design intervention is not necessarily a material artifact. As described in Le Dantec's book as well as in this doctoral work, a design intervention could also be a social invention, for example a public, a social group, or a collaborative organization in Manzini's term (2015). Therefore, by research through infrastructuring, I encourage interaction designers to identify certain issues that they are interested in tackling and then to initialize and constitute their own publics. It would be very fascinating to understand the community-based project in more depth and to produce visions and proposals that can guide future design process of such projects. I believe valuable design knowledge could be produced from that kind of study.

8.4. Limitations of this study

This doctoral work uncovered the detailed design process in social innovation projects under community contexts and highlighted the implications related to them, but it is important to recognize the limitations of the findings. In this section, I present the limitations of this study.

First, the case study methodology applied in this study has the inherent limitation of being hard to reproduce or generalize. Case study allows for the in-depth understanding of the real world phenomenon, however it is limited to see how the findings would be generalized to other cases.

Another limitation of this work comes from the context where the study is conducted. Social innovation is a phenomenon that happens all over the world across different cultures. Because of the practicalities of conducting research in Vancouver where I have my doctoral study, it is hard to be close to social innovation projects that have developed in other places. However, it is my fortune that Vancouver is such a vibrant city in which diverse social innovation projects are initiated and supported. It would be very interesting to study how social innovation projects grow in other places, such as cities in China where a variety of projects aiming for social changes are booming.

A third limitation of this work relates to the fluid constitution of the social groups in my study. I recruited 23 participants for studying the three projects. Some of them are involved for a long time, or recently engaged, or have already left for couple of years. It is important to acknowledge that these individuals can not represent all actors who are involved in those projects. However, I also want to highlight the participants recruited in this study are selected by their roles in this project and therefore offer me different perspectives about the design process of the projects. In addition, I also include other types of evidence, such as documents and participant observations, to understand the projects more comprehensively. Future works should include a variety of people and records to unfold the process of the projects as much as possible.

Lastly, social innovation is a phenomenon that is open-ended and constantly evolving since it begins. It is hard to accurately trace and catch all the dynamics occurred in its design process from an outsider's perspective and afterwards. However, to have the opportunity to be a volunteer and event participant has provided me with much more vivid evidence in order to better understand the projects. In future research, it would be very valuable to find ways to study how social innovation projects develop and evolve since they are initiated.

8.5. Summary

In this chapter, I have articulated the effectiveness of the theory of infrastructuring in describing the design process of social innovation projects in community context. Based on the findings from chapter 5 to 7, I also highlighted the aspect of the theoretical framework that can be improved by pointing out that local situations are a necessary component for comprehensively understanding such projects.

In addition, I have also presented the characteristics of the design process in community-based social innovation projects and reflected on the implications of this work for interaction design. Specifically, I discussed the perspectives on design to support dynamic publics, mapping the network of resources, design venues for exchanges and understandings, design of creative social and technical resources, and design (and research) through infrastructuring. Finally, I presented the limitations of my work.

Chapter 9.

Conclusion

In order to validate the effectiveness of the theory of infrastructuring in describing the underlying design process of the social innovation projects and uncover the characteristics of the design process in such projects, this dissertation undertook a descriptive and multiple-case studies approach to explore the design process in three community-based projects (Chapter 3). In each case, the design process was studied by collecting and analyzing evidence from multiple data sources (Chapter 4). The findings of the three case studies illustrated that the theory of infrastructuring in relation to the theoretical framework of publics is effective in describing the design process of social innovation projects in community contexts. However, the findings from studying the three projects also provide thoughtful evidence that the theoretical framework would be more effective (Chapter 5, 6, and 7). In addition, a discussion based on the findings highlighted the characteristics of the design process and the implications of this study for interaction design (Chapter 8).

In this last chapter, I offer my concluding reflections on the work conducted in this dissertation. The multiple case studies allow me to validate the effectiveness of the theory of infrastructuring in depicting the design process of community-based social innovation projects and allow me to answer my first research question: *How does the theory of infrastructuring in relation to the theoretical framework of publics (Le Dantec, 2016) effectively describe the collective design of community-based social innovation projects in an urban Canadian city?* In addition, I was also able to uncover the characteristics of the design process and present a discussion of the implications for interaction design. This allowed me to answer the second research question: *Based on the theory of infrastructuring, what are the characteristics of the design process in community-based social innovation projects that can be supported by interaction designers?*

In the first section of this chapter, I revisit the research questions and present the answers to them. After that, I articulate the contributions of this doctoral work. Finally, based on the findings of this dissertation, I outline three directions for future work.

9.1. Revisiting the two research questions

There are two purposes for this doctoral work as presented at the beginning of this dissertation. My first purpose was to validate the effectiveness of the theory of infrastructuring in describing the design process of community-based social innovation projects. My second goal was to uncover the characteristics of the design process in such projects that can be supported by interaction designers. These two purposes lead to my research questions. Below, I sum up my answers based on this doctoral study.

9.1.1. The first research question

My first research question in this doctoral research was: *How does the theory of infrastructuring in relation to the theoretical framework of publics (Le Dantec, 2016) effectively describe the collective design of community-based social innovation projects in an urban Canadian city?*

The theoretical framework of publics and its element of infrastructuring provide a vantage point from which the complex and dynamic design process of community-based projects can be understood and described. Specifically, the concept of issues provides a lens to help understand the engine behind the dynamic design process and the fluid cast of actors who are enrolled to deal with those issues. Attachments then offer a language to articulate the diverse individuals, artifacts, and institutions involved and the complex relations formed among them around the issues. The work of infrastructuring allows for an account of the process through which the resources are identified and marshalled so that a "durable and ready-to-hand" (Le Dantec, 2016, p.26) infrastructure is built up to support the public to act.

In this multiple-case study, three projects were analyzed by using the above conceptual tools. Although this doctoral work was not extensive enough to describe the full design process of those three projects, it still provides impressive examples that the concept of infrastructuring from the framework of publics can effectively describe the collective design process of community-based social innovation projects. It is encouraging to see how helpful these concepts can account for the underlying complex and dynamic design process in those projects.

In addition, the findings from the three case studies also highlight the aspect of the design process that falls out of the theoretical framework, which thus offers thoughtful evidence that the framework would be more effective. As articulated in the three case reports as well as in section 8.1, local situations, in which higher-level infrastructuring work is in progress (the ongoing design process of the urban city in this doctoral study), are considered to be a necessary ingredient for comprehensively understanding the design process of community-based projects for social innovations. By emphasizing the local situations in the understanding of the design process of social innovation projects in community contexts, I aim to highlight the significant role of local political, social, and cultural impacts in shaping the design process of those projects, and also highlight how the social innovation projects themselves influence the local political and cultural environment as demonstrations of the visionary future in that local area.

Therefore, the study provides detailed and rich supporting evidence of the effectiveness of the theory of infrastructuring in describing the dynamic design process of social innovation projects in community context. Furthermore, this work also uncovers the aspect that the theory could be improved and expanded.

9.1.2. The second research question

The second research question I asked was: *Based on the theory of infrastructuring, what are the characteristics of the design process in community-based social innovation projects that can be supported by interaction designers?*

In section 8.2 and 8.3, I articulated six characteristics of the design process in such projects and the implications for interaction design.

First, publics formed in the design process of the community-based projects are dynamic and heterogeneous. On the one hand, when issues are emerging and evolving, the constitutions of the publics change. In the three projects, I presented the different publics formed around the different issues. I show how durable but fluid the publics are in dealing with the emerged issues. On the other hand, the individuals forming the publics are not a homogeneous group. They are people with diverse time availabilities and skills who are balancing their participations in the design process of the projects with their daily work and life.

Second, I describe how creative and resourceful the publics are in the design process. In three cases, I show the creativity of actors in developing visions for their projects and in the adoption and appropriation of diverse resources. I also illustrate the resourcefulness of actors in identifying and using the network of social and material resources through their present and newly created attachments.

Third, I articulate how publics build relations to access more resources. I highlight four strategies that are used by publics in creating and maintaining attachments. In terms of swap, I describe how publics use their present resources to exchange for the social and material resources they need. I also articulate how mutual benefits, shared values, and converging interests become a drive in the creations of attachments.

Fourth, I show how a variety of social and material resources and relations are understood as resources for further design acts by the publics in design processes. In particular, I highlight how social resources, such as individuals and institutions, are seen as resources in their design process. In addition, I show how built relations are adjusted to allow better design acts in future.

Fifth, I emphasize the open-ended nature of the design process in community-based social innovation projects. I articulate how this characteristic supports and limits the creativity of the design actions of publics in responding to issues that they are facing.

Finally, I articulate how the whole design process of the projects impact and have been impacted by the ongoing design process of the city. I show how the design processes of the three projects are shaped by the ongoing design process of the City of Vancouver. More importantly, I illustrate their pioneer role in the city's development, which is considered as a particularly prominent characteristic of the design process of social innovation projects.

According to the uncovered characteristics, I proposed five implications for interaction design to support the design process of community-based social innovation projects.

First, in response to the dynamic and heterogeneous characteristic of publics, I highlight that it is important to design technologies that are simple and easy to learn for new actors, thus not raising the threshold for participation. In addition, designers should

also recognize that any updates to existing systems that publics are using should be small, because any changes will take time for the built infrastructure to digest. The less work technologies require the public to conduct, the more successful the designs will be.

Second, in light of the variety of social and material resources adopted as design resources in the design process of community-based projects, I propose that interaction designers could design technologies to visualize the resources in the built infrastructure to support the publics to identify the resources they could use. In addition, I also point out that interaction designers should carefully think about how to integrate the designed tools into the current built infrastructure.

Third, based on the characteristics of the multiple ways in building attachments in the design process, I highlight the design opportunities for interaction designers in supporting the exchanges and understandings. Specifically, I encourage interaction designers to think about digital platforms that can be integrated by publics to exchange their resources with other necessaries. In addition to an online platform, I propose that interaction designers who are interested in supporting social innovations think about endeavouring to realize the physical living lab operated in his or her neighbourhood or city to support the match-value process in the community-based projects.

Fourth, according to the resourcefulness of publics, I argued for the notion of designing to support the descriptions of roles that can make individuals become creative resources, which expands the current focus on artifacts when researchers discuss resourcefulness. Furthermore, I also articulated the design opportunities for interaction designers to make the invisible local situations more visible and configurable.

Lastly, in light of the open-ended nature of the design process, I encourage interaction design researchers to study the design process of social innovation projects in community context from a first person perspective and for a long time to obtain more detailed data.

9.2. Contributions of the study

The first contribution the study provides is descriptive. The three case studies presented in chapter 5, 6, and 7 together offer detailed evidence of the design process of

social innovation projects in community contexts. The three chapters describe how publics identify and integrate diverse social and material resources in contending with the issues they confront. The theory of infrastructuring and the framework of publics applied in this study allowed for an account of the complexity and dynamism of the design process.

Second, the three case studies conducted offer rich evidence in validating the effectiveness of the infrastructuring theory in relation to the framework of publics in describing the design process of social innovation projects in community context.

Third, this work provides thoughtful evidence to further improve the theoretical framework in describing the design process of community-based projects for social innovation. It emphasizes the dynamic local situation – which is a higher level of local infrastructuring work – is a necessary component for comprehensively understanding the design process of community-based social innovation projects.

Finally, this dissertation provides implications for interaction design to support social innovation projects in community context. The implications include design to support dynamic publics, mapping the network of resources, design venues for exchanges and understandings, design of creative social and technical resources, and design (and research) through infrastructuring.

9.3. Future work

By applying the theory of infrastructuring, this study has uncovered the underlying design process of social innovation projects in community contexts and articulated how interaction design can support the design process of such projects. In this section, I outline several directions for future explorations.

9.3.1. Including more actors in each case study

It would be valuable to continue this research and involve more actors who participated in the design process in each case study. For example, in the Vancouver Tool Library project, most interviewees were current participants in the project. Data collected thus reflect the recent issues and the current publics, attachments, and

infrastructuring work. Founders and actors in the initial design process of the projects are also very important. Although this research did not reach them, future work should study them so that to get a more holistic understanding about the design process of the project.

9.3.2. Studies of social innovation projects in other places

As I mentioned in the limitations of this study, this doctoral work only examined projects in the city of Vancouver. It would be very worthwhile to study social innovation projects from other places with different social, political, and cultural backgrounds. Future work could also compare and contrast the design process from different settings. For example, it would be very interesting to study social innovation projects in Beijing, Hong Kong, New York, or Amsterdam, and understand what are the similarities and differences between those projects and the projects discussed in this doctoral work.

As an international student from China, I am particularly interested in investigating projects in China as an extension of this study. For example, as a project also based on the CSA model, what are the characteristics of the design process of the Little Donkey Farm project in Beijing? How similar or different are the Little Donkey Farm[6] project and Inner City Farms projects? This would allow for a more comprehensive view of how actors collectively design in order to tackle their shared issues and build their own idea of well-being.

9.3.3. Research through design (social invention)

Since this doctoral work relied on in-depth interviews and short-term participant observations as the primary data source, it is hard to show a full picture of how the design process of those projects has evolved since they were initiated. In future studies, researchers could participate in the projects for a long term and document and record the design process from a first-person perspective to reach more valuable findings.

A more exciting direction for future work is that a researcher who is interested in dealing with social conditions or creating more preferred living environment could initiate and develop a social innovation project in his or her community. As I articulated in 8.3.5, a design intervention is not necessarily a material artifact. It could be a social invention.

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[6] http://www.littledonkeyfarm.com/

Through engaging in the process of designing social invention, researchers could explore design opportunities and challenges for guiding the future design process of social innovation projects. Expansive design knowledge would be produced.

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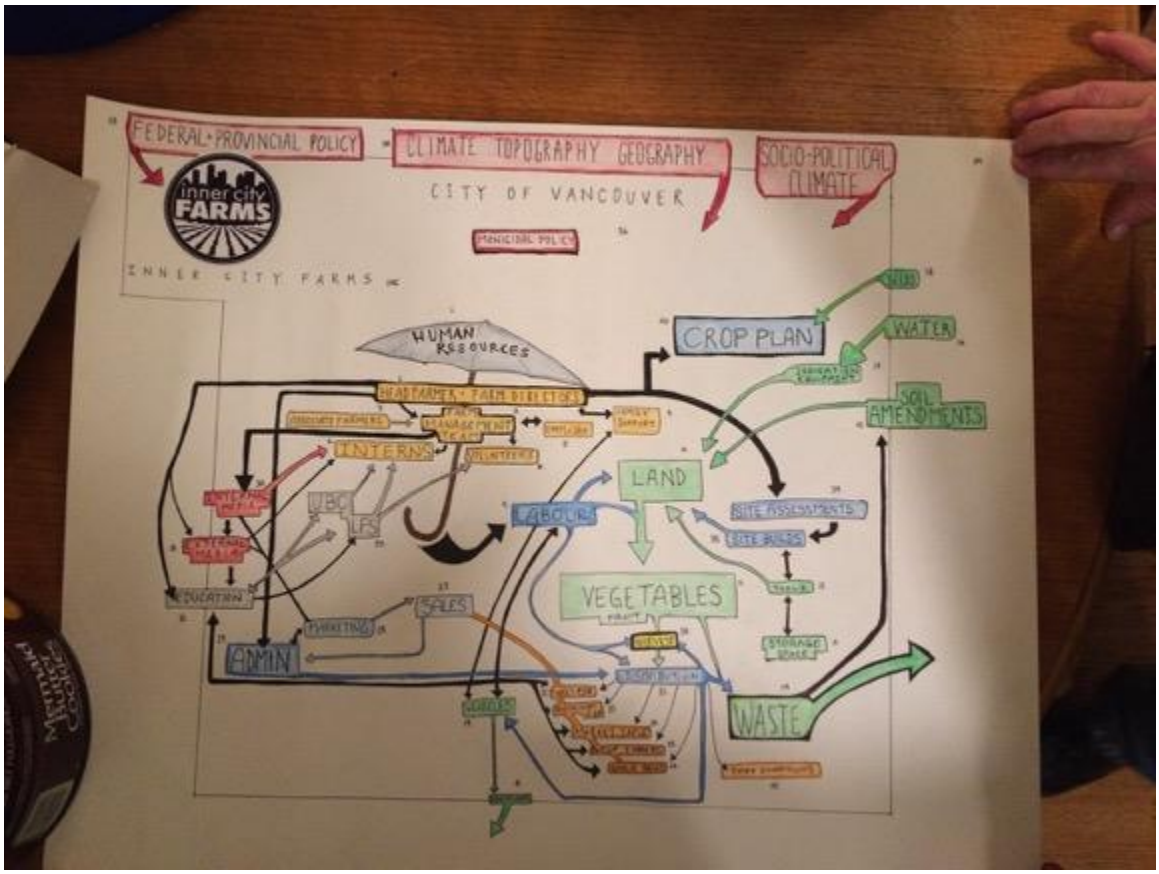
Appendix A.

Documents collected in Inner City Farms project



Document 1: Inner City Farms System Map
Note: Provided by participant Tony. Used with permission.

2014 Internships

Inner City Farms is now accepting applications for our 2014 urban farming internship. Interns will learn to farm and manage a network of small vegetable plots built primarily in residential spaces throughout Vancouver.

Commitment: Minimum of one 8hr work shift from Monday to Friday and a 4-8hr shift every other Sunday morning.

– Weekday shifts will be spent alongside our head farmer

– Sundays will be based around our CSA harvest

This is a volunteer position at this time. There will be occasional workdays as of early April, full hours will start early May. The season will last through October.

If interested, please send a resume and a paragraph to info@innercityfarms.com

outlining your qualifications, interests, and why an urban farming internship is something that you would like to take on.

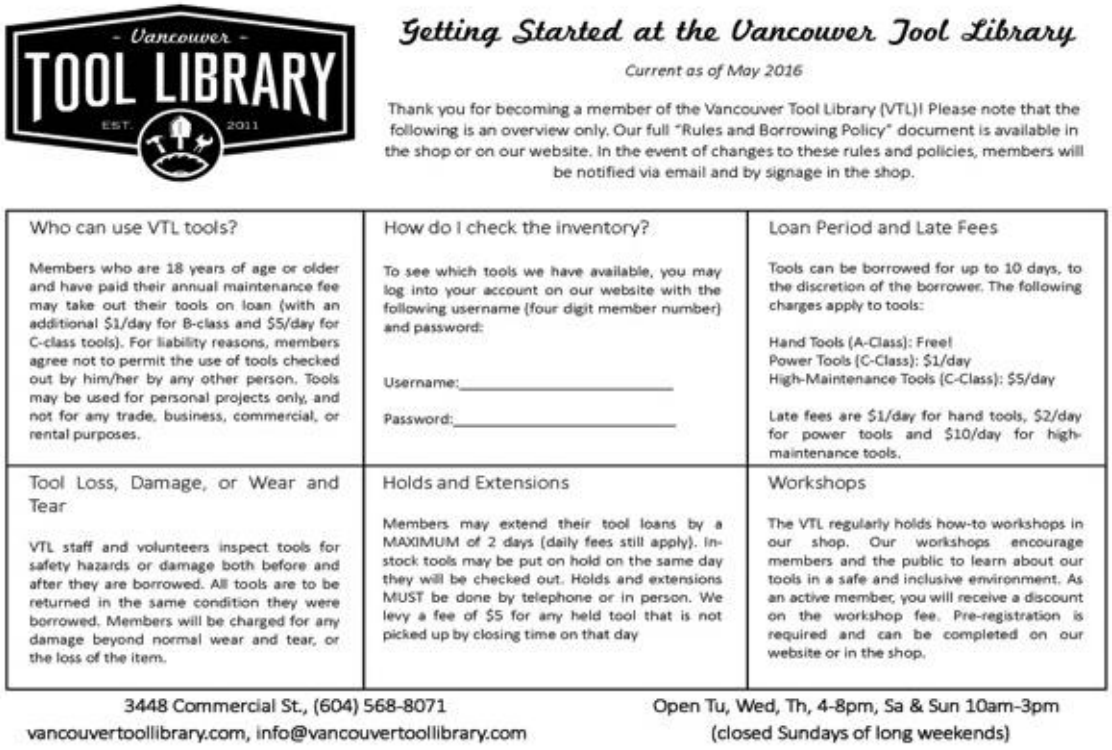
Inner City Farms will contact prospective interns for in-person interviews.

Farm this city!

Document 2: CSA and Internship post
Retrieved from: http://innercityfarms.com/

Appendix B.

Documents collected in Vancouver Tool Library project



Vancouver TOOL LIBRARY EST. 2011

Getting Started at the Vancouver Tool Library

Current as of May 2016

Thank you for becoming a member of the Vancouver Tool Library (VTL)! Please note that the following is an overview only. Our full "Rules and Borrowing Policy" document is available in the shop or on our website. In the event of changes to these rules and policies, members will be notified via email and by signage in the shop.

Who can use VTL tools?

Members who are 18 years of age or older and have paid their annual maintenance fee may take out their tools on loan (with an additional $1/day for B-class and $5/day for C-class tools). For liability reasons, members agree not to permit the use of tools checked out by him/her by any other person. Tools may be used for personal projects only, and not for any trade, business, commercial, or rental purposes.

How do I check the inventory?

To see which tools we have available, you may log into your account on our website with the following username (four digit member number) and password:

Username:_____

Password:_____

Loan Period and Late Fees

Tools can be borrowed for up to 10 days, to the discretion of the borrower. The following charges apply to tools:

Hand Tools (A-Class): Free!
Power Tools (C-Class): $1/day
High-Maintenance Tools (C-Class): $5/day

Late fees are $1/day for hand tools, $2/day for power tools and $10/day for high-maintenance tools.

Tool Loss, Damage, or Wear and Tear

VTL staff and volunteers inspect tools for safety hazards or damage both before and after they are borrowed. All tools are to be returned in the same condition they were borrowed. Members will be charged for any damage beyond normal wear and tear, or the loss of the item.

Holds and Extensions

Members may extend their tool loans by a MAXIMUM of 2 days (daily fees still apply). In-stock tools may be put on hold on the same day they will be checked out. Holds and extensions MUST be done by telephone or in person. We levy a fee of $5 for any held tool that is not picked up by closing time on that day

Workshops

The VTL regularly holds how-to workshops in our shop. Our workshops encourage members and the public to learn about our tools in a safe and inclusive environment. As an active member, you will receive a discount on the workshop fee. Pre-registration is required and can be completed on our website or in the shop.

3448 Commercial St., (604) 568-8071
vancouvertoollibrary.com, info@vancouvertoollibrary.com

Open Tu, Wed, Th, 4-8pm, Sa & Sun 10am-3pm
(closed Sundays of long weekends)

Document 1: New Member Flyer

The Vancouver Tool Library Cooperative

COOPERATIVE AGREEMENT

Members of The Vancouver Tool Library Cooperative …

- *Must purchase one membership share, valued at $20,*
- *Have one vote at general and other co-op meetings,*
- *Are eligible for election to the board,*
- *Are eligible for appointment to committees (eg. Nominations, Tool etc.),*
- Have access to education about all aspects of the cooperative, including its governance structure, rules, policies, and financial status,
- Will not be discriminated against,
- Will receive proper notice of all meetings,
- Will abide by the cooperative's memorandum of association, rules, and other policies when participating in the cooperative's governance.

Members of The Vancouver Tool Library Cooperative are encouraged to …

- *Understand how the cooperative operates and its general financial status*
- *Participate to the best of their ability in the business of the co-op,*
- *Attend, and cast informed votes at, General Meetings,*
- Stand for election to board when possible,
- Serve on committees when possible,
- Volunteer when possible,
- Support the objectives of the cooperative,
- Provide considered opinions on in cooperative planning and policy.

The Vancouver Tool Library Cooperative and its Board of Directors will …

- *Provide information about all aspects of the cooperative, including governance structure and financial status,*
- *Provide avenues for members to participate in the business of the*

cooperative,

- Be responsive to cooperative members; all policies of the cooperative will reflect the values and interests of the membership,
- Provide notice of and information about cooperative meetings to all members,
- Ensure that an efficient and transparent system for decision-making is in place,
- Ensure that systems are in place for smooth business operations,
- Consult with members before making any major changes to its operations,
- Operate in a way that does not put members' investment in the cooperative at excessive risk,
- Refund membership shares if/when a member leaves the cooperative.

Document 2: Cooperative Agreement

The Vancouver Tool Library

RULES & BORROWING POLICIES

- Members must be 18 years of age or older to borrow tools from The Vancouver Tool Library Cooperative ("VTLC").

- Only Members are authorized to use VTLC tools. Members shall not permit the use of VTLC items by any non-member.

- All share-holding Members must read and sign the VTLC Waiver and Indemnification Form and read, sign, and complete the Membership Form (verifying that they have read and will abide by both the Rules and Borrowing Policy, and the Cooperative Agreement).

- Any tool in the inventory of the VTLC may be used by Members to renovate, repair, construct or otherwise improve a Member's place of residence, recreation or business, but may not be used in the regular conduct or normal operation of business or for any trade, industrial, rental, or commercial purpose. The VTLC reserves the right to differentiate and delineate such purposes as it sees fit, and refuse the loan of any tool to a Member based on such an appraisal.

- Prior to borrowing tools from the VTLC, a Member must have paid the appropriate Annual Membership Fees no more than one (1) year in advance of the date of loan and have paid off any and all accrued Late Fees (see section 9). Such a Member is considered to be in "Good Standing".

- A Member in Good Standing may borrow Hand Tools (those with Identification numbers starting with the letter "A") at no extra fee. A Member in Good Standing may borrow Power Tools (those with Identification numbers starting with the letter "B") for an additional $1 Power Tool Loan Fee per day up to 10 days and High Maintenance Power Tools (those with Identification

numbers starting with the letter "C") for an additional $5 Power Tool Loan Fee per day up to 10 days.

- Prior to borrowing tools, all Members must provide one (1) piece of Federal or Provincial government-issued photo identification (such as a BC Driver's Licence) and record the relevant information to their Membership Form. The Member agrees to update the provided information in the event that it changes prior to borrowing tools or using any other services offered by the VTLC.

- Tools may be borrowed for a maximum period of ten days. All tools borrowed are to be returned to the shop location from which they were borrowed (the "Library") by the close of business on their due date. Tools may only be returned during the Library's hours of operation.

- If a tool is returned late, the Member will be responsible for a late fee of $2 per tool per day for Power Tools and $1 per tool per day for Hand Tools and $10 per day for High Maintenance Power Tools. Late fees are capped at the full replacement cost of the tool plus a $5 administrative fee per tool.

- The Library may replace severely delinquent tools, holding the Member responsible for the full replacement cost plus a $5 administrative fee. Fines must be paid in full before borrowing additional items.

- The Library reserves the right to use appropriate steps to retrieve delinquent tools or unpaid fines and fees, including the use of a collection agency and/or legal action and assess the delinquent Member with the cost of any such action. The Library also reserves the right to forgive fees due to special circumstances.

- Members may put in-stock items on hold, by phone or in person only, on the same day of checkout. Failure to pick up a tool before shop closing time will result in a $5 fee charged to the member's account. The Tool Library reserves the right to make an exception to this policy for large, community events. No exceptions will be made for individual lending.

- Borrowed tools may be renewed during normal hours of operation either in person or over the phone, provided there is at least one tool of the

same type available in the shop at the time of renewal. Members must not have any late fees when they renew.

- Power Tool renewals are subject to the $1 Power Tool Loan Fee and High Maintenance Tools are subject to the $5 Power Tool Loan Fee. A Power Tool Loan Fee incurred by a renewal made by phone during regular hours of operation will be noted on a Member's profile at the Library. Any and all outstanding fees will be paid upon return of the tool to the Library, and the Member may not borrow additional tools until said fee is paid.

- Members may only extend a tool loan by 2 days. They may only extend their tool loan once.

- The Member agrees that the Library is not responsible for any manufacturing, material, or quality of workmanship defects of borrowed tools.

- By taking possession of any item, the Member is certifying that they are capable of using that item in a safe and proper manner.

- The Member agrees that if any borrowed tool becomes unsafe or enters a state of disrepair, the Member must immediately discontinue use of the tool and notify the Library of the issue on return, if not earlier.

- All tools are to be returned in the same condition as they were issued, barring normal wear and tear. All tools must be returned clean. The Member agrees to pay for the loss of or damage to any item and further agrees to accept the Library's assessment of condition of items and to further agree to the Library's assessment of fair restitution for damage, dirtiness, delinquency, and/or loss of items in part or in total. This restitution amount may equal the full replacement cost of the item plus a $5 administrative fee.

- The Library reserves the right to refuse the loan of any item at its discretion.

- The Library reserves the right to alter the tool policy at any time. The current policies Rules & Borrowing Policies will be displayed and available in print at the Library during normal hours of operation.

Document 3: Rules and Borrowing Policies

Member Number ___ ___

❑ **Entered into Local Tools?**

❑ **Entered into Mailchimp?**

Membership Form

Member Information:

Name: _____

Phone Number: _____

Email Address: _____

Address: _____

Postal Code: _____

*Year of Birth: _____ Gender: _____

How did you first hear about us?

__ TV/Radio
__ Community Newsletter/Listserve
__ Newspaper
__ On a flier around town
__ From a friend
__ Through social media
__ Internet search
__ Not sure
__ Other:

**This information helps us track the demographics of our membership*

VANCOUVER TOOL LIBRARY USE ONLY

Government-Issued Photo Identification:

□ Driver's License □ Provincial ID Card □ Passport □ Other _____

Province of Issue: _____ Country of Issue: _____

Identification Number: _____ Expiration Date: _____

I, _____ *(print name)* state that I understand and agree to the rights and responsibilities associated with co-op membership, as listed on the Cooperative Agreement.

I, _____ *(print name)* state that I have read, understand and agree to abide by the Vancouver Tool Library's Rules and Borrowing Policy. I understand that failure to comply with any of these rules may result in revocation of my borrowing privileges and/or legal action against me.

I, _____ *(print name)* affirm that the above information is current, true and correct.

Member's Signature: _____

Member's Name (print): _____ Date: _____

Witness Signature: _____

Witness Name (print): _____ Date: _____

The Vancouver Tool Library

WAIVER & INDEMNIFICATION FORM

WAIVER & INDEMNIFICATION

I, _____*(print full name)*, state that I am capable and experienced in using the tools I am borrowing, and that I will use the tools I am borrowing in a proper manner.

I, _____*(print full name*), do hereby for myself, on behalf of my successors , heirs and assigns, in consideration of being permitted to borrow tools, such consideration I agree is sufficient, waive any and all claims against The Vancouver Tool Library Cooperative, its officers, agents, members, volunteers and employees for any injury or injuries of any nature that I may suffer or incur in the use of the tools that I am borrowing from The Vancouver Tool Library Cooperative.

I, _____*(print full name*), hereby for myself, on behalf of my successors and assigns, in consideration of being permitted to borrow tools, agree to **release** and **indemnify** and **hold harmless** The Vancouver Tool Library Cooperative, its officers, agents, and employees from any and all liability, loss, claims, and demands, actions or causes of action for the death or injury to any persons and for any property damage suffered or incurred by any person which arises or may arise or be occasioned in any way from the use of tools I am borrowing from The Vancouver Tool Library Cooperative, whether those damages or injuries are caused by myself or a third party. I am aware that The Vancouver Tool Library Cooperative, its partners, directors, officers, members, volunteers and

employees claim no expertise and make no representation concerning the fitness of any tool for any particular use.

I state that I have read and fully understand the Rules and Borrowing Policy of The Vancouver Tool Library Cooperative and I understand that failure to comply with any of these rules may result in revocation of my borrowing privileges and/or legal action against me. I have read and signed this Waiver and Indemnification form, relinquishing any and all claims against The Vancouver Tool Library Cooperative, its officers, agents, directors, volunteers, and employees.

Member's Signature: _____

Member's Name (print): _____ Date: _____

Witness Signature: _____

Witness Name (print): _____ Date: _____

Document 4: Membership Form and Waiver

Memorandum of Understanding

between

Vancouver Tool Library Co-operative (VTL)

and

The Wood Shop

Purpose

The purpose of this memorandum is to clarify the terms of the use of The Wood Shop work space (251 Southern. St., Vancouver, BC) for VTL executing workshops.

Operations

VTL may use The Wood Shop work space on agreed-upon dates under the following terms:

VTL will waive Annual Maintenance Fees for The Wood Shop's Organizational Membership at VTLC (value $140/year).

VTL will waive Tool Loan Fees for tools borrowed by The Wood Shop from VTL

VTL will pay The Wood Shop $100 per day of work space usage.

The Wood Shop will ensure that the work space is in adequate condition for VTL workshops. The work space will be clear of debris and safe for operating woodworking equipment.

The Wood Shop will allow VTL and VTL workshop participants use of The Wood Shop tools and equipment during workshops, unless otherwise agreed upon.

Rationale/Scope

- ***Both the VTL and The Wood Shop find this agreement mutually valuable and agreed upon in the spirit of cooperation.***

Authorization

Vancouver Tool Library Co-operative ***Date:***

The Wood Shop ***Date:***

Document 5: Memorandum of Understanding

VTL New Shop Volunteer Orientation Package

Table of Contents

1. Introduction

Thank you for your interest in Volunteering with the Vancouver Tool Library (VTL). Volunteers are a critical part of our cooperative. We contribute thousands of hours per year on the Board, behind the desk, on committees, at events and in workshops. Without volunteers like you, the VTL could not exist. Thanks!

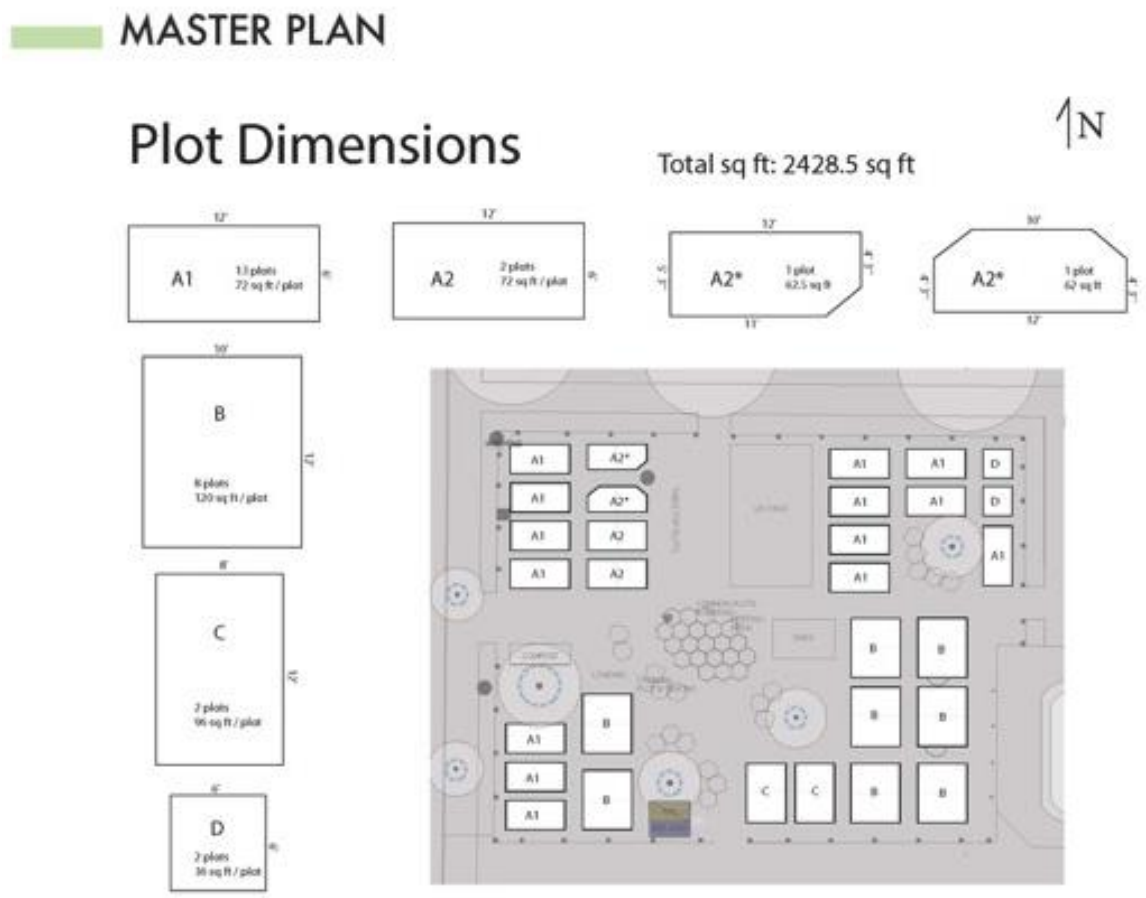
This document is provided to all new volunteers. It contains lots of useful information about the VTL, your position as a volunteer, and shop operations. It will also help guide you through your first training shift. We suggest you read it throughly and bring it with you to your first few shifts.

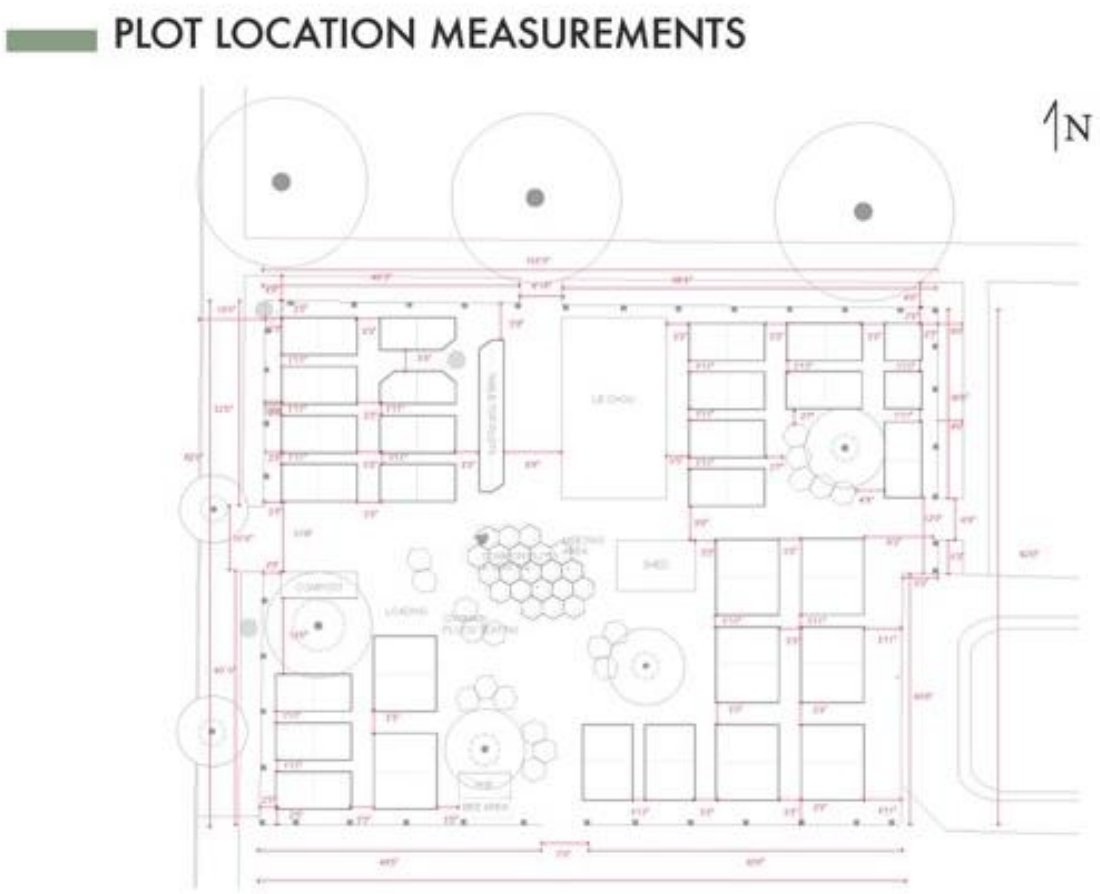
Thanks again for volunteering and welcome to the VTL family!

Document 6: Part of New Shop Volunteer Orientation Package

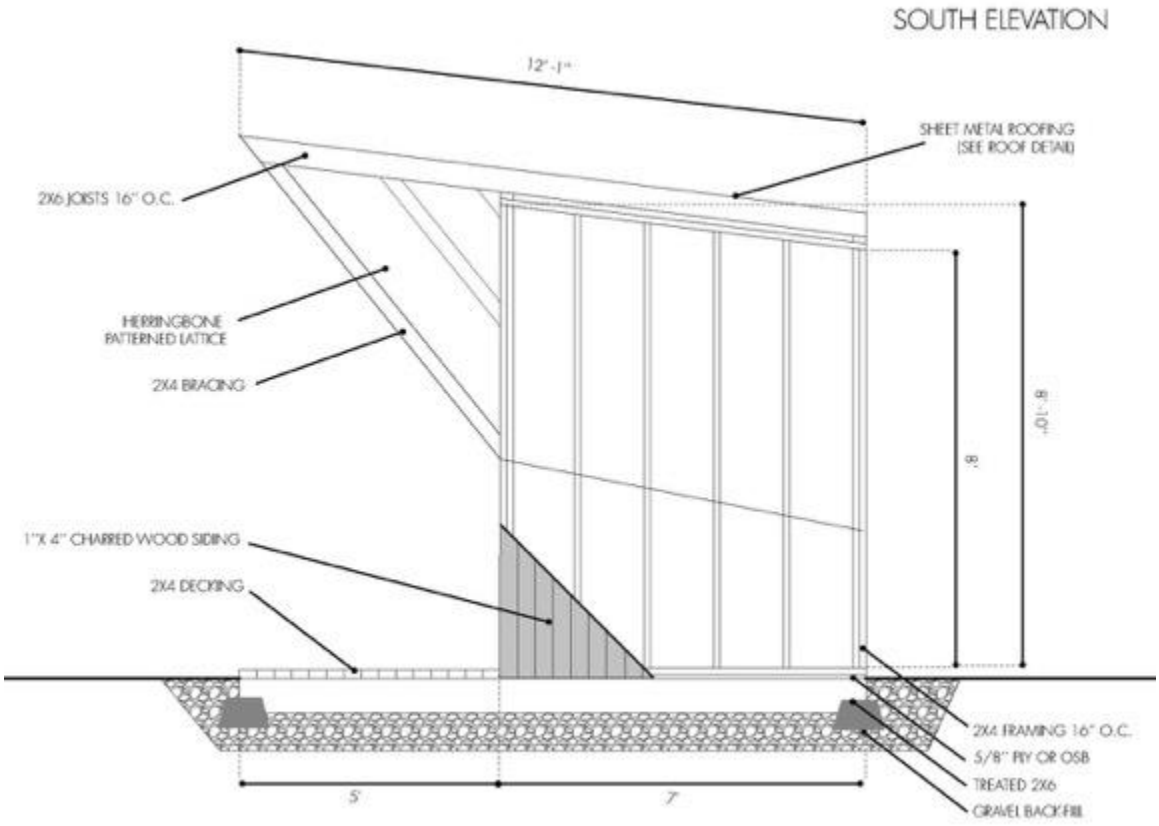
Appendix C.

Documents collected in Woodland Community Garden project





Document 1: Part of the Construction Book



Document 2: Part of the Shed Package

Date: July 11, 2012

TO: **Board Members – Vancouver Park Board**
FROM: **General Manager – Parks and Recreation**
SUBJECT: **Community garden at Woodland Park**

RECOMMENDATIONS

A. *THAT the Board approve the use of an area within Woodland Park for the purposes of a community garden, with all specifications to the satisfaction of the General Manager.*

B. *THAT the Board grant a five-year license to the Village Vancouver Transition Society to operate the community garden, with all terms consistent with the Community Garden Policy.*

POLICY

The Board endorsed Phase 1 of its new Strategic Plan on May 18, 2012, including the strategic objective to being "a Leader in Greening", and more specifically "to support community based food production by contributing to the development of neighbourhood and city-wide food infrastructure programs and assets".

Vancouver City Council approved the Greenest City 2020 Action Plan (GCAP) on July 12, 2011. GCAP includes a target to increase local food assets by 50%, by 2020.

The Board approved a revised Community Garden Policy on September 19, 2005, which outlines the terms and conditions under which the Board will consider community gardens to be operated on park lands (Appendix A).

The Grandview Woodland neighbourhood is currently in the process of creating a new community plan, due to be completed in late 2013.

BACKGROUND

The Board has received a proposal from the Village Vancouver Transition Society ("Village Vancouver") to build a community garden in Woodland Park. Village Vancouver envisions Vancouver as a vibrant city at the leading edge of sustainability, where residents know their neighbours and participate in collective actions to minimise their ecological footprint. Village Vancouver is an entirely volunteer-driven organisation of more than 1,500 Vancouver residents, including several hundred already involved in gardening. They hold dozens of urban gardening workshops each year, led by local professional farmers and master gardeners. Village Vancouver is organised into local

villages, with the Grandview Woodland village active since January 2011 and having 70 members. Together, the garden applicants from the neighbourhood have experience in volunteer recruitment and management, direct gardening experience, art-based community development, and project management.

The proposal identifies the Grandview Woodland neighbourhood as home to a demographic that would benefit from new community gardens, as only 9.8% of residents live in a single detached home and thus most residents have limited access to private yard space. Grandview Woodland is also a relatively lower income neighbourhood compared with other parts of Vancouver, with 35.2% of residents living in lower income households. This demographic is most likely to face issues of food insecurity and could benefit from having the opportunity to grow some of their own food.

The proposal meets the Park Board Community Garden Policy in the following ways:

- Will create and maintain an organic community garden that will increase the ecological biodiversity of Vancouver and provide increased understanding of local food production.
- Will produce food and flowers for the personal use of society members, as well as for shared benefit of the community.
- Will have a community development component involving local child care and non-profit agencies.

DISCUSSION

This area of Grandview-Woodland has many renters and co-op members without access to gardens. A neighbourhood-wide survey of potential gardening spaces, also including other public and private underutilised sites, resulted in the Woodland Park location as the preferred option. The proposed site for the community garden is in the centre of the park, located just west of the field house and an older wading pool. It is situated between two playing fields and will not interfere with these active uses.

The proposed garden is 25m by 35m, and will combine a generous public area connecting the two fields with cooperative garden spaces and private allotment beds. This combination of uses invites people to enjoy the garden as passers-by, as visitors and as gardeners of communal or individual plots. Also included are:

- Wheelchair accessible raised beds
- A small shed or waterproof box for tool storage
- Space for compost production
- Edible berry bushes
- Natural building elements

The garden will be developed at no cost to the Board, and will be operated by volunteers from the community. The exception to this is that the Board will provide the first year of compost, the water hook up, and potentially some fruit trees. Funding for this is available in the 2012 Park Board Capital Budget.

PUBLIC CONSULTATION

From June 11-30, 2012 public consultation on this proposal was held. Staff and garden volunteers delivered 500 flyers to neighbours (both residential and commercial) within a 2-block radius of the proposed garden site, as required by the community garden policy. In addition to this, a sign was posted on the site and an open house was held on June 21, 2012 from 7:00-8:30pm with both staff and Village Vancouver representatives on hand.

The Park Board received a total of 63 responses in both written form and via email. Of these, 81% (52 submissions) were in favour, and 19% (12 submissions) were not in favour or had concerns.

The most common reasons for supporting the garden proposal included:

- Many apartment dwellers living nearby that would like gardening space close to where they live.
- Project will create more community and build connections, break social isolation, increase social capital and encourage placemaking by drawing out a diversity of local residents to interact with each other
- Having more people who constructively use the park will displace less desirable activity - more "eyes in the park"
- Provision of an excellent learning opportunity for kids and encourages family time together

The most common concerns included:

- Creating a division/barrier between north and south sections of park
- Park already has a number of transient people who conduct activities that create a security problem, garden will increase this activity at risk to residents
- Lack of park space in neighbourhood for growing population
- Creating a space in the park that is exclusively used by a few people

- Would like to see a bigger plan to revitalize the park, including off-leash dog area

If the Board approves this garden proposal, Park Board staff would require the proponent to respond to community concerns by inviting neighbourhood residents to participate in a collaborative workshop that finalises the design of the garden, achieving:

- A generous welcoming space/path through the centre of the garden (north-south) to maintain clear visual and pedestrian connections between the north and south;
- accessible, welcoming public seating and space for passive recreation and enjoyment by all park users;
- space for shared gardening and shared harvest, for all park users to enjoy as well as for sharing with local food banks (and similar organisations);
- Respect the run out requirements of the baseball field to the south in garden design and operation;
- All requirements outlined in the Community Gardens Policy.

NEXT STEPS

1. Produce final design that meets Park Board requirements and integrates responses to public concerns specific to the garden that were heard during consultation;
2. Submit final design to General Manager for review and approval;
3. Enter into license agreement;
4. Garden construction can begin.

SUMMARY

The proposed plan furthers the Park Board local food objectives as well as the City and Park Board's Greenest City target and actions. It meets the criteria of the Community Garden Policy. The garden will contribute to increasing our local food assets, and will also build community connections. Staff recommend that the Board approve this proposal for a community garden at Woodland Park, and that Park Board staff work with Village Vancouver to develop a final plan for the garden.

Prepared by:

Parks
Vancouver Board of Parks and Recreation
/LC

Document 3: Board of Parks and Recreation report

Woodland Community Garden (WCG) Membership Requirements

Welcome to Woodland Community Garden

Toward making the Woodland Community Garden a pleasant and rewarding experience for everyone, we wish to put forward some common-sense requirements for all gardeners to abide by, so that the communal and shared nature of the garden may be unequivocally understood and upheld by all.

Volunteer Hours

- WCG gardeners are required to complete a minimum of 8 hours volunteer work per year (counted March 1 to end of February; not related to the date of plot assignment).
- The work must contribute to the collective areas of the garden (not an individual plot).
- Yearly volunteer hours accrue beginning March 1 and are due by end of February the following year. For new gardeners who are assigned space later in the year, hours may be pro-rated. This amount needs to be established with WCG.
- It is the gardener's responsibility to complete and record volunteer hours on the timesheet provided on the day of the work party or other such means as appropriate.
- WCG may grant exceptions based on personal hardship and special circumstances. Arrangements need to be made with the WCG Plot and Task Team.

Gardening and Maintenance

1. Organic gardening methods and integrated pest management principles are to be followed. NO synthetic chemicals including; pesticides, insecticides, herbicides, weed killers, and fertilizers are allowed. Organic fertilizers are allowed (compost, fish meal, composted manure, lime, etc.).
2. No Invasive Plants. Invasive plants are those that run amok once planted in a garden. They spread across garden plots and can be impossible to get rid of. They will re-grow from just a fragment of a stem or a root left behind. Please be sure to know what you are planting to ensure you do not spread invasive plants through the WCG.
3. Year-round gardening and maintenance of the assigned garden space is the plot holder's responsibility. Garden space is defined as a garden plot and the pathway that surrounds that plot. Always keep garden pathways inside and adjacent to garden plots safe, level, clear of weeds and obstacles.
4. You will harvest only your own crops unless given permission by other plot owners.
5. Trees may only be planted in areas approved by the WCG.
6. No tilling of existing ground is allowed. Any new soil brought to the site must be suitable for planting edible vegetation.
7. Produce from plots is for home use or donation only, not commercial purposes.
8. Seasonal and temporary gardening structures such as trellises and cloches are allowed only if they do not encroach upon paths, community spaces or neighbouring plots. Be considerate of your neighbors and orient your structures to minimize shade on other plots.

Plot Turnover

- Plot holder(s) cannot give the garden space to others but co-gardeners are allowed.
- When the plot holder no longer wants the plot:
    - Plot holder(s) must notify and establish a timeline for turnover with the WCG.
    - Plot holder(s) needs to leave the garden space in reasonable condition and remove all structures and other non-plant materials unless arrangements are made with WCG.
- Plot holder(s) are not allowed to permanently work other people's plots.
- Plots vacated are offered to the next person on the waiting list.

Compost

There are compost bins located on site. It is very important not to put meat, or meat by-products, dairy, fish and seafood products, oils, pet waste, weeds (such as morning glory) rocks or inorganic materials in the compost. Please dispose of garbage at home or in the garbage bins located in the park. It is also very important to chop up the materials that you put into the compost or else the compost will take longer to biodegrade. More instructions on compost maintenance and care will be posted.

Compliance

- Failure to adhere to any of the requirements of the WCG is cause for exclusion from the garden and loss of your plot.
- You will receive one email, telephone or verbal warning from the WCG.
    - If no response or correction has been made, you will receive written notice two weeks later.
    - In another two weeks, if no correction or response has been made, you will receive final notification that you have forfeited your gardening privileges and that your plot fees will not be refunded.
- If a member disagrees with the assessment, they will be given the opportunity to redress with the Plot and Task Team.
- You may reapply for another garden plot after one year at the discretion of WCG.

Document 4: Woodland Community Garden Membership Requirements

City of Vancouver *Planning - By-law Administration Bulletins*
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REZONING POLICY FOR SUSTAINABLE LARGE DEVELOPMENTS

(Formerly: EcoCity Policies for Rezoning of Sustainable Large Sites)

Authority - Director of Planning
Effective December 15, 2010
Amended May 16, 2013, August 1, 2013 and December 16, 2014

GENERAL INFORMATION

In June 2008, Council approved the EcoDensity/EcoCity Revised Charter and Initial Actions. Revised Action A-2 established policies to achieve higher sustainability standards as an essential component in the rezoning of large development sites.

The policy was revisited in 2013 to refine the definition of a large site to include large developments, and better articulate the requirements associated with this policy and their association with the Greenest City 2020 goals and targets. The policy is now known as the Rezoning Policy for Sustainable Large Developments, and can be found online at: vancouver.ca

In essence, the policy states that development proposals put forward though rezoning applications that:

- involve a land parcel or parcels having a total site size of 8,000 m^2 (1.98 acres) or more, or
- contain 45,000 m^2 (484,375 sq. ft.) or more of new development floor area

will be considered to be large developments. For large developments, the City requires defined plans or studies on the following:

1. Sustainable Site Design
2. Access to Nature
3. Sustainable Food Systems
4. Green Mobility
5. Rainwater Management
6. Zero Waste Planning
7. Affordable Housing
8. Low Carbon Energy Supply

Projects that are limited in scope may be excluded from the requirements of this policy, including:

- text amendments to the existing zoning for minor changes to large sites, or
- projects that contain less than 4,700 m^2 (50,590 sq. ft.) of new development

In such cases, a request for partial exemption from the policy requirements should be discussed with the rezoning planner prior to zoning application submission. Alternatives can be considered and, if warranted, some of the requirements may be waived by the General Manager of Planning and Development Services (under Director of Planning authority).

3.0 SUSTAINABLE FOOD SYSTEMS

3.1 Objective

The City will require applicant to demonstrate the overall increase of food system assets. Food assets are defined as resources, facilities, services or spaces that are available to residents of the city (either at the citywide or neighbourhood scale) and which are used to support the city's food system.

This will contribute to our Greenest City target of supporting Local Food – by 2020, to increase city and neighbourhood food assets by a minimum of 50% over 2010 levels.

3.2 Intent

The intent of creating a sustainable food system is to improve the resilience of Vancouver's food system in accordance with the vision, principles and goals defined in the Vancouver Food Strategy (2013).

3.3 Primary Deliverable

The primary deliverable is the demonstration of the delivery of a minimum three food assets. The application should illustrate how the applicant intends to deliver a minimum of three food assets and meet the City's food system vision, goals and principles as reflected in current City food policies, initiatives, and guidelines.

For reference, City of Vancouver food related policy and guidelines include

- Administration of Community Food Markets (2014)
- The Vancouver Food Strategy (2013)
- Farmers Market policy (2013)
- Greenest City Action Plan (GCAP) (2011)
- Urban Agriculture Design Guidelines for the Private Realm (2009)
- Operational Guidelines for Community Gardens on City Land Other than Parks (2009)
- Vancouver Food Charter (2007)
- Guidelines for Urban Beekeeping (2005)

3.4 Components

Food assets are defined as resources, facilities, services or spaces that are available to residents of the city (either at the citywide or neighbourhood scale) and which are used to support the city's sustainable food system. In order to meet the requirements, applicants are required to provide a detailed description of how a minimum of three food system assets from the following list will be included and delivered in the development:

- Community gardens / community orchards
- Edible landscaping
- Community kitchen
- Community food market
- On-site organics management
- Facilities to support neighbourhood food networks

In lieu of three food assets, the City may also consider a contribution to a broader scope, citywide food processing/storage/distribution infrastructure/operation and would assess this on a case-by-case basis. The applicant must outline why the three on-site food assets cannot be delivered, and how the contribution will contribute to other citywide food assets.

These guidelines define and describe the physical features and attributes of the six food assets. The success of a food asset is determined by effective programing and maintenance. The applicant is encouraged to work with City staff to identify potential users and caretakers well in advance. In many cases, non-profit organizations could assist in governing the food asset, and a community use agreement could be developed to clearly define roles and responsibilities of parties involved.

Document 5: Part of Rezoning Policy for Sustainable Large Developments

Appendix D.

An Example of In-depth Interview Transcript

Participant: Tony

Institution: Inner City Farms

Interviewer: Xiaolan Wang (XW)

XW: Can you give a brief introduction of your project?

Tony: Sure! I run a project called Inner City Farms. And Inner City Farms is urban farms here in Vancouver. What we do is we grow mixed vegetables, different types of vegetables, all non-herbicide, and organic practices. In the City of Vancouver, we do it on land that people provide for us, basically that people in the community that have yard spaces that they are not using. They can give their spaces over to us and we build vegetable gardens. Normally, they give us grass and we take out the grass and we build vegetable gardens. So what we have done is building the network of front and back yard farms in the City. And in aggregate, we manage that space as our farm. So, it is basically to emphasize local food projects and sustainable food projects. Our motivation is to resist the dominant food paradigm that based in industrial food and quite destructive in our opinion. And we are trying to take action against that, in a way that is relatively peaceful and responds to our lives as well. We want to grow food for ourselves; our families and we also grow food for other people. So, we distributed our food through a program called community supported agriculture, or CSA. So, that is usually how we get food out. We do that with restaurants, the restaurant CSAs. And we do family CSAs. Our customers buy our membership at the beginning of the season. Every week for about 20 weeks, in the growing season in Vancouver, we provide our customers with the share of the harvest.

XW: What are the roles you play in this project?

Tony: I was one the original funders of the project. Five of us started it at the beginning. We are friends just talking about we were not producing any of our own food. We were only buying food and we also want to have gardens. So we got together and said “ok,

let's ask people let us use their space", so we can use their space and give them some food and take the rest ourselves. So, we started very small. We have a few yards at the first season in 2009/2010. After that, it got some attraction. People are interested and people were willing to support us and offer us spaces. So, after that summer, we decided that we needed to hire someone to work in the farms full time. First year, we were just volunteers after work or after school and on weekends. It was only 5 of us, so it was equal initially. In the next summer, we decided that we need to hire someone. If we want to make the project better and bigger, and we decided to hire me! So, I began as the first head farmer in Inner City Farms. And I have remained that role ever since. The project grows every year and it is almost 10 years now. We just become a non-profit organization about year ago. We were small business before. But now we are transferring to a society under the society actor of British Columbia. So, now I am technically the executive of director of the Inner City Farms Society, that is my title. And I am also the head farmer of Inner City Farms.

XW: What is the moment making you decide to make it a non-profit organization instead of being a business.

Tony: So, initially, we registered our organization as a business, legally. We could be a legal entity. When you need to have a bank account, with your name on it. You need to be a legal entity. We kind of looked at different forms. And we decided initially we could become co-operation. So we registered as co-operation with the government. We did that for many years. And there were two things were stumbling blocks. One is that we didn't make any real profit. Every year we spend all the money were made on the operation of the project and on the wages the kind of stuff. The cost is equal to the revenue. So, no one is going to making any money. We didn't recognized early. But we were able to keep the project to live. So, that 's fine. And there are other urban farms in Vancouver. And one was a non-profit organization and working with other bigger entities. It seams to have more success. So we became clear that there was a component of urban farming that are involved external funding that wasn't just based on the sales of vegetables. And Inner City Farms, we've only ever generated revenue from vegetable sales. That is good enough to keep us alive, but it is not good enough for us to grow and become an organization that has an impact that we believed we like to have. So, we thought maybe we followed that model. The other farms that we were looking at were Sole Food Farm and Fresh Roots Urban Farm. So, we started at the same time as those

farms. They are friends of us. And they ended up taking different directions at the beginning. It seams works for them pretty well. So, we won't have to reinvent the wheel and follow those guys.

The other thing is that, overwhelmingly, the Inner City Farm is volunteer run. Under the employment in Canada, you cannot volunteer for business. So, in many places, like United States, you can just do a volunteer or an internship and try to get a job within the company later. But in Canada, that is not legal. So, we knew that we already have lots of volunteers. We want to legitimize the volunteering. So, we decided we become a non-profit. The differences is, with that co-operation, let's say, you make a million dollars. The owner can take as much money as they want. With the non-profit, if you make a million dollars, all that money has to go back into the project itself. That is the biggest legal difference I think. But it is not an issue for us. All of our money was already going to the project. It is a big decision, but it is good. It really has not changed anything yet, because we have not aligned with other external funders. The other thing is applying for grant money. Lots of programs for students that want to work, for different educational things. There are ways to get funding in non-profit, but we have not really adventured to that. The non-profit can still hire people. I am hired by the non-profit. So, I still earn a wage. Technically, there is a board of directors, and they are all volunteers. They don't get any money. They set the direction for the non-profit. One of their decisions is to hire a head farmer and that's me. So, the other funder of this project is on the board as well. And there are new few people that can help us with direction stuff, but are mostly volunteers.

XW: Can you describe the development process of this project since it was an idea? For example, what individuals, organizations, tools and materials that have been involved in the project, in what reason they got involved, and how?

Tony: So, when we started, we thought it would be very hard to get space. We didn't realize how small or how big the project is going to be. We really didn't know much about anything. We just thought ok, let's try it. For the first season, we were pretty disorganized, but also we were very small. So, we were ok. We were not bothering anybody. But we used that first season to learn. And by the end of the first year, we earn much more knowledge. We started from 9 CSAs, so 9 families were getting vegetables. And they were all friends and family. We realized in half way of the season that we were able to grow much more food than we thought. So, we added more and more share

holders. So, the first season started at 9 but ended up at 17. So, we learned how much we can grow in the small space. We were exited about the more people talked about the project, more positive repercussion we got. So, everyone thought it was really cool, really interesting, no one had heard anything like that before. It is pretty easy to explain how our food system is destructive in our society. The ecological, social, and economic arguments for the system needing to be revolutionized are quite secure and quite easier to show academically. There is no controversy in regards to the impacts of the food system. And people have such intimate relationships with food. It doesn't matter what your politics are, what your background is. So, everyone has already hade that relationship. So, it is really to start there, and discuss other things too. What kind of food you like, where is your food come from, who is your farmer, all these things. All sorts of people were attracted to our project to get involved and interact. Very accessible.

So, it is amazing, how much support we had from our community. When people give us their space, that is quite amazing thing, so you are going to give us your whole yards that we can grow vegetables? People thought that was crazy, but lots of people want to do it!

And we got people who are willing to trade their expertise for vegetables. So for example, we got some one who wants to do our accounting in exchange for the vegetable share for the season. We had a couple who went a website building company, so they were willing to help us build the website, and exchange for vegetables. So, it really becomes this community project in all kinds of different ways. People who didn't have time to garden or didn't have the interests in gardening but thought "wow this is a cool project, I want think about what I can do in order to make this project go!." So, we got tons of help from people. We were never survived if not for all these folks. We even had a lawyer; a friend of us is a lawyer. He did all of our legal documentations and exchange for vegetables.

It also has to do with the fact that there are five of us that started the project, and we all from Vancouver, and we have all very connected to our community, and we were all ready. We have schools here. We have lots of friends here. So, it was easy for people to find out what we were doing to offer like "hey, do you want me to involved" and so we can really use help from here and there and people are up for it. The strength of the project really starts with the strength of our community. Even getting the space, at the

initially, we just put the word out into people that we knew. Because we are from here, we know people's parents, aunts, uncles, friends and neighbors. There were already a quite wide network that we could draw from. So, lots of trading, lots of exchanges, lots of community helps. And we put the call to volunteers, too. This is what we were doing and anyone wants to help. And we got lots of applicants for that.

XW: For the volunteers, what they usually do in the project? They farming?

Tony: The main volunteering program we have is called "Urban Farming Internship." We offer people for opportunities to learn how to grow food here in Vancouver. They spend one or two days a week with us for the whole season. Normally they are young people who are interested in food growing and never really done it but are curious about it. Or who recognized that there is a sustainable angle and they want to work towards to more sustainable future. In Inner City Farms, they have a concrete place to put that energy, so there are a lot people are worried about it and don't really know what to do. This is one thing that you can do this and they can have an option. So, we get a lot of students and a lot of young people that are interested in a sustainable future. And they want to learn how to grow food. The idea for us is that at the end of season, they can use their experience as a stepping-stone into professional farming if that's what they want to do, Certainly, they should have the skills to have their own gardens at their own house for their rest of lives. Our roles are the teachers of the internship.

We don't give them any money. They are the volunteers. But we were very hopeful they will come a way with: for one, they will meet a bunch of other people who are doing the same thing, so there is usually quite a connection as a social networks, but also, they will have the skills necessarily for building a garden and maintain it in the future. They will know how to do that after the season with us. So, that's the goal.

XW: Are there any organizations and tools involved in the development of ICF? For example, funders or others?

Tony: So, we don't have any external funders. 2012 is the first year that we decided to see if we could also get some restaurants to sign up to our CSA. So, we work with one restaurant in 2012. And we went well. In the next year, we decided ok, let's do the same model the CSA that they pay us in the spring the farm for the whole season and they get percentage of our harvest. So, in the last year we got 13 restaurants. That was grown

every year. Vancouver was a city that lots of chefs want to serve local sustainable fresh food. And the story behind the food is important for them, too. So, we have a bit of social media present and we make sure we got the story out there and explain why we were doing this differently. Why a carrot that produced in the farms is different from a carrot from the supermarket. So, we've very supported by the chefs, mostly from the perspective of buying vegetables.

We do lots of educational stuffs, too. We give lots of talks. There are some organizations that connected to us is that realm. We talked a lot in the Faculty of Land and Food Systems at UBC, Kwantlen Farm School, and high schools and elementary schools. Usually, they find us to invite us to talk. So, they come to the farm and we give talks at the farm. Or we go to their schools.

The other thing is media. We have a good story and we were been featured in newspaper or TV. It helps to spread the world about our project. Through these organizations, we got advertising. People see our logo and get on our website and get in touch in emails with us and say, hey why don't you come to our house, and do this at my house. Same in the educational program, it is great for volunteers. You go to talk to second year applied biology class about sustainable food. Some students want to do that. It is great for us.

In terms of tools, we use a bunch of gardening tools, almost are hand tools. When we need to do a bigger project. We rent tools from a tool rental store, only for a day or two. Big tools like a Rototiller, just like mixed up the soil. These bigger tools we only use once or twice a year, so we rent them from the rental place. We don't have storage or inventory places. We take our vegetables right out of the garden and we take them directly to whom gonna eat them. We don't have an intermediary space.

In terms of digital tools, social media is a big one. We could jump our project forward through like if our website is better and if we have more expertise and more people that were able to help build soft wares. Those are different angles that could be explored. We haven't done that yet. But when you have a CSA, one thing people do is they offer weekly add-ons like cut flowers, eggs, or something that you would not get it every week, but it would be nice if you can order that online. Streamlining some of those processes.

We do most of our communications are through email, standard and basic. It is all about relationships based. The whole farm runs through me and I know everybody. It is all about keeping those relationships open and try to communicate as best as possible. It is not always easy because different people have different standards, have different priorities. Some people take more time than other people. It's part of the goal of the project, too. When we started, we were realizing that we were doing a food project. And soon, we realize that it is actually a community-building project. So, now we have this big network. One of our interns need to rent an apartment, we just put the word out. Some one needs an apartment, some one buys a car, ok, who is selling a car. It is almost like a family now, you know, everyone is connected. I am talking to sorts of people; there is a degree of trust and knowledge that are built. So, if someone needs a job, and ok, anyone knows a job? It may or may not be something that we post online, but just I am moving around different gardens, different homeowners, different people, all the CSA holders, and restaurants. I am connected to all these people, so in a restaurant, they are looking for a new waitresses, often someone in the Inner City Farms ended up working in the restaurants we grow food for. Or ones from the restaurant ends up farming with us, because they heard about our project through their work and they want to come and work in the garden. So, it is organic growth. A specific story is one of the women on our board directors; I met her just because where our team meets is a coffee shop where she works. She serves us coffee in the morning when we were together going to get the truck to work. We were friend of her because she was making us coffee in the morning. And then she started to volunteer at the farm. That is the first time of her farming and she started to really liking it. She connected us with the owner of the coffee shops. They ended up buying food from the farm as well. And she knows all the work about the coffee shop and they are still our customers. And now she is on the board of directors of the whole project. She has been around for a year now.

I write a lot of reference letters for people. There are a lot of people farming as their career, who started farming with me. They are applying a job for farming and I talked to the farmer. It becomes a community of urban farming in the City. That is the beauty of the project that people become friends. That's the power of food. And you work with somebody every week for a year. You get to know them pretty well. You see their good days and bad days. When you all work together to accomplish a goal, connections are built out.

XW: Can you tell the challenges and problems happened in this process? How were the problems solved?

Tony: There is a lot day to day challenges on the ground, such as water and pests and working on windy days. To solve those problems, just relying on experiences, asking questions. So, the farming problem is one of the problems. Another problem is generating enough income to let the farm survive. If we had way more money, it will be a lot easier to solve some of the problem on the ground. We really need a green house, oh, let's build one green house. But greenhouse is very expensive. And we cannot afford a truck. Of course, there are problems with people, just staffing problem, scheduling problems. It is just natural problems. We were not worried about them.

XW: How about the challenges and problems that were happened when you want to use people's land and space? Maybe you want to use theirs but they didn't want to?

Tony: We've never identified space and approach people and said "hey, we should build a farm in front of your house", and they said "yes". That never happened once. It has always been people contacted us, usually through our website. And they say "hey, your project looks cool, how does it work?" They we have a meeting and go there to see. Sometimes there is space that would not work at all. So, "while, we cannot really do in your house because you have a big tree in your yard, you have five dogs, it's not gonna work." Sometimes, there is beautiful space, and they said "we used to have kids and now they are old, and now we just have this big yard, nobody goes there." And we said "ok" and you see how much sun you get. So, it is always people coming to us. The meeting is also the time we get to know each other. So, we have to get along. For us, it is the investment to build the farm first of all. So, we want to make sure that the relationship is going to be good. They want to stay a long term.

XW: Are there any cases that at the beginning people want you to use their land, but then they changed their idea?

Tony: Yes, that's happened a few times. One story is that the guy is super into it. He owned the house and the front and back yards. That was a great farm we built there. His girl friend was a happy lady and she loved it. Then, he and his girl friend broke out. And he got a new girl friend. She didn't like it at all. So, we have to stop. He said "we don't want to do this anymore." And really, they have the final say. It is their house. And we

don't want to be anywhere the land provider is not happy. The other example is that, people were renting the house, and they said “oh, we talked to our landlord, and it is find”. But then they moved out. So, after a few years, a few this situations, we decided that we only do it for the houses where the homeowners are the persons living there. It just saves us the extra level of communication, the extra filter. We just had a couple of negative experiences to understood what is happening. It is a lot of work for us the build the place. So, we adapted.

XW: Are there any contracts or agreements made between you and the landowners?

Tony: So, initially no, we don't do anything like that. We just have a meeting, a tea or coffee and talk and walk in the yard together and discuss the vision and the possible and not possible from my side. And at the end, we know we like each other and we all likely to do it. And we decided we are going to do it. We have an information sheet that we give to the land providers. And it is just handshake agreements. There is no legal contract at this point. And there never has been. Basically, we say we don't want to take it over less than a year and for sure to give us three years. Ideally, you want to use it forever. Ideal scenario is that you are not looking at it as a short-term thing. Because for us, it takes time to build up the soil, to get to know the space. So, we need to go several years. Often we get people who have a short-term project they have in mind on the land. They are going to build a huge building but for a year they are not going to do anything. “So, do you want to farm here for a year?” But this is really not working for us, so we would not say yes to them. So, minimum three years. Ideally into perpetually. It is really handshake agreement. But, there is a new urban farm policy of City of Vancouver. It is a new policy implemented last year, like a trial policy. I think they require formal agreement now. So, we might have to go back and write formal contract. But I am not sure, we haven’t done that yet.

If you give us your yard, we give you a CSA with no cost. So, you don't get food from your house, you get the food from the whole network and you get a weekly full basket.

XW: What will you do if some plants in their yards were broken, say because of a dog?

Tony: Yes, we had that for a few times. We just try to ask them to be respectful to it. Sometimes, a few things get broken. It is to be expected that there will be certain

percentage of that through all the systems of the farms. If we were consistent with those problem, we will deal with it. But we haven't had too much of them.

XW: Any changes you made because of a problem that frequently happened?

Tony: Nothing in my mind now. But it was really important that not even start building a farm until you are confident on that. It is a good idea. And we try to really do that.

XW: Is there any case that you said no to people and then change to yes after they requested for more times?

Tony: Not really. It is luck we have enough options. We are able to take the best ones. If we were a bigger organization, we may need more spaces. But we haven't had an issue with that. Like I said, initially, we thought that finding spaces will be hardest thing. Not at all. It is super easy. I think it is a reflective of Vancouver. There a lot of people that are align with our values. Food grown in a way that they believe in something they already think about, value and wants.

XW: Any different thoughts you and the landowners hold on the usage of their land?

Tony: I am pretty clear that I need create the control of the space. They can give me advices, but for the most part of it they should understand that I am taking over the space. I am going to do the work, and you don't have to do anything. So, that is pretty clear. And there are always conversations. It is relationship management.

XW: I saw space is a big thing in ICF, any other stories around it?

Tony: You see there is much more density happened in Vancouver. So, one of the things are happening is that back yards are disappearing. That will affect us in a long term. Instead of single family dwelling, they are building condos or coach house in the back. So, space is becoming less and less available in our City.

XW: Are there any contracts or agreements made with some organizations?

Tony: When you talk about organization, so, the City of Vancouver is a pretty big organization that looms over everything we do. There are rules to follow. There is one rule to follow when we started. But there are not now. We were part of group consulted

by the City. They want urban farming to succeed in Vancouver. But they also want to keep it regulated.

XW: Are there any challenges and problems with the Volunteers?

Tony: So, it is almost all beginners. So, every year we start with nobody really knows about anything. So, that is a challenge. But I like to teach, that's fine. What is nice is that they end up at how I want to them to do it. And with Volunteers and staff, they have to work in other jobs to make their money and they want to go camping and they want to this and that. So, it is really only out of the goodness of their own heart that they come. So, we need to be able to provide experience for them that motivates them to come back. And we really try to do that and we value these people a lot. They are willing to give us time and energy that is a really big gift to our project. So, trading with them with respect and flexibility. We've been super lucky that we had really great people who really dedicated. They just connected to who they are. That's the ideal for us.

XW: Are there any challenges and problems with the restaurants?

Tony: I did some out reach initially to the restaurants. I looked for restaurants that obviously through the way they present themselves that they want to be local sustainable restaurants. Because they want that, ideally they are acting in that way. And we offer that. Vancouver is a city that has a lot of chefs and has a pretty vibrant culinary culture. So, that fits well with us. We offer vegetables and we can offer vegetables are fresher than anyone else, because we literally harvest and bring them to your kitchen sometimes under an hour. And chefs, people who really love cooking food, know the differences. They see food from a whole different angle that I admire a lot. I really like cooking and I really admire chefs. When I eat something delicious and I don't know how someone prepared that, pretty impressed. So, they love knowing the farmers directly. The community again, Vancouver is ready for that. It has embraced that. It is also interesting that it's a small community of the chefs too. They all work with each other. So, they spread the words. So, I asked "hey, who else I should talk to or ask to?". "Oh, you should talked to this guy." And we have pretty good reputation. They like I am in charge of the project and I go talk to them. We go have a beer and talk about what you want, you know, that's pretty good. And we are pretty lucky. Those chefs come back year after year.

XW: Do you need to sign any contracts or agreements with the chefs?

Tony: No, they come in for a season. We have food for a year. Once they come in, they committed. But we don't have to sign anything. I have an information sheet. Here is the deal. But it is all handshakes. I had invoice for them. I just send them invoices that they paid it.

One thing is that we kind of braking all the rules. We are not efficient. We are slow. We have beautiful product. And we have good relationships. Those are important. And that's is not languages for business. We can really scale up very easily. But we believe that that is what missing, you know small family based, community based, mutually benefit each other, and wanting to work hard for something you believe in.

XW: Are there any challenges and problems with the educational parts?

Tony: Most concrete educational thing we do is teaching people how to farm. It was nice to be in educational part that it motivates us keep going. But if people were gone tomorrow, the project has not to be stopped. It is not a component that is completely necessary. It is something that really valuable for us personally. And the educational engagement fits to the initial reason we starts the farm. We feel that we need to reinvent the food system and one that can sustain us in a long term. In order to do that, you need to get as many people on board as possible. So, the educational component is ready for that. It calls back to the initial energy why we start this.

XW: Any challenges that brought by the City?

Tony: They just implemented an urban farming business license, some regulation, some policy. Part of their motivations is that once the policy is written, it is much harder to say no one is allowed to do this. So, in the future, even it is not the same people in charge, there are established regulations and guidelines. It is on the books. It is a thing legitimated in our City. In doing that process, they are also impacting how we are doing it a little bit. For us, it has not really be a big deal. We'll see as we move forward.

We are non-profit now, but we were commercial business on residential land. So in the City, there is no category for this. But take a look at the policy, you will see it is pretty straightforward now. They really allow for what we are doing for existence. Initially, it was not allowed. Now, they changed. There are guys like us started to farm in the City, and

the City didn't know. It has already been several years before the City got involved. And the City wants to be the Greenest City in 2020. So, what we were doing right fit to their policy. But the actual nuts and butts of the rules have to be changed to allow what was already happening. The policy catches up what the community is doing. That is what is happening with urban farming. So, there were these urban farms and they were talking about how it was important to be green. If they start to shut down urban farms, there will be huge political problem for them. So, they have to act differently. How do we make this legitimate?

XW: How about the problems and challenges around tools?

Tony: Tools break, you need to buy new ones or rent from the rental places. But we are doing anything too advances. It is low-tech. We don't rely on many digital tools. Emails are pretty reliable. We use Facebook, Twitter and Instagram.

XW: Any agreements in the process?

Tony: Agreement with the land provider, the restaurants, the CSA share holders, and binding by the City rules, what to expect to the internship. Agreements to the volunteers. The standards are set, but it is pretty informal. Although it is in informality, but the expectations are clear.

XW: How you guarantee that?

Tony: When you came, it would be clear what you want and what we want. We do interviews with our all interns before we take them on. We explain what we need from them and they have to tell us if that works for them. If they can only be there for three weeks, we won't take them on. But if they say I can be there every week, I am interested in it, and ok, let's do it. It is all relationship based. There is no benefit for someone comes for three weeks and they leave. No reason for them to do that.

XW: Are there any resources that you are interested to get, but you have not?

Tony: The new thing is that I want to apply extra funding in grants. So, I have not got any of that yet. We applied for only one grant but we did not get it. Learning the structure of the funding is what we actually do to meet the requirements of funding body is looking for. But because we are a non-profit, that door is opening now. It would be great to have

a green house. If we have money, we can afford it. At the end it will make us more efficient, we can grow better food and more food. It is not anything that will hold us back, it is just opportunities for us to grow. If we got a green house, we can get the operation to a whole new level. As there are more additions that come, maybe the project get bigger and impactful and maybe we can hire another farmer. For me, everywhere this is loans and grass; I imagine it is gardens and farms in the whole city. How do we get to that point?

XW: For the greenhouse, what are the reasons that we cannot build one?

Tony: The lands to build it on and the cost. A real high tech green house will cost you million dollars. There are commercial green house that grow potatoes and peppers, we don't need anything like that. We just want stuff that starts our plants when it is too cold. But it is a little technical, it is good to have electricity. So, we know some thing will be good for us, and the history of this project that sooner or later that something is going come along that will work, we will figure it out. We are pretty creative.

XW: Among all the resources we talked, anything that you feel meet your needs but could be better?

Tony: We can have better hand tools. But it is easy to buy new ones when we want.

XW: Any related people or organizations that you feel could be better?

Tony: I don't have it really. You just want people to do their best. But there are no gaps. Not a concern for me.

XW: Another question, people exchange with their skills, so they got membership?

Tony: Yes, we have vegetables, That is what we can offer. It is always through the community that we get connected with people. For example, the woman built our website. She and her husband had a website company. She worked at another job. So, one of our people worked with her. She was exited about our project. And people who would love to contribute but don't have time to do extra farming or they were not interested. But they do something else that the farm needs. And they identified that "hey, do you guys need a website?" "Yes, we do." We don't have enough money to buy a website and we'd happy to give you a couple of years' membership for free. And we

don't have the expectations that if we were painful for it. Maybe it takes a little bit longer or it is less complicated than if we buying it, but we don't have the enough money to buy a fancy website. Would people care about something, they are willing to put their energy and expertise to it. And it is only about they find the project is interesting and care about it that they would get involved in the first place. One of friends, her brother in law is an accountant. That's how we met him, they just helped us and we trade to give him the vegetables. So, it is all social capital.

XW: In the website, I didn't see the newest updates.

Tony: That is the thing that she is now moved away. Maybe someone else could come along. Facebook also is quite now because of the leaving of that woman. But I got another volunteer want to take over the Facebook. So, I just need to meet her and discuss the strategy. But also we sell our vegetables every year. It has not held us back. But it would be better if we can have more staff, more than just me, That would help a lot. We can have people just run the social media as a part-time job, which would be awesome.

XW: Can you tell the changes occurred that are not covered in our above interview questions? What are the reasons cause that change?

Tony: The shift to a non-profit is an important change for us. Initially it was just me and my four friends were doing it. Overtime it is changed, now they've all stepped back a little bit, and I am more in charged. There is a bunch of other people that I have got involved. Just the personnel has shifted over time. Because it is all volunteer-based, we get people that are really good that last for years, but they go on and do something else. So, there is a constantly evolution of who is connected. We got one bigger farm a few years ago, and that changes a little bit of the nature of the project. We were able to grow more food but we were not able to sustain small farms. So, that changes some of how we operate. So much time are going to that space. It is swallowing our resources. It shifted the nature of the project and it is great and super cool. Part of we like is impacted that we like being in the neighborhoods with people, the diversity of our farms. It is hard to manage. But as I said, it is always evolving. We tend to let the momentum of the project lead the way. All we do is try to keep us on the rails. Initially we just started to make it rolling, now it is rolling, we just try to make sure it does not stop rolling. Also the new

urban farming policy at the City is important to keep in mind. They contact the urban farms that we are operating, and we acted as the consultant for the policy. They had questions like what they needed to look at and we were already the experts in the unban farm. We told them what we were doing. And then they tried to shift the policy in a way that is standardized but would not impact the operations to the point where we have to shut down.

XW: What are the aspects that need more support or improvement in this project based on your experience with it?

Tony: More people and more volunteers who are interested in growing food and have the energy and want to work with us are always good. Now, we have new needs too. We started for applying grants. We need people who have the expertise in grant writing that helps us.