

**Transdisciplinary social learning
and transdisciplinary capacity:
Responding to the challenge of transdisciplinary
knowledge integration in the public sector**

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Abstract

Transdisciplinarity is becoming increasingly popular as a research approach to solving wicked problems, such as the increasing datafication of society. However, the literature shows that integrating the knowledge developed by transdisciplinarity into the public sector remains a significant challenge. In this paper, I investigate how this challenge of integrating transdisciplinary knowledge into the public sector can be overcome in a process of social learning. To tackle this challenge, I develop a dynamic model of transdisciplinary social learning which details the social learning processes and outcomes which can lead to the integration of transdisciplinary knowledge. I conduct participatory action research to explore the value of this model in a case study of a transdisciplinary collaboration, the Datawerkplaats. In addition to exploring whether transdisciplinary social learning can help integrate transdisciplinary knowledge into the public sector, I explore the potential limitations to transdisciplinary social learning from the context of science and the context of the public sector. In addition to the limitations posed by the scientific context and a need for a transdisciplinary capacity of scientists, I find that the public sector context can limit the ability of transdisciplinary social learning to take place but that a transdisciplinary capacity of public sector organizations can help overcome these limitations.

The findings of this research contribute to both academic and practical knowledge about transdisciplinarity. This research makes contributions to theory about the challenge of transdisciplinary knowledge integration through its development of a model of transdisciplinary social learning, its focus on limitations from the public sector context of transdisciplinary knowledge integration, and its proposal that a transdisciplinary capacity of public sector organizations is necessary to engage in transdisciplinary work. Additional academic contributions stem from the innovative action research methodology used and the rich empirical data collected through this action research. This research also contributes to practical outcomes for the local government organizations that participate in the Datawerkplaats. These practical outcomes mean that the findings of this research can be relevant for local and regional government organizations that wish to engage in impactful transdisciplinary work.

Chapter 1: Introduction

This past year has seen the rise of increasingly difficult and complex societal problems: a global pandemic, the widespread effects of climate change, and a global migration crisis (OECD, 2020). These emergent problems of the past year add to the list of already complex societal challenges associated with globalization, such as demographic changes, resource stress, urbanization, and the rise of enabling technologies that contribute to the increasing datafication of society (Kitchin, 2014; Van der Wal, 2017). This research paper focuses on the complex challenge of the datafication of society. As a result of the “data revolution,” where digital technologies increasingly allow the world around us to be captured in the form of data, new ways of conducting business and governing society have emerged (Kitchin, 2014). Although both the public and private sector make use of this explosion of data (Kim, Trimi, & Chung, 2014), the focus of this paper is on its use in the public sector, as this datafication changes the way governments “research, prioritize, and manage public services” (Redden, 2018, p.3).

This datafication carries both benefits and risks for governments. On the one hand, it can improve the delivery of public services (Redden, 2018; Micheli, Craglia, & Suman, 2020). In addition to improved public services, the use of data in governance can improve quality of life for citizens through better engagement and empowerment (Kim & Chung, 2014; Micheli et al., 2020; Redden, 2018). However, the increased use of data in governance can also lead to risks in terms of transparency and accountability (Redden, 2018) and challenges related to privacy and security (Maciejewski, 2017; Redden, 2018). But what makes datafication a unique challenge for governments is the context of the public sector. While balancing the potential benefits and risks of data, governments must also contend with how these challenges interact with the particular characteristics of the public sector such as a bureaucratic decision-making process, the varied goals and accountability of the sector, and the qualities of public sector employees. Thus, the challenge of governing the datafied society and what that means for the public sector is a complex problem worthy of attention.

Difficult to solve and complex societal problems, such as datafication, are often referred to as wicked problems (Klijn & Koppenjan, 2016). Wicked problems are defined by both their complexity and the range of knowledge needed to solve them (Bannink & Trommel, 2019); thus, they require innovative and collaborative approaches to problem solving (Klijn & Koppenjan, 2016). One approach to solving such complex problems is transdisciplinarity. Transdisciplinarity

is an approach to research that takes complex societal questions as its starting point and engages in a collaborative process between scientists and practitioners to lead to outcomes that progress both science and society (Jahn, Bergmann, & Keil, 2012). Proponents of transdisciplinarity advocate it as a promising way to solve complex societal problems, especially wicked problems (Jahn et al., 2012).

Despite its promise, transdisciplinarity faces distinct challenges. One of the major challenges of transdisciplinarity is knowledge integration (Hoffmann, Pohl, & Hering, 2017). In models of transdisciplinary collaboration, the transdisciplinary process is often envisioned as three phases: problem transformation, problem analysis, and knowledge integration (Jahn et al., 2012; Klein, 2004; Mobjörk, 2010). Thus, the afore-mentioned challenge lies in this third phase, knowledge integration. What should occur in this third phase of knowledge integration involves taking the knowledge produced through transdisciplinary research and using it to contribute to solving a societal or practical problem as well as to contribute to scientific discourse (Bergmann et al., 2005; Lang et al., 2012; Hoffmann et al., 2017). However, how transdisciplinary knowledge should be used to solve a societal problem is not clear from the literature. Most definitions of transdisciplinarity emphasize some form of learning between science and society as one of its core principles (Jahn et al., 2012; Schaupenlehner-Kloyber & Penker, 2015; Scholz, 2020). This scholarship makes a loose association between learning and the integration of the developed knowledge into the realm of practice but does not specify how this should take place – how this learning should lead to knowledge integration (Jahn et al., 2012; Mobjörk, 2010; Scholz, 2020; Schmidt et al., 2020). *Thus, herein lies the challenge of transdisciplinary knowledge integration: this integration, whereby the knowledge produced by transdisciplinarity is embedded into the practice environment, does not happen automatically or easily, especially in the practice environment (Lang et al., 2012; Hoffmann et al., 2017).* Yet, there is a lack of empirical work that addresses how to improve this transdisciplinary knowledge integration process (Hoffmann et al., 2017).

My thesis addresses the challenge of integrating transdisciplinary knowledge into the public sector by taking a closer look at the learning that should occur to integrate this knowledge as well as both the scientific and practical contexts of that integration. To do this, I use the theoretical lens of social learning. I choose social learning as a theoretical lens for this research for two reasons. First, using social learning as a theoretical lens can provide a detailed look at the

learning processes that should take place in transdisciplinary knowledge integration. Second, this lens also helps focus on the outcomes of social learning, which emphasize the embedding of the learning outcomes in the wider socio-ecological environment (Reed et al., 2010; Wenger, 2000). This embedding is what is needed to have transdisciplinary knowledge be integrated into the practice realm; therefore, using a social learning lens helps specify the outcomes and focuses on how they can be retained and transferred to the practice environment.

In my thesis I investigate the question, *how can the challenge of integrating transdisciplinary knowledge into the public sector be overcome in a process of social learning?*

To answer this question, I first create a dynamic model of transdisciplinary social learning to detail the processes and outcomes that should occur during the knowledge integration stage of transdisciplinarity. In this model I explore aspects of the scientific and public sector context that might limit this transdisciplinary social learning from taking place. The existing theoretical work on transdisciplinarity cites several potential limitations to transdisciplinary work. These limitations mostly relate to tensions around the power relations, objectives, and outcomes between science and practice (Gray, 2008; Jahn et al., 2012; Klein, 2004; Hanssen & Polk, 2018; Pohl et al, 2017; Schmidt et al., 2020), and transdisciplinary scholars advocate a “transdisciplinary capacity” that scientists need to engage in this type of work (Klein, 2004). This means that most of the academic work focuses on limitations that originate from its own field. However, it would make sense that to integrate knowledge into the realm of practice, it would be helpful to focus on the context of that practice environment, especially a practice environment like the public sector which has a distinct set of characteristics that may increase the difficulty of integrating transdisciplinary knowledge, such as bureaucratic decision-making, mixed accountability and goals, and the qualities of public sector employees. I propose that there is a need for a transdisciplinary capacity in these public sector organizations to overcome these contextual limitations to transdisciplinary social learning.

I explore the value of my model of transdisciplinary social learning by applying it to an empirical case study using the methodology of participatory action research. The case, the Datawerkplaats, is a transdisciplinary research collaboration centered on helping local and regional governments in the Netherlands deal with the increasing datafication and digitalization of society. The transdisciplinary knowledge that was created as a result of this collaboration are concrete instruments for the participating government organizations to use in building the capacities of their

organizations to operate in a datafied society. In earlier research that I conducted as a research assistant for the Datawerkplaats, I found that, although the collaboration developed innovative instruments that were supported by knowledge from science and practice, it remained a challenge to implement the instruments produced by the collaboration into the participating organizations. Therefore, the practical challenge of implementing the instruments of the Datawerkplaats provides an example of the theoretical challenge of integrating transdisciplinary knowledge into the public sector. In my thesis research, I follow up on my previous research to tackle the challenge of integrating the transdisciplinary knowledge of the Datawerkplaats into these local and regional government organizations. To do this, I conduct participatory action research to apply my new model of transdisciplinary social learning model to this case. What I find is that transdisciplinary social learning *can* help achieve the integration of transdisciplinary knowledge into the public sector. However, this integration of transdisciplinary knowledge remains difficult to achieve because of the specific limitations of the public sector context. Therefore, I find that a transdisciplinary capacity of public sector organizations is necessary to achieve long-term transdisciplinary social learning.

The scientific merits of this research include its contributions to theory about transdisciplinarity, its innovative methodology, and its rich and in-depth empirical findings. This research contributes to theoretical knowledge about the challenge of transdisciplinary knowledge integration in three ways. The first is by developing a model of transdisciplinary social learning. The development of this model contributes to the theoretical debate about transdisciplinarity by detailing the processes and outcomes that should occur during knowledge integration. Second, this model enriches the literature on transdisciplinarity by including potentially limiting factors stemming from the context of the public sector, whereas existing work academic emphasizes limiting factors from the side of science. The third theoretical contribution is my proposal of a transdisciplinary capacity of public sector organizations to overcome these limitations of the public sector context, which is an addition to the existing literature which emphasizes the need for a transdisciplinary capacity of scientists. A second scientific merit of this research is its innovative methodological approach. The choice to conduct participatory action research means that, as a researcher, I was involved in a process of learning and change within these local government organizations, as I conducted a series of interventions in close collaboration with practitioners. The action research cycles were also designed to be iterative, in which the phases of data collection

and analysis overlapped, leading to a close connection between the empirical data and theory development. However, to collect this rich data in co-collaboration with practitioners, action research puts the researcher directly in the context of the research, which I found can be a time-intensive approach. The third scientific contribution of this research is precisely the rich and in-depth findings gained by conducting four action research interventions in the six participating organizations of the Datawerkplaats. This fills a gap in the academic literature which cites a lack of empirical insights into overcoming the challenge of transdisciplinary knowledge integration in the public sector (Hoffmann et al., 2017).

Finally, this research contributes to practical outcomes for the participating local and regional government organizations of the Datawerkplaats. It achieves its practical goal of helping these government organizations implement the Datawerkplaats tools in their organizations. It reaches additional goals of contributing to the learning processes of employees around topics of datafication and digitalization as well as facilitating horizontal learning between these organizations by connecting the network of organizations to each other. These sub-goals contribute to the larger goal of building the capacity of these organizations to work and provide services in a datafied society. Realizing these outcomes for the involved organizations shows that the research I conducted has a practical impact. Additionally, my findings may be relevant for other local and regional government organizations who want to learn about integrating transdisciplinary knowledge into their own organizations.

This paper proceeds as follows. Chapter 2 sketches the theoretical background of transdisciplinarity as well as the challenge of transdisciplinary knowledge integration. This leads to the creation of a dynamic model of the integration phase of transdisciplinarity which I call transdisciplinary social learning. Chapter 3 explains how the design and corresponding methodology and analysis undertaken by this research provides a rich empirical illustration of this model and improves our understanding of transdisciplinary social learning. Chapter 4 operationalizes the research question and provides anecdotes and examples from my empirical work as I follow the model of transdisciplinary social learning. Chapter 5 discusses the main findings and limitations of this research, while Chapter 6 concludes the paper.

Chapter 2: Theoretical framework for transdisciplinary social learning in the public sector

In this chapter I present the theoretical background of transdisciplinarity, the challenge of transdisciplinary knowledge integration, and my theoretical approach to this challenge. I begin with an overview of what transdisciplinarity is in order to provide a basis for understanding the challenge of integrating transdisciplinarity knowledge into the public sector. As a response to this challenge, I present my approach using the theoretical lens of social learning, combining work on individual, organizational, inter-organizational, and social learning to arrive at a definition of social learning processes and outcomes. I use this definition to create a dynamic model of the knowledge integration phase of transdisciplinarity and call this model transdisciplinary social learning. This model of transdisciplinary social learning details both the social learning processes and social learning outcomes that should occur in order to overcome the challenge of transdisciplinary knowledge integration and allow this knowledge to become successfully embedded in the public sector. In this model I also describe the limiting factors from the context of science and the context of the public sector that may act as barriers to this transdisciplinary social learning. I propose that to overcome these barriers, there is a need for a transdisciplinary capacity of both scientists and public sector organizations.

2.1 Knowledge integration as a phase of transdisciplinary research

In this section I provide an overview of what transdisciplinarity is. I present its defining characteristics as well as describe the phases of the transdisciplinary process. The overview of its characteristics provides a basis for understanding transdisciplinary work, while the description of the phases of transdisciplinarity provides the location for the main research puzzle of this paper, the challenge of transdisciplinary knowledge integration, in the third phase of transdisciplinarity. This helps to situate the research question explored in this paper within the larger topic of transdisciplinarity and provides a basis for the later creation of a dynamic model of this phase.

2.1.1 Defining characteristics of transdisciplinarity

Here I give an overview of what transdisciplinarity is and explain its defining features. The concept of transdisciplinarity used in this paper is based on Jahn et al.'s (2012) definition: "Transdisciplinarity is a reflexive research approach that addresses societal problems by means of interdisciplinary collaboration as well as the collaboration between researchers and extra-scientific actors; its aim is to enable mutual learning processes between science and society; integration is the main cognitive challenge of the research process" (p.4). Therefore, the first defining feature

of transdisciplinarity is that it is an approach to knowledge production, and specifically, to producing knowledge through research (Jahn et al., 2012; Klein, 2004; Mobjörk, 2010; Schmidt et al., 2020). The second defining feature of transdisciplinarity is that it solves complex, multidimensional, and uncertain problems (Jahn et al., 2012; Klein, 2004; Mobjörk, 2010; Schmidt et al., 2020). In fact, it is often advocated as a research approach because of its ability to transform what may be seen as separate problems from science or society into a common concept (Jahn et al., 2012; Klein, 2004). The third defining characteristic of transdisciplinarity is the collaboration between science and practice (Jahn et al., 2012; Mobjörk, 2010). Transdisciplinarity differs from multidisciplinary or interdisciplinary because it focuses explicitly on collaborating with partners from outside academia (Mobjörk, 2010). This paper focuses on participatory transdisciplinarity, whereby societal or non-academic actors participate equally with scientific actors in the knowledge production process, rather than consulting transdisciplinarity that limits societal actors to a more reactive role (Mobjörk, 2010). The fourth defining characteristic of transdisciplinarity is its reflexivity. Transdisciplinarity is not a prescribed set of theories or methods but relies on reflexivity to fit itself to the context of the problem and actors involved (Jahn et al. 2012; Mobjörk, 2010; Schmidt et al., 2020). Finally, the fifth defining characteristic of transdisciplinarity is its goal to produce new knowledge that progresses both science and society (Jahn et al., 2012). This production of knowledge involves mutual learning between science and society. These five defining characteristics of transdisciplinarity are summarized below in Table 1. These defining characteristics are used later in this paper to categorize the empirical research as transdisciplinary.

Table 1

Defining Transdisciplinarity

Defining characteristics of transdisciplinarity

- An approach to research
- Collaboration between science and practice
- Reflexive
- Solves complex problems
- Produces knowledge to progress both science and society

2.1.2 Positing knowledge integration in the phases of transdisciplinary research

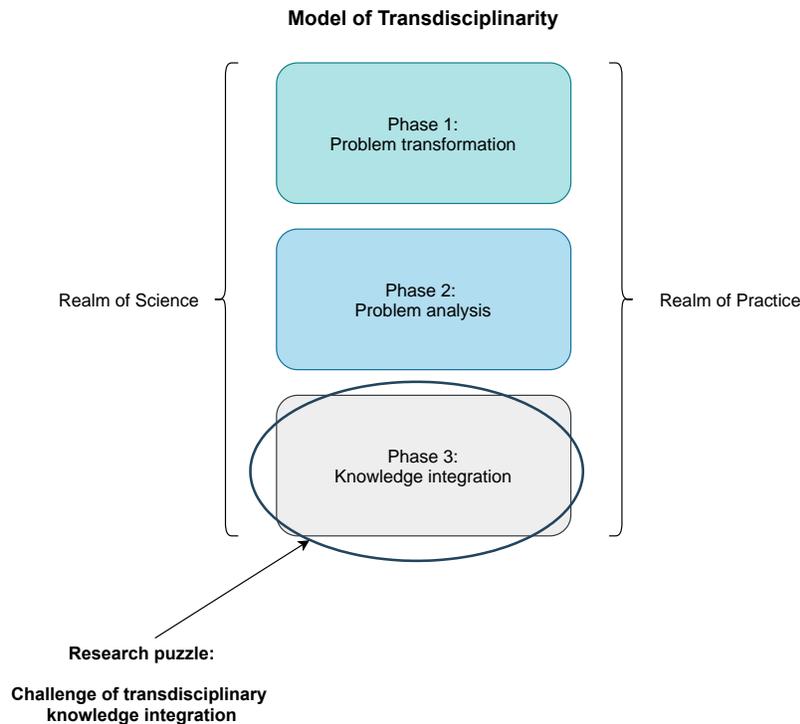
The research puzzle explored in this paper is about the challenge of transdisciplinary knowledge integration. This section explains the phases in the transdisciplinary research process

to situate that research challenge in the third phase of the transdisciplinary process. Transdisciplinarity is often conceptualized as a process that leads to the production of knowledge which, through integration into the realms of practice and science, can eventually lead to societal impact and the solution of wicked problems (Jahn et al., 2012). Jahn et al. (2012) visualize the transdisciplinary research process as a model of problem transformation, production of new knowledge, and knowledge integration, whereby the knowledge is evaluated for its contribution to science and society. Mobjörk (2010) distinguishes these phases as problem identification, problem analysis, and implementation. In Pohl et al.'s (2017) model, these phases are categorized as framing the problem, analyzing the problem, and exploring the impact. What differs in Pohl's model is the flexibility between the stages as well as the positioning of transdisciplinarity as a middle ground between the "realm of science" and the "realm of practice" (Pohl et al., 2017, p.44). Combining these models, this paper describes the transdisciplinary process as three phases: problem transformation, problem analysis, and knowledge integration that take place between the realm of science and practice. Although different scholars have different names for these phases, the actions that take place within each phase are similar and will be further described below.

The first phase, problem transformation, identifies problems from different disciplines or with different underlying values and transforms them into a common problem (Jahn et al., 2012; Klein, 2004). The second phase, problem analysis, is where the first analysis and work towards producing new knowledge in relation to the identified problem takes place (Jahn et al, 2012; Mobjörk, 2010). Finally, the third phase, the knowledge integration phase, evaluates and combines the knowledge produced in the problem analysis phase (Jahn et al, 2012). The knowledge integration phase produces new knowledge by reflecting on and evaluating the outcomes of the problem analysis phase. This process of reflection and evaluation leads to integrated knowledge in the form of outputs, such as usable products, or outcomes, such as enhanced capacity or network effects, and finally leads to societal impact, which is transformational change (Hansson & Polk, 2018; Jahn et al., 2012). Therefore, this integration of knowledge is what should eventually lead to progress for science and society. The research puzzle explored in this paper occurs in this third phase, the integration of transdisciplinary knowledge in the realm of practice. Because of the timeframe of this master's thesis research, the empirical research described in this paper explores integrated knowledge outcomes, but does not explore the following step, societal impact.

Figure 1

Phases of transdisciplinarity



Note. This model is based on models by Jahn et al. (2012), Mobjörk (2010), and Pohl et al. (2017)

2.1.3. The challenge of knowledge integration in transdisciplinarity

The challenge explored in this research, knowledge integration, occurs in the third phase of the transdisciplinary process. This knowledge integration phase of transdisciplinarity as described in the literature should be where the developed knowledge is evaluated and integrated in order to become embedded into the realm of practice (Jahn et al, 2012; Mobjörk, 2010; Pohl et al., 2017). It is this integration that allows the knowledge to be used to solve societal problems. In this section I describe the challenge of knowledge integration and why additional theory and empirical work is needed to overcome this challenge.

The knowledge integration phase is where the knowledge produced through transdisciplinary research is evaluated to produce impact (Jahn et al., 2012). It is during this phase that the knowledge produced should be applied to societal practice (Lang et al, 2012; Schuppenlehner-Kloyber & Penker, 2015). However, the literature on transdisciplinarity shows that knowledge integration is often challenging to achieve (Bergmann et al., 2005; Hoffmann et al., 2017; Lang et al., 2012). Most descriptions of this integration mention a link to learning;

however, the exact learning processes that should occur and how they contribute to outcomes such as integration and impact is missing from the literature. Jahn et al. (2012) write that the aim of transdisciplinarity is “to enable mutual learning processes between science and society” (p.4). However, rather than elaborating this concept further, they describe it as part of the process of integrating knowledge (Jahn et al., 2012). Additionally, Scholz (2020) writes that “mutual learning by science and practice is a basic principle of transdisciplinarity” (p.1039) but also fails to elaborate on the process of mutual learning itself. According to Schaupenlehner-Kloyber & Penker (2015), in the existing work on transdisciplinarity, “there has been little reflection on the ‘how to’ and the needs occurring on individual and group level in learning processes” (p. 58). Lang et al. (2012) reach a similar conclusion, stating that “the literature is rather fragmented and dispersed, without providing good guidance to interested researchers and practitioners” (p.26). Thus, in examining the challenge of transdisciplinary knowledge integration, there is broad consensus that a form of learning should take place and that this learning is part of the process of integrating knowledge into the realm of practice, but there is little detail on *how* this learning should take place to achieve this goal. In the few works that do specify a type of learning, a link is made between transdisciplinarity and social learning (Schaupenlehner-Kloyber & Penker, 2015; Schmidt et al., 2020; Slater & Robinson, 2020). However, social learning is then envisioned as separate from transdisciplinarity; in this model, social learning is an additional process outside of transdisciplinarity that amplifies transdisciplinary results (Slater & Robinson, 2020). Placing social learning outside of the transdisciplinary process does not help to fill in the blanks about what should occur during transdisciplinarity in order to embed the outcomes in practice.

Thus, what is clear from the existing work on transdisciplinarity is, first, that the integration of transdisciplinary knowledge is difficult to achieve, second, that “proponents [of transdisciplinarity] seem loath to engage with its contradictions” (Russell, Wickson, & Carew, 2008, p.470), and third, that there is therefore a lack of empirical work detailing how to overcome this challenge (Hoffmann et al., 2017).

2.2. A theoretical lens to overcome the challenge of transdisciplinary knowledge integration: Social learning

To approach the challenge of knowledge integration in transdisciplinarity I use the theoretical lens of social learning. I choose social learning as a theoretical lens for two reasons. The first reason is because social learning is an interactive process of learning between individuals

and groups. This focus on the process can help fill the gap in explanation for what should occur between the scientific and societal participants to transdisciplinarity. The second reason that I choose social learning as a theoretical lens is because social learning focuses on the integration of learning outcomes in the wider socio-ecological environment. This matches well with the challenge of knowledge integration and the need for the developed knowledge to land in the realm of practice.

In this section I develop a definition of social learning based on theories of individual, organizational, inter-organizational, and social learning to fit the context of transdisciplinarity. Later in this chapter, this definition will be used to develop a detailed model of the processes and outcomes of the knowledge integration phase of transdisciplinarity.

2.2.1 Arriving at an integrated definition of social learning

Here I develop an integrated definition of social learning based on literature on organizational, inter-organizational, and social learning in order to fit this definition to the specific context of transdisciplinarity. These above-named theoretical approaches to learning are relevant to transdisciplinarity for several reasons. When we are looking at learning with regard to transdisciplinarity, it is about both individual and collective learning. Transdisciplinarity does involve learning at the individual level, but because of its emphasis on societal impact, there must also be an element of learning for a larger group than the individuals directly involved in the research. The non-academic participants to transdisciplinarity are often embedded in organizations, such as public organizations or private companies. These organizations often participate and act in networks of similar organizations. Therefore, theories of organizational and interorganizational learning are relevant to the learning taking place in transdisciplinarity. Further, these individuals and their organizations are embedded within larger environments, made up of different communities and groups; thus, theories of social learning that encompass these socio-ecological systems are also relevant. In fact, since transdisciplinarity strives to have a societal impact and to progress both science and society, social learning is an important concept precisely because it situates learning in the larger socio-ecological system where these impacts can take place. This section interweaves concepts from organizational, interorganizational, and social learning to create a definition of the social learning processes and outcomes that will be used to create a new model of transdisciplinary knowledge integration.

2.2.1.1 Social learning as a process

Learning can be both a product, as in knowledge or information, or it can be a process, through the creation, retention, and transfer of that knowledge (Argote & Miron-Spektor, 2011; Argyris & Schön, 1996). This section describes the three elements of the social learning process, which are knowledge creation, retention, and transfer. Knowledge can be said to be created when a unit or entity “generates knowledge that is new to it” (Argote & Miron-Spektor, 2011, p.1128). This new knowledge can consist of either facts or procedures (Argote & Miron-Spektor, 2011), also referred to as information or know-how (Kale et al, 2000). This new knowledge can be retained – that is, it can be reused – or it can be forgotten (Argote & Miron-Spektor, 2011). This knowledge can also be transferred from one unit to another when one group or unit is “affected by the experience of another” (Argote et al. 2000, p.3). Thus, when individuals participate in a process of social learning, they engage in the creation, retention, and transfer of knowledge.

This knowledge creation, transfer, and retention occurs through social interactions between individuals (Reed et al., 2010; Slater & Robinson, 2020). However, the act of participation in a collaboration is not necessarily enough to constitute social learning (Schmidt et al., 2020; Slater & Robinson, 2020). To become social learning, the participation requires “close and intense interaction” (Kale et al., 2000, p.221). These close and intense interactions are necessary to transfer tacit knowledge between participants, which is an essential yet hard to articulate type of knowledge. Jointly developed knowledge usually contains an element of tacit knowledge of the participants, thus “social interactions between individual members of the collaborating organizations are necessary to allow an exchange of the tacit component of knowledge.” Spaapen & Van Drooge (2011) characterize interactions that contribute to social impact as “productive interactions” (p.213) that produce scientifically and socially relevant knowledge through a combination of direct encounters, indirect reports and writings, and financial arrangements. These productive social interactions are exactly the type of boundary spanning activities that Janowicz-Panjaitan & Noorderhaven (2008) describe as essential to transferring both explicit and tacit knowledge. In fact, this exchange of knowledge occurs when participants “observe and emulate each other in the process of being involved in a shared task” (Janowicz-Panjaitan & Noorderhaven, 2008, p.1340). These shared tasks can be organized as a combination of meetings, joints projects, reciprocal visits, and joint training activities (Janowicz-Panjaitan & Noorderhaven, 2008). Other productive social interactions that foster social learning include a combination of educational sessions with a broad

outreach as well as training courses with a small number of participants (Schmidt et al., 2020). The use of workshops, focus groups, and team sparring sessions are also seen as powerful techniques for social learning (Lüscher & Lewis, 2008; Schmidt et al., 2020). Thus, social learning processes take place through productive social interactions where knowledge is created, transferred, and retained. This process of social learning can take place at the individual level or at the group or organizational level. These learning processes can also occur between organizations, referred to as interorganizational learning (Janowicz-Panjaitan & Noorderhaven, 2008). In conclusion, social learning processes are *productive social interactions that create, transfer, and retain knowledge between individuals, organizations, and societal groups*.

2.2.1.2 Social learning as a product: Short-term and long-term outcomes

This section describes social learning products, looking at what is created, transferred, and retained as a result of the productive social interactions that occur in the social learning process. Reed et al. (2010) specify two conditions for learning outcomes to be considered social learning: first, that a change in understanding takes place in the individuals involved in the learning process, and, second, that the outcomes must go beyond the individuals involved.

I use Reed's (2010) conditions for social learning to create two categories of social learning outcomes: individual, short-term outcomes of social learning and group-level, longer-term outcomes of social learning. I categorize the first condition of social learning, a change in understanding that takes place in individuals, as equivalent to short-term social learning outcomes in the form of new knowledge, new relations, and new actions (Slater & Robinson, 2020). New knowledge, as defined in the previous section, is anything that is new to an individual or a group (Argote & Miron-Spektor, 2011). New relations involve the sharing of experiences between individuals to lead to the creation of new roles or identities between the involved actors (Slater & Robinson, 2020). New actions are new tasks or new approaches undertaken by individuals or participants to transdisciplinarity (Argote & Ingram, 2000; Slater & Robinson, 2020). Therefore, the short-term outcomes of social learning are the new knowledge, actions, and relations that take place between the individuals involved in transdisciplinary research, and these outcomes fulfill the first condition of social learning.

I categorize the second condition of social learning, outcomes that go beyond the individuals involved, as longer-term outcomes that occur beyond the individuals directly involved in transdisciplinary research, thus these outcomes occur at the group level. These outcomes are a

change in cognition, practices, or performance of the group, organization, or group of organizations. These long-term social learning outcomes will be further described below.

A change in cognition can be said to occur when a change in knowledge occurs. To look at this at the group level, it is helpful to look to theories of organizational learning. Organizational learning is conceptualized as “a change in the organization’s knowledge that occurs as a function of experience” (Argote & Miron-Spektor, 2011, p.1124). Argyris & Schön (1996) theorize organizational learning as the interaction of an individual’s theories-in-use, which are systems of belief that underlie individual actions, with the organizational theory-in-use that is embedded in the images and artifacts of the organizational environment. Thus, an organization’s knowledge is based on interaction with the knowledge and experiences of a widespread group of individuals within the organization. In the same way that a change in knowledge in an individual could be classified as a change in cognition, a change in the organizational knowledge can be classified as a change in cognition at the organizational level. Therefore, when a change in cognition occurs in individuals in the organization outside the participants to the transdisciplinary research, it could be said that a change in cognition of the group or organization has occurred.

A change in practices occurs when new tasks or actions are repeated as new routines (Argote & Miron-Spektor, 2011). When the new actions that comprised social learning outcomes at the individual level become part of these repeated tasks and routines in a group or organization, then it can be said that this change in practices takes place at the group-level. According to Argote & Miron-Spektor (2011), routines are repeated tasks that serve as repositories as well as transfer mechanisms for new knowledge. Therefore, when the organizational activities or procedures change on a repeated basis, resulting in new routines, this allows the new knowledge to be diffused and embedded within the organization, fulfilling the requirement of social learning to spread beyond the individuals involved and to become part of the larger social system (Reed et al., 2010). The change in performance of a group or organization is not discussed as part of this paper because organizational performance is a long-term outcome that is not able to be observed within the timeframe of this research.

Thus, social learning that, first, leads to a change in understanding in the individuals involved, and, second, goes beyond those individuals can be defined as *short-term social learning outcomes in the form of new knowledge, new relations, and new actions of individuals that can lead to long-term social learning outcomes in the form of changes in cognition, practices, and*

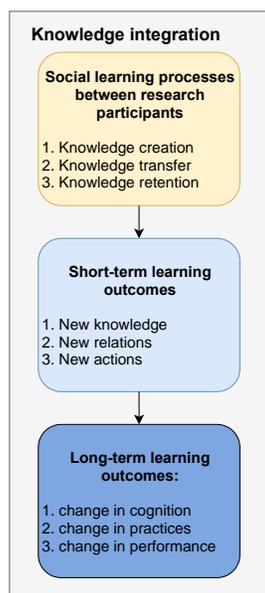
performance of those individuals, groups, their organizations, and other elements of the larger socio-ecological system. These long-term social learning outcomes, because of their repeated occurrence at group level, provide evidence of the integration of transdisciplinary knowledge in the practice environment.

In summary, I define social learning processes as *processes that create, retain, and transfer knowledge through productive social interactions between individuals, groups, organizations, and societal systems.* I define social learning outcomes as *new knowledge, new actions, and new relationships that cause changes in the cognition, practices, or performance of individuals, groups, organizations, and social systems.* I use this definition in my model of transdisciplinary social learning to detail the processes and outcomes that should occur during the knowledge integration phase of transdisciplinarity, as seen below in Figure 2. I will explain the full model later in this chapter, but, first, I will discuss potentially limiting factors to these transdisciplinary social learning processes and outcomes.

Figure 2

The knowledge integration phase of transdisciplinarity

Model of Transdisciplinary Social Learning

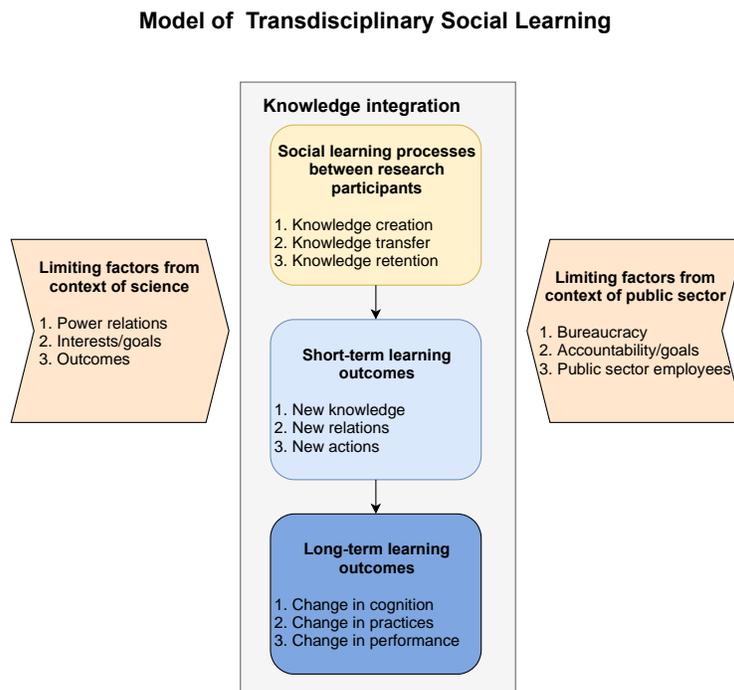


2.3 Limiting factors to transdisciplinary social learning

The above section of the model outlines the processes and outcomes that should occur during transdisciplinary knowledge integration, but it is not complete. It does not include contextual factors that might limit these processes and outcomes from taking place. There is limited academic work that addresses the challenges of transdisciplinarity, but the academic work that does acknowledge the difficulties of working in a transdisciplinary way tend to focus on limiting factors from the context of science. These limiting factors could potentially hinder the learning processes in the above model of transdisciplinary social learning. In this section I give an overview of these potentially limiting factors but also explain why focusing only on factors from the scientific context provides an incomplete view of this challenge. I find that in a challenge focused on embedding outcomes in the practice environment, factors from that practice context could be reasonably expected to play a role in that challenge. The realm of practice focused on in this paper is the public sector, so I will highlight potentially limiting factors from the context of the public sector.

Figure 3

Limiting factors to transdisciplinary social learning



2.3.1 Limiting factors from the context of science

Academics that do acknowledge the difficulties involved in conducting transdisciplinary research mainly focus on limiting factors resulting from the tensions between science and practice and why this poses a challenge for the inadequate skills of scientific researchers. These limiting factors include a tension between the traditional role of the scientist as an expert versus the equal collaboration of science and practice required by transdisciplinarity (Schmidt et al., 2020; Russell et al., 2008), a tension between the interests and objectives of transdisciplinary researchers and practitioners (Jahn et al., 2012; Klein, 2004; Schmidt et al., 2020), and a tension between relevant outcomes for science and practice (Hanssen & Polk, 2018; Pohl et al., 2017). These tensions could potentially hinder social learning processes and outcomes, thus these three limiting factors will be further described below.

The first potentially limiting factor to transdisciplinary social learning is the power imbalance between researchers and practitioners. In traditional research relationships, the scientist is seen as the ultimate “knowledge producer” (Schmidt et al., 2020, p.8), and scientific knowledge can be considered more valuable or privileged (Russell et al., 2008) because of strong societal conceptions about what scientific knowledge is (Bulten et al., 2021). However, in transdisciplinarity, where the knowledge of practitioners is equal to the knowledge of scientists, a tension exists between this traditional role of the scientist as expert versus the new equality required by the co-collaboration of transdisciplinarity. Jahn et al. (2012) go so far as to say that mutual learning is “retarded by power asymmetries between the participating actors” (p.3), thereby stressing the importance of the power relations involved in transdisciplinary collaborations (Jahn et al., 2012; Mobjörk, 2010).

The second potentially limiting factor to transdisciplinary social learning stems from the differences in interests and therefore objectives of the scientific and practical participants to transdisciplinary research (Jahn et al., 2012; Klein, 2004). These differences can mean a lack of a common problem focus (Gray, 2008). If unresolved, these differences can lead to differing intentions and expectations of the involved participants, which can ultimately limit the impact of the knowledge produced by the collaboration (Schmidt et al., 2020). Within this challenge stemming from the differences in interests and goals of the parties, the role of communication and the establishment of a mutual language can also be an obstacle to overcome (Klein, 2004; Janowics-Panjaitan & Noorderhaven, 2008). This tension means that the learning that should occur

can be hampered by conflicts between individuals and their ways of working, interests, values, and goals.

A third potentially limiting factor to transdisciplinary social learning relates to its outcomes. There is an inherent tension between creating outcomes that are valuable for society and practitioners and creating outcomes that are valuable for science and researchers. Science often values answers to the question “Is it true?” and looks for evidence to support that answer (Pohl et al, 2017, p.45), whereas practice asks the question “Does it work?” (Pohl et al., 2017, p.45) and looks for practical solutions to problems (Schaupenlehner-Kloyber & Penker, 2015). Academic institutions and societal partners have different expectations about what is an acceptable scientific output versus a “readily applicable” societal output (Bulten et al., 2021, p.11). Therefore, how practice evaluates the outcomes can be very different from how academia evaluates these outcomes (Hanssen & Polk, 2018). Additionally, difficulties can arise in the ownership of the outcomes (Russell et al., 2008).

2.3.2 Overcoming these limitations by a transdisciplinarity capacity of scientists

Prominent scholars in the field assert that conducting real transdisciplinary research requires a “transdisciplinary capacity” (Klein, 2004, p.521), which is a sensitivity to and an ability to work in a way to achieve true integration in its results. The existing work in this field stresses that transdisciplinarity struggles to overcome the above-named tensions related to its power differences, its diverse goals, and its valuation of outcomes because those leading it, often scientists, may lack this capacity and therefore the skills to be able to do so (Gray, 2008). Researchers are often portrayed as lacking the skills and know-how to conduct transdisciplinary research (Bulten et al., 2021; Schaupenlehner-Kloyber & Penker, 2015). Gray (2008) describes the process skills required for transdisciplinarity as decision-making, problem solving, conflict resolution, information exchange, coordination, and boundary management. Schaupenlehner-Kloyber & Penker (2015) describe the need for scientists to be able to alternate between such diverse roles as reflective scientists, intermediaries, and facilitators, while Hoffman et al. (2017) describe the role of the transdisciplinary researcher as a collaborator, facilitator, scholar, and advocate. The argument is that, because of this lack of transdisciplinary capacity in researchers, the tensions between science and practice prevent transdisciplinarity from achieving societal impact.

Thus, the existing work on the difficulties of conducting transdisciplinary research and the challenge of integrating this developed knowledge places the blame squarely at the feet of scientists and researchers. It is argued that if researchers possessed the transdisciplinarity capacity to balance the inherent tensions of transdisciplinary research, the outcomes would lead to more impact in the realm of practice. However, although these factors may play a role, it seems illogical to place the blame fully on the side of science when the knowledge needs to land in the realm of practice. Therefore, the next section of this paper investigates how contextual factors from the realm of practice might also limit the processes and outcomes of transdisciplinary social learning.

2.3.3 Limiting factors from the context of practice – the public sector

This section focuses on potentially limiting factors to transdisciplinary social learning that are related to its practical context. Transdisciplinarity is advocated as a way to solve complex societal problems, and the actors involved in these complex problems and their solution are often part of the public sector. Therefore, this section explores the context of the public sector as the realm of practice where transdisciplinary knowledge needs to be integrated in order to lead to societal impact. This section examines aspects of this public sector context that may limit transdisciplinary social learning processes and outcomes from taking place.

Although there is much debate in the field of public administration about the real versus perceived differences between the public and private sector (Boyne, 2002), there are several characteristics that are agreed upon as belonging to the public sector, and these characteristics may potentially limit transdisciplinary social learning. One of these characteristics is bureaucracy. Bureaucracy is one of the defining characteristics of organizations in the public sector (Boyne, 2002; Wilson, 1989), as public organizations often follow a strict system of rules and procedures (Parker & Bradley, 2000). These formal procedures often make public organizations less flexible (Bozeman & Kingsley, 1998), as decisions often have to travel through the hierarchy of an organization to be approved (Boyne, 2002).

A second characteristic of public sector organizations is their mixed accountability and goal structures. Public organizations are subject to public scrutiny and public expectations (Rainey, Backoff, & Levine, 1976). Public sector organizations are also subject to a wider range of goals and performance measures, including openness and fairness, that private sector organizations may not be subject to (Rainey et al., 1976). This diverse range of goals can lead to goal conflict and complicates the operations of public organizations (Rainey et al., 1976). This increased

accountability and ambiguity of goals can lead to a culture of risk aversion in the public sector (Boyne, 2002; Bozeman & Kingsley, 1998). The fear of being held responsible for decisions or actions in the political arena can also contribute to a culture of risk aversion in the public sector (Boyne, 2002; Rainey et al., 1976).

A third characteristic of the public sector relates to the specific qualities of the employees in this sector. On the one hand, public sector employees may be less materialistic than private sector employees because they are motivated by a desire to serve the public (Boyne, 2002). This is called public service motivation (Perry, 1996). However, despite this motivation and devotion to serve the public, these employees may be less attached to the specific public organization (Boyne, 2002). This lower level of organizational commitment can result in higher employee turnover.

These well-documented characteristics of the public sector, namely bureaucratic decision-making, mixed accountability and goals, and qualities of public sector employees may also limit the ability of transdisciplinary social learning to occur. Therefore, it is important to consider these pressures from the context of the public sector in addition to factors from the scientific context.

2.3.4 Overcoming these limitations by a transdisciplinary capacity of the public sector

The literature on transdisciplinarity emphasizes the need for a transdisciplinary capacity of scientists in order to navigate the limitations of the scientific context of transdisciplinarity. However, just as scientists and scientific institutions are expected to possess a transdisciplinary capacity to engage in transdisciplinarity, I propose that organizations in the public sector should also possess a capacity to navigate the potential limitations to transdisciplinary social learning. This proposal for a transdisciplinary capacity of public sector organizations will be explored during the empirical research of this case study.

2.4 Applying social learning to a new model of transdisciplinary knowledge integration: Transdisciplinary social learning

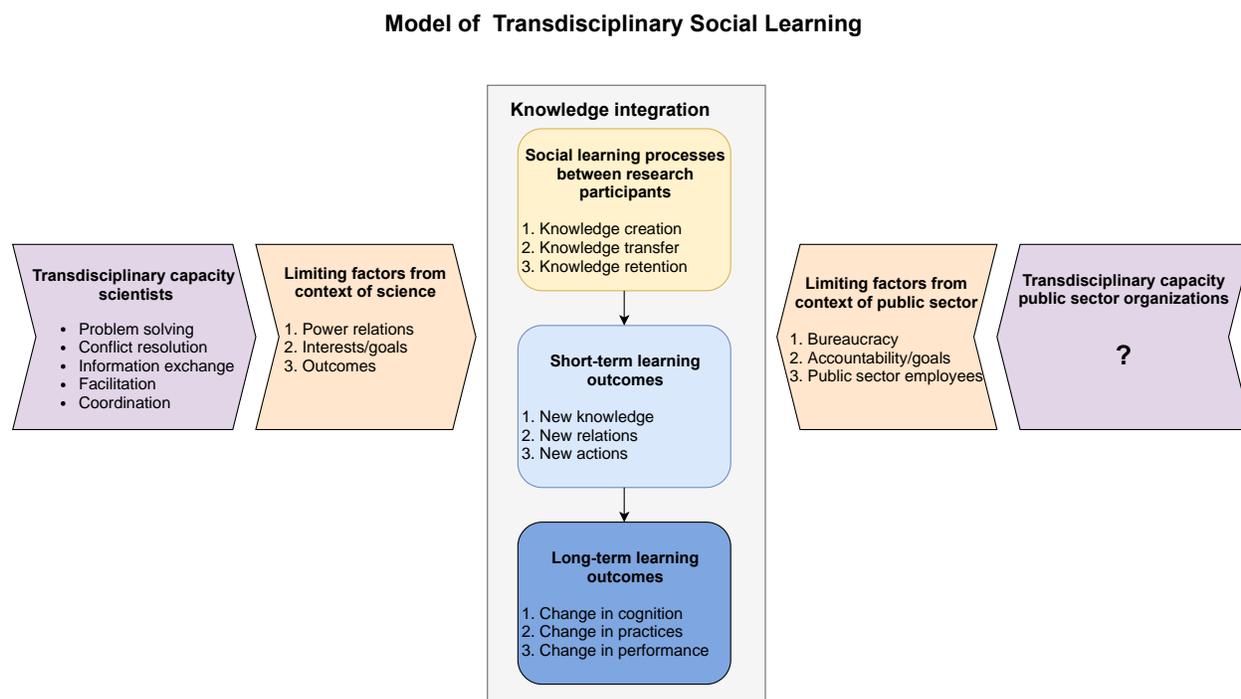
The existing literature on transdisciplinarity describes transdisciplinary knowledge integration as the phase where knowledge is applied to the realm of practice; however, there is little guidance on how mutual learning between science and practice should achieve this goal. As a response to Schauenlehner-Kloyber & Penker's (2015) observation that "there has been little reflection on the 'how to' and the needs occurring on individual and group level in learning

processes” (p.58), I develop a dynamic model of the knowledge integration phase of transdisciplinarity and call it transdisciplinary social learning.

There are three main features to my model of transdisciplinary social learning. The first is that knowledge integration should be understood as a process of social learning that leads to social learning outcomes. The second is that there are factors that can limit these social learning processes and outcomes from two sides, the scientific context and the public sector context. The third feature is that, in addition to a transdisciplinary capacity of scientists, a transdisciplinary capacity of the public sector is proposed to overcome these limiting factors.

Figure 4

Model of Transdisciplinary Social Learning



In this model of transdisciplinary social learning, I conceptualize the collaboration between scientists and practitioners and the actions that take place during transdisciplinary knowledge integration as a combination of social learning processes and social learning outcomes. The social learning processes are productive social interactions that take place between scientists and practitioner participants to transdisciplinary research through knowledge creation, knowledge transfer, and knowledge retention. These processes lead to social learning outcomes that will ultimately affect the ability of transdisciplinary knowledge to be embedded in practice. These

social learning processes produce short-term social learning outcomes such as new knowledge, new relations, and new actions in the individual participants to the research. When this knowledge creation, knowledge transfer, and knowledge retention continues over a longer-time period, then these short-term social learning outcomes of new knowledge, relations, and actions are able to lead to long-term social learning outcomes in the form of a change in cognition, a change in practices, or a change in performance at the level of groups, organizations, and social systems. These long-term outcomes such as a change in cognition, practices, or performance are how the knowledge is successfully integrated into the group, organizational, or social setting. These social learning processes and outcomes should contain the essential features of transdisciplinarity in that they are an approach to research, a collaboration between science and practice, are reflexive, aim to solve complex problems, and produce knowledge for both science and society.

This model also shows that these transdisciplinary social learning processes and outcomes can be limited by factors from both the context of science and the context of the public sector. These limiting factors from the scientific context include the power relations between researchers and practitioners, the tension between their interests and goals, and the tension between outcomes that are relevant for science or for practice. The limiting factors from the context of the public sector include characteristics of the public sector such as bureaucracy, mixed accountability and goals, and the qualities of public sector employees.

The model also demonstrates that these limiting factors can be overcome by a transdisciplinary capacity of both scientists and public sector organizations. The transdisciplinary capacity of scientists is based on academic literature which describes this capacity as process skills such as problem solving, conflict resolution, information exchange, coordination, and facilitation (Gray, 2008; Hoffman et al., 2017; Klein, 2004; Schuppenlehner-Kloyber & Penker, 2015). Mirroring this capacity on the practice side of the model, I propose that limiting factors from the public sector context can also be overcome by a transdisciplinary capacity of public organizations. This transdisciplinary capacity of public sector organizations will be further explored during the empirical case study. What this model illustrates is that transdisciplinary knowledge integration can be achieved in a process of transdisciplinary social learning that overcomes contextual limitations by a transdisciplinary capacity of scientists and public sector organizations when engaging in this work.

This model enriches the literature on transdisciplinarity by describing the social learning processes and outcomes that should occur during the knowledge integration phase of transdisciplinarity, by describing limiting factors to this transdisciplinary social learning from the contexts of science and the public sector, and by proposing a transdisciplinary capacity of the public sector. These aspects of the model will be further explored through the empirical case study of the Datawerkplaats.

Chapter 3: Research design and methods

3.1 Research problem: The challenge of transdisciplinary knowledge integration

In this empirical research I investigate the question, *how can the challenge of integrating transdisciplinary knowledge in the public sector be overcome in a process of social learning?* This research question took form based on findings in the literature that, first, the integration of knowledge into the realm of practice is a large challenge of transdisciplinarity (Bergmann et al., 2005; Lang et al., 2012; Hoffmann et al., 2017); second, that the existing transdisciplinary models do not explicitly describe the learning processes that should lead to this knowledge integration; and third, that there is a lack of empirical work about this challenge (Hoffmann et al., 2017). This led to my development of a theoretical model of transdisciplinary social learning that describes both the social learning processes as well as the social learning outcomes that should take place during transdisciplinary knowledge integration in order to successfully integrate transdisciplinary knowledge into the public sector. This model of transdisciplinary social learning also presents a set of limiting factors from the context of science and the context of the public sector which can be overcome by a transdisciplinary capacity of both scientists and public sector organizations. I use this model of transdisciplinary social learning to guide an exploratory case study to develop empirical knowledge about this challenge as well as these potentially limiting and driving factors.

The purpose of this research is to realize both scientific and practical outcomes. The scientific purpose is to develop theoretical and empirical knowledge about the challenge of transdisciplinary knowledge integration in the public sector and to explore whether it can be overcome in a process of transdisciplinary social learning. Additionally, this research develops knowledge about the potentially limiting factors from the scientific and public sector context where this work takes place and explores whether a transdisciplinary capacity can overcome these limitations. The practical purpose of this research is to help the local and regional government organizations of the Datawerkplaats research collaboration implement transdisciplinary knowledge in their organizations, in addition to improving learning outcomes for their employees around the topics of datafication and digitalization and connecting these organizations with each other.

To achieve these purposes, I conduct participatory action research in a case study of a transdisciplinary collaboration, the Datawerkplaats. To guide this exploratory case study, I developed the following four sub-questions:

1. Do transdisciplinary social learning processes take place in this research?

Answering this question shows whether the model of transdisciplinary social learning has taken place in this case study. This provides a basis for understanding whether the model and its proposed outcomes can be studied in this case.

2. Do these processes lead to transdisciplinary social learning outcomes and thereby the integration of transdisciplinary knowledge?

Answering this question shows whether the social learning processes result in the short-term and long-term social learning outcomes described in the model, which indicate that transdisciplinary knowledge integration has taken place.

3. How do factors from the scientific context limit transdisciplinary social learning and how can a transdisciplinary capacity of scientists overcome these limitations?

Answering this question helps to explain what kinds of limitations the transdisciplinary social learning model might face from the scientific context as well as what kinds of skills and capacities are asked of scientists who want to overcome these limitations while engaging in transdisciplinary social learning.

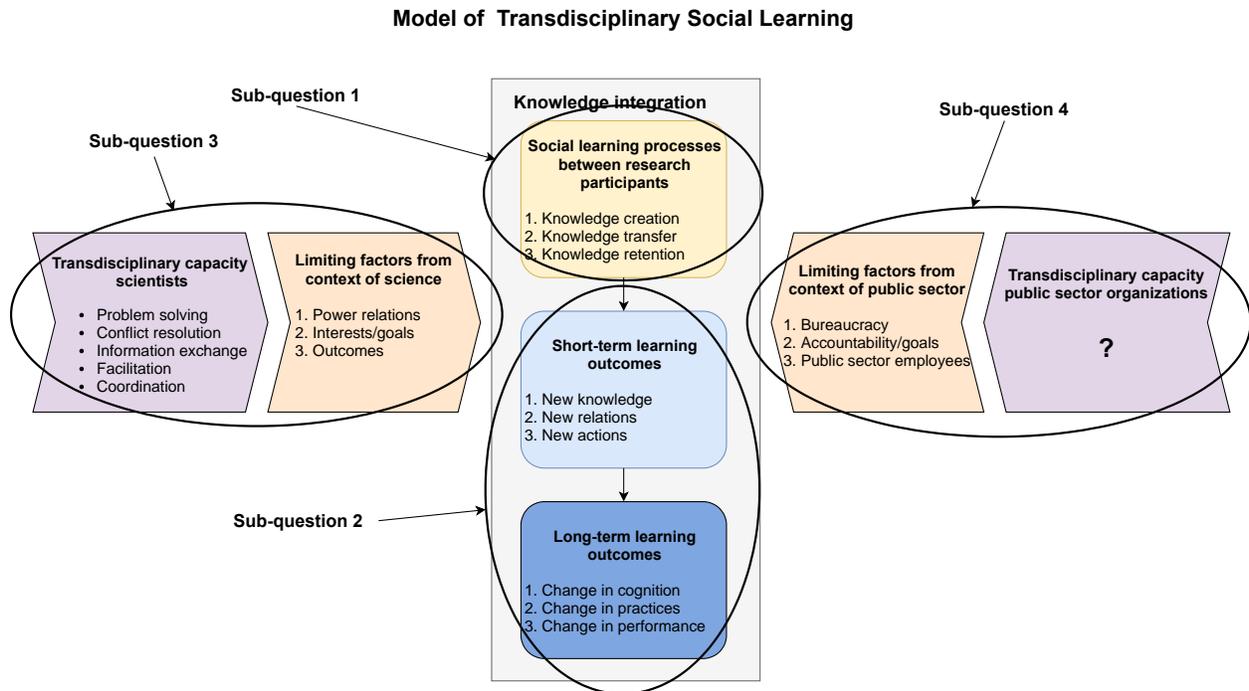
4. How do factors from the public sector context limit transdisciplinary social learning and how can a transdisciplinary capacity in public sector organizations overcome these limitations?

Answering these questions helps to explain what kinds of limitations the transdisciplinary social learning model might face from the context of the public sector as well as what kinds of capacities are asked of public sector organizations that want to overcome these limitations while engaging in transdisciplinary social learning.

Answering these four sub-questions helps to answer the overarching research question of how the challenge of integrating transdisciplinary knowledge in the public sector can be overcome in a process of social learning by detailing the social learning processes, the social learning outcomes, the potential limitations, and the potential capacities needed by scientists and public sector organizations to tackle this challenge. I answer this overarching research question and sub-questions by exploring this model of transdisciplinary social learning in the case study, the Datawerkplaats.

Figure 5

Operationalization of the research



3.2 The case: The Datawerkplaats

The case where this model is explored is the Datawerkplaats, a research collaboration centered around helping local and regional governments in the Netherlands respond to and deal with the increasing datafication and digitalization of society. I am able to conduct this empirical research for my master's thesis because of my position as a research assistant for the Datawerkplaats.

3.2.1 An overview of the Datawerkplaats

The Datawerkplaats was started two years ago by two departments of Utrecht University in the Netherlands, the School of Governance and the Data School, along with four local and regional government organizations in the Netherlands: the province of South Holland, the municipality of Gouda, the municipality of Woerden, and the municipality of Almere. These organizations participated in the first round of the Datawerkplaats collaboration from 2019 to 2020. During this first round, the outputs of this research collaboration were tools and instruments that the participating organizations could use to facilitate their organizational shift to data-driven working and to respond to the digital transition taking place in society. These tools were developed

based on research that had been conducted by the academic and government partners to this collaboration.

The Datawerkplaats research collaboration can be considered transdisciplinary because it demonstrates the five defining characteristics of transdisciplinarity. First, it is an approach to research and, second, it is a collaboration between science and practice. The university and local and regional government partners participate in a collaborative research process where the research questions and research processes result in the development of concrete instruments and tools for the partner organizations. Therefore, the Datawerkplaats also fulfills the definition of being reflexive in its way of working, the third characteristic of transdisciplinarity, and in looking at complex problems around datafication and digitalization in local and regional government, the fourth characteristic. The goal of this collaboration is to produce both practical knowledge for the participating organizations as well as scientific knowledge for the universities, matching with the fifth characteristic of transdisciplinarity. Therefore, the research conducted by the Datawerkplaats can be considered transdisciplinary.

Table 2

The Datawerkplaats as an example of transdisciplinarity

Defining characteristics of transdisciplinarity	Datawerkplaats
An approach to research	Research collaboration
Collaboration between science and practice	Between Utrecht University and local and regional government partners
Reflexive	Open and adaptive in its way of working, reflection built into the process
Solves complex problems	Datafication and digitalization in local and regional government organizations
Produces knowledge to progress both science and society	Goal of both practical and scientific knowledge

The practical knowledge developed by the first round of this research collaboration took the form of five tools. These tools are the Data Team Start, the Checklist Sharing Data Together, the Dashboards with Value for the Whole Organization Tool, the Data Ethics Awareness Test, and the Meaningful Digital Collaboration Tool¹ (Utrecht Data School, 2021). The Data Team Start is a tool that helps a project team organize the beginning of a data project by discovering the

¹ The names of the Datawerkplaats tools have been translated from Dutch to English.

competencies that team members already have, and where needed, adding to this. The Checklist Sharing Data Together is a tool that helps organizations make arrangements to responsibly share data with each other. The Dashboard Tool is a means for co-workers who are involved in a dashboard project to discuss the human and organizational implications of the use of dashboards. The Data Ethics Awareness Test is a survey instrument that measures the ethical sensitivity around data topics within the organization. Finally, the Meaningful Digital Collaboration Tool helps a team make concrete arrangements around digital or hybrid working to ensure an effective, creative, and inclusive work environment. These tools are outputs of previous transdisciplinary research that has been conducted by the Datawerkplaats.

Table 3

Tools of the Datawerkplaats

Tool Name	Purpose of Tool
Data Team Start	Organizing a data project by having the right people with the right competencies involved
Checklist Sharing Data Together	Making arrangements for responsible data sharing
Dashboards with Value for the Whole Organization	Generating a discussion about the human and organizational side to the use of dashboards
Data Ethics Awareness Test	Measuring the ethical sensitivity to data topics within the organization
Meaningful Digital Collaboration	Making arrangements for meaningful digital work environments

3.2.2. Building on previous transdisciplinary research at the Datawerkplaats

As a research assistant for the Datawerkplaats, I conducted research in the fall of 2020 to evaluate the first two years of the Datawerkplaats collaboration. The results of this evaluation would inform the second round of the Datawerkplaats that would begin in January 2021. In my evaluation of the first round of the collaboration, I found that, although this collaboration resulted in the development of tools that were supported by scientific and practical knowledge and were viewed quite positively by the participating organizations, it remained a challenge for the participating government organizations to use the tools within their organizations. A second finding was that the tools as an outcome were over-emphasized at the expense of the broader

learning outcomes of the collaboration. The organizations also missed the horizontal connections with each other that they hoped would improve this learning network. In the second round of the Datawerkplaats, three government organizations remained in the collaboration, the municipality of Gouda, the municipality of Almere, and the province of South Holland, and three new partners joined, the province of Utrecht, the municipality of Zuidplas, and the municipality of Amersfoort. These findings were presented to the second-round partner organizations, who indicated that their goals were to improve the implementation of the existing tools, contribute to the learning processes of their employees around datafication and digitalization, and increase the knowledge exchanged between the partner organizations by improving their connections with each other. My master's thesis research is designed as a follow-up to my research from fall 2020; therefore, the research that I conduct and describe in this master's thesis is part of the second round of the Datawerkplaats research collaboration. My work is based on previous transdisciplinary research, my own and that of other researchers who developed the tools, and it will feed into new research that occurs in this larger transdisciplinary research collaboration of the Datawerkplaats.

3.2.3 Case selection

The Datawerkplaats case was selected for this empirical work for several reasons. First, this case presents a practical example of the challenge of transdisciplinary knowledge integration. The difficulty of implementing the tools of the Datawerkplaats, which are the transdisciplinary knowledge, in the participating organizations, demonstrates the theoretical challenge of integrating transdisciplinary knowledge in the public sector. Second, the Datawerkplaats can be seen as a most advanced practice in the field of transdisciplinary collaboration on the topic of datafication in local government. The Netherlands in general is quite advanced in terms of e-governance, and the Datawerkplaats is one of the few transdisciplinary research collaborations taking place on this topic. This shows that the challenge of knowledge integration is present in an advanced case of transdisciplinarity, thus the knowledge generated by this research could be expected to apply to less advanced cases as well. Third, I selected this case because of its accessibility, following Lüscher & Lewis' (2008) case selection logic for their organizational action research. As a research assistant for the Datawerkplaats, I had the access necessary to conduct this participation-intensive style of action research. Additionally, the organizations in the Datawerkplaats were both interested in and willing to participate in this type of research, and this openness is an important requirement for the effective results of transdisciplinary research (Hansson & Polk, 2018) and for conducting

action research, as it should take place “with members of an organization over a matter which is of genuine concern to them and in which there is an intent by the organizational members to take action based on the intervention” (Eden & Huxham, 1996, p.75).

3.3 Research design

This section explains my choice of methodology and the design of the empirical research. In order to answer the above research question as well as the sub-questions, this research is designed as a qualitative case study using the methodology of participatory action research. Using action research methods fits well with the question and goals of this research described in Section 3.1, as the literature on both transdisciplinarity and action research stress the importance of research outcomes that involve change, learning, and relevance for both science and for society (Eden & Huxham, 1996; Jahn et al., 2012). Additionally, transdisciplinary research is reflexive in that it should use a method that is suited to its goals and outcomes, thus there is not one set methodology that should be used in transdisciplinary research (Jahn et al., 2012; Mobjörk, 2010). However, transdisciplinary scholars often describe action research as suited for transdisciplinarity (Russell et al, 2008; Klein, 2004), because the goals and outcomes of transdisciplinary research overlap with those of action research. Like transdisciplinarity, action research focuses on the involvement and equality of scientist and societal actor, as Sussman & Evered (1978) write of action research, “Neither client nor researcher has better knowledge; in a sense, they are both experts” (p.17). Practitioners should be “equal and full participants in the research process” (Stringer, 2007, p.10), as action research focuses on involving participants as collaborators in changing their system or organization (Friedman & Rogers, 2008; Ospina et al., 2008; Stringer, 2007). This focus on change as well as learning is another way that action research is similar to transdisciplinarity (Friedman & Rogers, 2008), as action research is often described as “transformative” (Wicks, Reason, & Bradbury, 2008, p.21). Action research is a method for producing knowledge that leads to learning outcomes for the participants (Friedman & Rogers, 2008) because it is “simultaneously concerned with bringing about change in organizations, in developing self-help competencies in organizations and adding to the scientific knowledge” (Shani & Pasmore, 1982, p.208). Thus, the similarity of the goals of transdisciplinarity and action research in collaborating with societal actors, producing learning outcomes, and leading to change is clear. Additionally, the transdisciplinary social learning model explored in this research draws on concepts from the field of organizational learning, and renowned organizational scholars Argyris

& Schon (1996) recommend using collaborative action research to investigate questions related to organizational learning.

Action research has faced criticism for lacking scientific validity (Eden & Huxham, 1996). To avoid this supposed trade-off between rigor and relevance, Eden & Huxham (1996) distinguish between non-scientific consulting projects that have the aim of being useful only to the practitioner, and scientific action research which must fulfill the requirement of being both useful to the practitioner and also explicitly concerned with theory. Thus, although action research should try to solve a situation-specific problem, the outcomes of the research must speak to other contexts and situations through the development of theory. In this way, scientific action research can be seen as taking a grounded theory approach where it incrementally develops theories from the data and practice uncovered as part of the research (Eden & Huxham, 1996; Boeije, 2010). To fulfill these dual goals of action research, this research was designed to achieve both the scientific and practical objectives described in Section 3.1, namely contributing to theory about transdisciplinary social learning and helping the Datawerkplaats organizations implement the transdisciplinary knowledge in their organizations.

The rigor of action research can also be established through the design of the action research. This design must have a high degree of method and orderliness as a counterbalance to the inductive and iterative nature of the action research process (Eden & Huxham, 1996). This is especially true in both collecting and reflecting on the data collected during the process (Eden & Huxham, 1996). Thus, the purpose of the research, the role of the research, and the flexibility of the research design should be clearly specified (Lüscher & Lewis, 2008). The process and analysis should also be clearly outlined, as outside observers should be able to follow the steps taken and the analysis should be replicable or demonstrable in how it led to the emergent theories (Eden & Huxham, 1996; Stringer, 2007). To fulfill these criteria, the steps undertaken as part of this action research are detailed below.

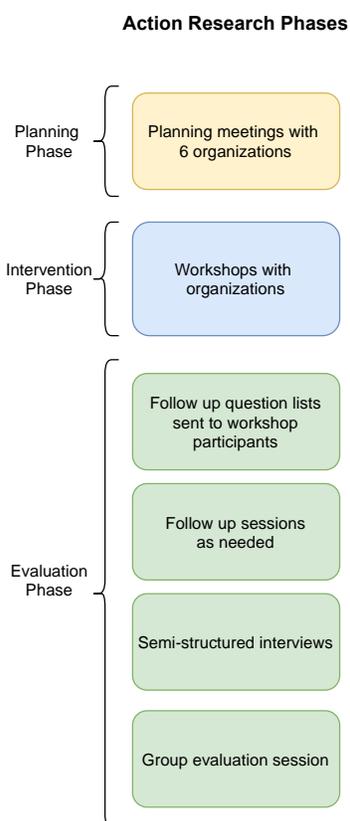
3.3.1 Action research phases

This section describes the phases of the action research that I designed to carry out this empirical work. Lewin (1946), one of the first proponents of action research, described action research as “a circle of planning, executing, and reconnaissance or fact-finding for the purpose of evaluating the results” (p.38). Susman & Evered (1978) describe five phases that can be used in designing action research: diagnosing, action planning, action taking, evaluating, and specifying

learning. To design this action research, I consulted the phases developed by these scholars as well as those used by Lüscher & Lewis (2008) in which their action research consisted of a cycle of plan development, intervention, and evaluation. This is similar to the process embraced by Coghlan & Shani (2005) which consists of cycles of diagnosing, planning, taking action, and evaluating action. Building on these previous works, I constructed my action research in a cycle of three phases: planning, intervention, and evaluation. These phases of the action research cycle took place as part of the social learning processes in the model of transdisciplinary social learning.

Figure 6

Action research phases

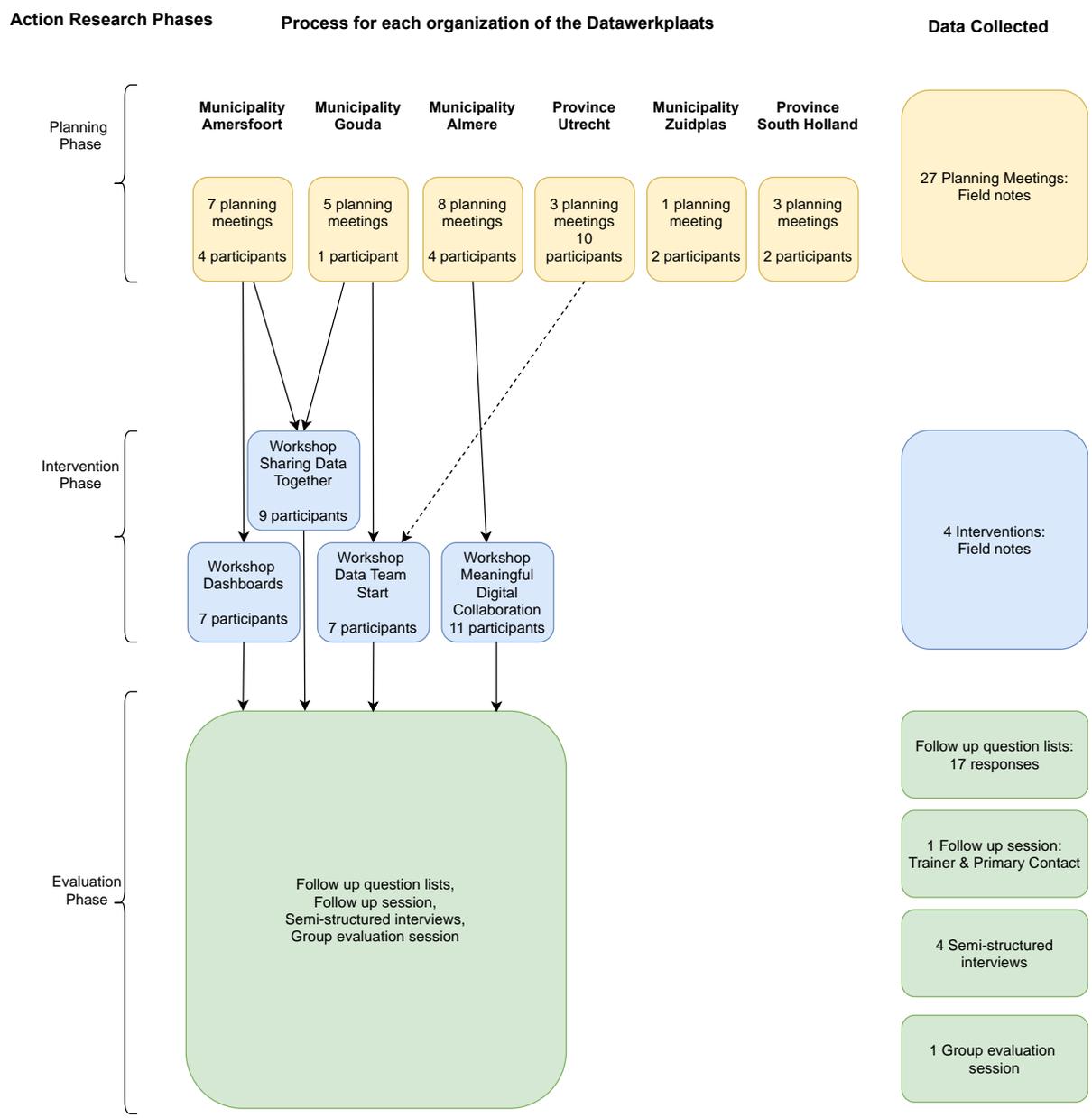


To keep the research flexible enough to fulfill the requirement of action research to be useful for the participants (Eden & Huxham, 1996), I allowed the exact nature of each phase in the research cycle to be contingent upon collaboration with the participants and the context of the research. In my research proposal I prepared possible templates for how each phase of the action research could look based on the literature about action research, and I used these templates as possible ideas in discussion with the participating organizations, thereby allowing for input from

and collaboration with practitioners. The three overlapping phases of the action research that I followed in collaboration with practitioners from the participating organizations can be seen in Figure 7 and are described in further detail below.

Figure 7

Action research phases in each organization along with corresponding data collection



3.3.1.1 Social learning processes take place in the planning phase

The planning phase of the action research cycle as seen in Figure 7 is a preparatory phase that first involves groundwork to gain an understanding of the context of the research (Lüscher & Lewis, 2008). According to the literature, this phase should involve making contact with stakeholders and developing an understanding of the key groups, the nature of the community, the relevant organizations, and the types of relationships that exist between these elements of the setting (Stringer, 2007). In action research that is geared towards organizations, this context consists of environmental, organizational, and individual characteristics, as well as the goals of the organizations and individuals participating in this research (Coghlan & Shani, 2005). This preparatory phase also needs to make clear the shared definitions, expectations, and agenda of both the researcher and the involved practitioners, as these clarifications can improve the collaborative processes and thereby enhance the social learning outcomes (Buchy & Ahmed, 2007). I followed these recommendations from the literature during the planning phase of my action research.

In the Datawerkplaats case study, the planning phase clarified and organized the knowledge creation, transfer, and retention that would take place during the action research interventions of the social learning process. To begin the planning phase, I made initial contact with each of the six organizations of the Datawerkplaats to discuss what their interests were in terms of their goals for this research and to discuss what kind of knowledge should be *created* in this research. In these initial contacts I wanted to establish which issues surrounding datafication were important to each organization as well as which of the already developed tools they would like to implement to deal with this specific issue. I offered each organization support for the implementation of up to two Datawerkplaats tools of their choice over the coming three months. The literature proposes that this contact should first be made with the heads of the organizations, citing Hansson & Polk's (2018) recommendation for transdisciplinary research to have high-level support. Therefore, I approached the Datawerkplaats coordinator for each organization, who are often high-level or direction-level employees. In some organizations I met directly with these employees who also invited mid-level employees to attend this initial session, while in other organizations, only the high-level employee attended. For each of these initial sessions, I presented information about the tools of the Datawerkplaats and their intended uses to provide a basic level of information about these topics to all practitioners. Each organization's interest in stimulating exchanges of

information around this topic through connections with other organizations in the network was also discussed at these initial meetings.

Once a decision had been made by each organization about which tools to work with, these initial meetings led to further contact with mid-level employees in each organization so that the mid-level practitioners and I could collaborate and discuss how to structure the social learning process in the form of productive social interactions. In these planning discussions, it was important to make decisions about what kind of social learning interaction to hold and who the participants should be (Hansson & Polk, 2018). These plans were made collaboratively to help clarify the expectations between the practitioners and myself as well as allow the interventions to deliver the most impact for the involved organizations because practitioners were co-designing them (Hansson & Polk, 2018; Schmidt et al., 2020).

In total, for the planning phase of this research, I participated in 27 meetings with practitioners at the six partner organizations of the Datawerkplaats. These meetings were not equally distributed among the participating organizations but were contingent upon both requests by the participating organizations and what I felt were each organization's needs for the planning process (See Figure 7). For each of these planning meetings, I made detailed field notes and observations during and directly after each meeting in order to capture the general discussion points as well as specific quotes from participants. An overview of the data collection in each phase of the research can also be seen in Figure 7. A striking feature of the planning phase of this research is how time-intensive this planning process was, involving 27 meetings with 23 practitioners in six organizations over a period of three months, from March 2021 through May 2021. The majority of the research time was spent on this planning phase. A detailed description of the planning and intervention process in each organization can be found in Appendix A.

3.3.1.2 Social learning processes take place in action research interventions

Due to the collaborative approach of this research, the action research interventions were designed and agreed upon during the planning phase in collaboration with practitioners at the partner organizations. These interventions were where a substantial part of the knowledge *creation* around the chosen tool took place. This knowledge creation was centered on evaluating and integrating the developed tool. To uphold the rigor of the action research methodology (Eden & Huxham, 1996), I initially created a range of potential interventions based on literature in the action research field, which I used to guide my initial conversations with practitioners.

However, after discussion with the practitioners from these organizations, most of these interventions took the form of workshops about the tools of the Datawerkplaats where small groups of practitioners could learn about the tools as well as engage in “productive interactions” (Spaapen & Van Drooge, 2011, p.213) with myself, members of their own organization, and sometimes members of other organizations. Workshops are a form of formal social interaction where boundary spanning activities can take place as participants engage in a task together, thus fostering knowledge creation and transfer (Janowicz-Panjaitan & Noorderhaven, 2008; Schmidt et al., 2020; Lüscher & Lewis, 2008). The workshops that I designed with participants, dependent on the preferences of the organization, usually took the form of an online workshop lasting one and a half hours with seven to eleven participants each. The diversity of the participants ranged in scope from members of one team, to members of separate teams, to members of different departments, to members of different organizations. During these workshops I acted as a facilitator and asked questions to spur a discussion about the tool and participants’ experiences with the topics addressed in each tool, as advocated by proponents of action research: “the role of the research facilitator, in this context, becomes more facilitative and less directive” (Stringer, 2013, p.11). I also tried to conclude each workshop with a reflection about how participants experienced each session in order to evaluate and *retain* the knowledge that we *created* during the session. By creating a space for productive social interactions between these practitioners and myself, these workshops follow the theoretical model by being a social learning process where knowledge can be created, transferred, and retained around the previously produced transdisciplinary knowledge, in this case a developed tool of the Datawerkplaats.

In total, four of these workshops took place in May of 2021, with participants from four of the six organizations. To collect data from these workshops, a separate researcher from the Datawerkplaats other than myself was present at each workshop to write down field notes and observations, as Lüscher & Lewis (2008) recommend having an external note-taker present at each session. I also held a follow-up session to one of the workshops with my primary contact person and a trainer from that organization at their request, and I took field notes on this session.

3.3.1.3 Action research steps continued: Evaluating the interventions

Evaluating the actions taken is the third phase of the action research cycle. This phase evaluates the initial knowledge developed in the intervention phase and reflects on it (Lüscher & Lewis, 2008), thereby *creating* another layer of new knowledge as well as helping to *retain* what

was learned and *transfer* this knowledge to others. Evaluation involves both data collection and data analysis. I collected data from the Planning and Intervention phases of the research in the form of field observations. However, an important factor in both transdisciplinary and action research is the value of the outcome for the participants (Hansson & Polk, 2018; Lüscher & Lewis, 2008). Thus, it is important for the participants to assess the value and the validity of the findings, not just the researcher (Lüscher & Lewis, 2008). For each of the interventions, it was important for my data collection and analysis process to solicit feedback from the participants on their experiences as well as their analysis and evaluation of my notes and observations.

The collection and comparison of data between the participants and myself allows for an important aspect of the action research process to take place, triangulation. As in other research methods, triangulation involves checking the validity of data by obtaining it from a range of sources (Eden & Huxham, 1996). However, in action research, triangulation is also a process of checking this data from my observations against the perceptions of the participants in order to generate new concepts and theories (Eden & Huxham, 1996).

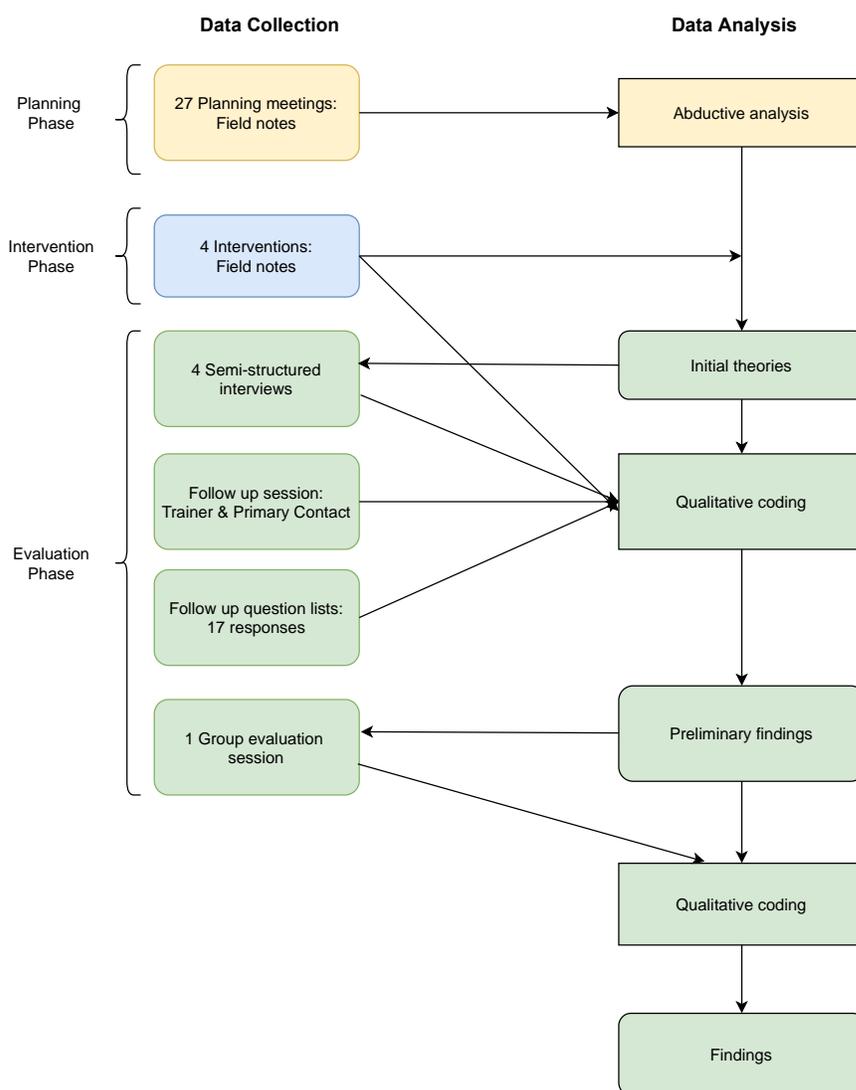
I collected data from multiple sources during this evaluation phase. The first was a written question list sent to each workshop participant after the workshops via email. These follow-up questions were open-answer questions about what the participants had learned during the intervention, what they felt they could contribute from their own knowledge during the workshop, and whether and to what extent they were planning to use what they had learned through the workshop in their work (for full question list, see Appendix B). I did not send this question list to my primary contact person at each organization because I conducted semi-structured interviews with these primary contacts.

In action research, the cycles of data collection and analysis can overlap (Lüscher & Lewis, 2008). Therefore, before I had finished collecting all the data for this research, I already began some initial analysis to develop preliminary ideas about what was occurring during the planning and execution of these social learning processes. The full overlap between my data collection and analysis can be seen in Figure 8. For my initial analysis, I used an abductive process. According to Brusaglioni (2016), abduction is an informal form of induction where the result is used to “infer the case” (p.11), thus it should come first in the reasoning process (Timmermans & Tavory, 2012). As recommended by Timmermans & Tavory (2012), I worked backwards from the outcomes of the planning and intervention phases to generate possible reasons for these results. This abductive

analysis was based on the field notes and observations from the 27 planning meetings as well as the field notes from the workshops. This abductive analysis led to preliminary ideas about the processes that were followed during the planning and interventions as well as possible factors which may have contributed to our, mine and these organizations', collaborative ability to plan and carry out these social learning processes.

Figure 8

Detailed data collection and analysis process



I used these initial theories from my abductive analysis to inform the next round of data collection. In this next round of data collection I conducted semi-structured interviews with the practitioners that I had worked most closely with, who I will refer to as primary contacts, during

the planning and execution of the four workshops. In total, I held four semi-structured interviews, which were recorded and transcribed. During these interviews, I asked my primary contacts about their experiences of collaboration during the planning and participation during the interventions, and I also shared my preliminary theories and ideas with them in order to include an element of triangulation whereby I checked my initial observations and theories against the perceptions of these participants.

Next, I qualitatively coded and analyzed my collected data in NVivo 12 for Mac. The data that I included in this qualitative coding included the transcriptions of the semi-structured interviews, the workshop participants' written responses to the follow-up questions, the field notes from the interventions, and the field notes from the follow-up session with the trainer. This qualitative analysis led to a set of observations and findings. To double-check these more consolidated findings against the perceptions of participants as well as to develop new theory about the transdisciplinary social learning processes and outcomes, as the final phase of my research I held a group session and invited my primary contacts from each organization to attend and take part. In total, six participants from four organizations attended this group session. In this group session, I shared my consolidated findings based on my qualitative analysis with the participants and encouraged a group discussion about these findings by asking whether these findings were recognizable and inviting participants to disagree with or add to these findings. A separate researcher attended this session to take field notes during the session. After this group session, I added the field notes from this session to NVivo and conducted another round of qualitative coding. My detailed coding process is described in Appendix C. A list of the data collected during this research can be seen in Table 4.

Table 4*Data collection per phase of action research*

Action research phase	Type of data	Number of data type
Planning phase	Field notes	27 planning meetings
Intervention phase	Field notes	4 workshops
Evaluation phase	Semi-structured interviews	4 primary contacts
	Follow-up question list	17 participants provide open-answer responses
	Field notes	1 follow-up session, trainer and primary contact
	Field notes	1 group evaluation session

One characteristic of this empirical research was that it was very time-intensive in organizing contacts at the participating organizations. This can be seen in the contact with participants in Table 5 below. In total, including my primary contact in each organization, 51 practitioners were involved in either planning or participating in these interventions. There was some overlap between the planning participants and workshop participants: 23 practitioners were involved in the planning process, and 33 practitioners participated in the workshops. The evaluation phase of the action research was based on responses from 24 of the practitioners who participated in the workshops. This means that about 70% of the practitioners who participated in a workshop also had a chance to evaluate the process and give feedback on the initial data. The evaluation phase with these 24 practitioners contributed to the data I collected in the form of interviews, follow-up sessions, email question lists, and a group session.

Table 5*Participant contact per phase of research*

Total participant contact during research	51 participants
Planning phase	23 participants
Interventions	33 participants
Evaluation	24 participants

3.4 Limitations of data collection and analysis

A limitation of this data collection process is that the organizations that did not succeed in planning and carrying out a workshop were also not willing to participate in follow-up emails,

interviews, or group sessions to provide a response to my initial findings. The municipality of Zuidplas and the province of South Holland were not able to organize a workshop with one of the tools during the research period, and members of these organizations did not participate in any of the workshops at the other organizations. Additionally, when I invited my contacts from both of these organizations to the group session to discuss the initial findings of my research, they both declined. The methodology of action research is very much based on a collaborative process, therefore, when these organizations did not collaborate, this limited the knowledge that could be gleaned about these processes in their organizations. The data that I collected are from the organizations that were both able to organize social learning processes within their organization and willing to participate in these processes. This may influence the analysis of the data in the later chapters of this paper because this analysis will be based on data from organizations where these processes were able to take place.

3.5 Summary of the research design and methodology

This research was designed as participatory action research in the case study of the Datawerkplaats in order to answer the research question of how the challenge of transdisciplinary knowledge integration can be overcome in a process of social learning. One of the main features and strengths of this research was its design to achieve both scientific and practical outcomes. Its scientific goal was to contribute to theory about transdisciplinary social learning and its practical goal was to help the organizations of the Datawerkplaats integrate transdisciplinary knowledge in their organizations in a process of social learning. This research achieves these goals by employing an innovative research methodology of participatory action research where practitioners from the Datawerkplaats organizations and I collaborated in planning and carrying out workshops focused on creating, transferring, and retaining knowledge about the tools of the Datawerkplaats within these organizations.

Because of the intense collaboration required by participatory action research methods, I had a large amount of contact with practitioners in these organizations. This led to a collaborative research process which resulted in very rich data. In fact, this rich empirical data is another strength of this methodological approach; however, this collaboration with participants was very time intensive, especially in the planning stage of the research.

Another strength of this research design was the overlap between the data collection and analysis phases of the action research. The initial data and findings were used to inform later

rounds of data collection, and participants to the research gave feedback on the initial observations and data in order to enrich the findings. This back and forth between data collection and analysis allowed the findings to reflect the participants' perceptions of the social learning process and outcomes. In the next chapter I will present this rich empirical data and demonstrate how this research approach helps to strengthen our understanding of transdisciplinary social learning.

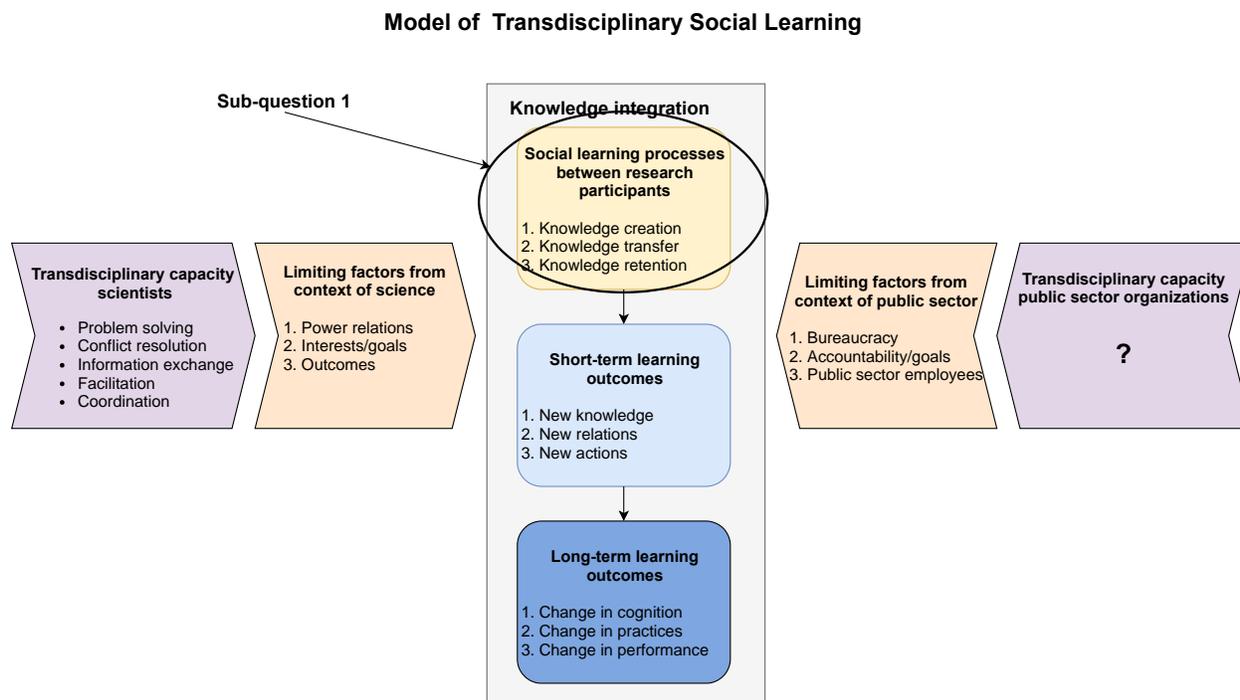
Chapter 4: Analysis of the empirical data through rich anecdotal illustrations

4.1 Does transdisciplinary social learning take place in this case study?

This section evaluates to what extent the planning and intervention phases of this research can be considered transdisciplinary social learning processes. Although I designed these planning sessions and workshops to meet the criteria of transdisciplinary social learning, I use this first section of the analysis to evaluate how well the case study follows my model. To do this, I highlight elements of the transdisciplinary nature of the planning phase as co-collaborations that valued input from both science and practice and that were reflexive in adapting to the needs of the involved practitioners and organizations. I also highlight elements of the workshops that can be considered productive social interactions and led to knowledge creation. The results of this analysis show that the action research that I carried out can be considered transdisciplinary social learning.

Figure 9

Area of transdisciplinary social learning model examined in Section 4.1



4.1.2 Transdisciplinary social learning takes place during the planning of the interventions

I first evaluate whether the planning phase of my action research cycle can be considered transdisciplinary social learning. I find that, during the planning phase, my collaboration with practitioners can be considered transdisciplinary because the research participants were co-designers of the process in that there was equal input from the side of science and the side of practice. This co-designing process was also transdisciplinary because it was reflexive and attuned to the goals of the practitioners. This pattern was true of all of the planning processes, but I demonstrate the transdisciplinary qualities here with an example from planning the Dashboard workshop with the municipality of Amersfoort.

The municipality of Amersfoort had indicated that they wanted to learn about the Dashboard Tool. This tool was originally developed in collaboration with the municipality of Woerden and contains ten statements about the organizational and human side of building dashboards (Utrecht Data School, 2021). The tool was designed to be used with a group of employees within the organization who were in some way involved in a particular dashboard project. In our initial meeting, Contact D expressed interest in using the questions of the dashboard tool for a slightly different purpose in her organization – she wanted “dashboard builders from different departments to come together”² (Interview 2). She purposefully wanted to bring a diverse group together to learn about each other’s experiences and initiate a conversation about the topics of the Dashboard tool. Therefore, we adapted the tool to make the discussion more relevant for the group of participants from Amersfoort by removing two of the statements that referred more specifically to internal dashboards (Interview 2). During the planning we also adjusted the wording of some the statements; for example, in statement 10 from the tool, we changed “Organizing dashboards is a technological process” to “Organizing dashboards is an organizational process” because Contact D felt that this made more sense in light of the previous statements in the tool and would still generate the same type of discussion (Planning Session 11).

This anecdote shows that the planning process for the Dashboard workshop can be considered transdisciplinary because of its co-collaborative and reflexive qualities. Interview

² I translated all quotations from participants from Dutch to English.

Respondent 2 described our collaboration as “pleasant working and very practical and short lines, customization.” This was also the case in the planning process for the other three workshops, as interview respondents remarked about those collaborative processes, “You knew exactly what the tools were about, you were able to give us a good answer, well provided with information, you prepared that workshop well” (Interview 1). This same respondent, when asked if she had enough ability to think along and give input to the planning process responded by saying, “Yes, because you could always explain things to us during the conversation and gave us the opportunity to ask for information from you and to give input. Yes, I certainly noticed that we filled in, that filling in was possible” (Interview 1).

In addition to collaborating on the substantive content of the workshops and tools, we also spent time during the planning process on designing the workshops to be social learning processes in the form of productive social interactions. In designing these productive social interactions, the practitioners and I made decisions about the goal of the workshop, the type of participants, and the online/offline environment of the workshop. I continue here with the example of the Dashboard workshop to show our attention to these elements of the social learning process in how we designed the workshop to be a productive social interaction where knowledge creation, transfer, and retention could take place.

To be a productive social interaction, we wanted there to be a way for participants to engage in “close and intense” discussions (Spaapen & van Drooge, 2011). Because of Covid-19 restrictions, the Dashboard workshop had to take place online, but we made plans to use Mentimeter to present the statements from the tool and then allow participants to rate their level of agreement with the statements. We planned that the participants would rate each statement in Mentimeter on their own devices and then I would share my screen to show the results (Planning Session 11). Contact D liked this plan but suggested that I stop sharing my screen during the discussion with participants. This would help the participants speak directly to each other, rather than to the small video feeds that show up during a shared presentation (Planning Session 11). Another decision that went into the design of this social learning processes was which participants to invite. To reach the goal of sharing experiences about dashboards and stimulating a discussion with participants, Contact D wanted to invite participants from different departments of the organization rather than participants who all worked together on one dashboard project. This meant

that within the organization, this interaction would be boundary spanning. However, no participants from other organizations were invited, which was in line with the organizational goal of creating a community within the organization (Interview 2).

This example from how we planned the social learning process of the Dashboard workshop shows that we designed the workshop to facilitate productive social interactions between the participants by choosing the format, the technology, and the participants to match the goals for the session. Overall, the planning process for the Dashboard workshop can be considered transdisciplinary social learning because it embodied the collaborative and reflexive elements of transdisciplinarity while we focused on designing the workshop to be a productive social learning process.

4.1.3 Transdisciplinary social learning takes place during the workshops

Although we planned the workshops to be transdisciplinary social learning processes, it is important to check whether they actually were in order to provide a basis for exploring the rest of the model of transdisciplinary social learning in this case study. In this section, I examine whether the workshops were both transdisciplinary and involved productive social learning interactions between the workshop participants. I find that the four workshops that took place can be considered transdisciplinary social learning processes. Their transdisciplinary nature can be seen in the rich contributions from both scientific and practitioner participants, while the nature of the productive social interactions can be seen in how participants were able to apply their knowledge during group discussion to the topic of the workshop. The workshop about the Data Team Start tool with the municipality of Gouda provides a good example of these qualities because it valued contributions from both science and practice and stimulated a productive interaction between participants.

The Data Team Start tool consists of a series of six exercises that members of a project team can do together to make sure that they have the right team members and the right competencies present to begin a data project. In each exercise, the participants work on a task together to generate and share knowledge. Contact E and I had decided ahead of time that we would do three of the six exercises during the workshop. One of these was a stakeholder analysis. To begin this exercise, I gave the participants a short definition of what stakeholders are and explained the classification matrix that we would use during the exercise. The participants then used an online brainstorm tool called a 'Jamboard' to list

different stakeholders from the “Vacancy project” about houses where no one is registered in the municipality. Participants contributed knowledge about which stakeholders and organizations should be involved in the project and also applied this knowledge to the framework of the tool. This led to an interesting discussion about whether the participants use this type of stakeholder analysis in their day-to-day roles as project leaders (Participant 5). During this discussion participants brought up a challenge that they frequently experience with data projects - that data projects are not seen as stand-alone projects; “not that it is actually seen as an entire project that requires a project leader” mentioned one participant (Field Notes C).

This anecdote gives an example of the knowledge that practitioners and I contributed to the workshop as well as how the participants were able to use their existing knowledge to create new knowledge while working on tasks together. Another aspect of the Data Team Start workshop that contributed to the productive nature of the interactions between participants was Contact E’s participation in the workshop.

Contact E was able to act as a facilitator between participants in the workshop, translating some of the scientific knowledge that I presented into recognizable terminology or examples for the participants. For example, when I explained one of the exercises in the tool, one participant did not understand the relevance of the questions about data. Contact E gave an example from her own experience of working with the tool, explaining that these questions can be used as “icebreakers” when working with employees who are not comfortable working with data (Field Notes B). This helped that participant better understand how the tool could be used with a project group.

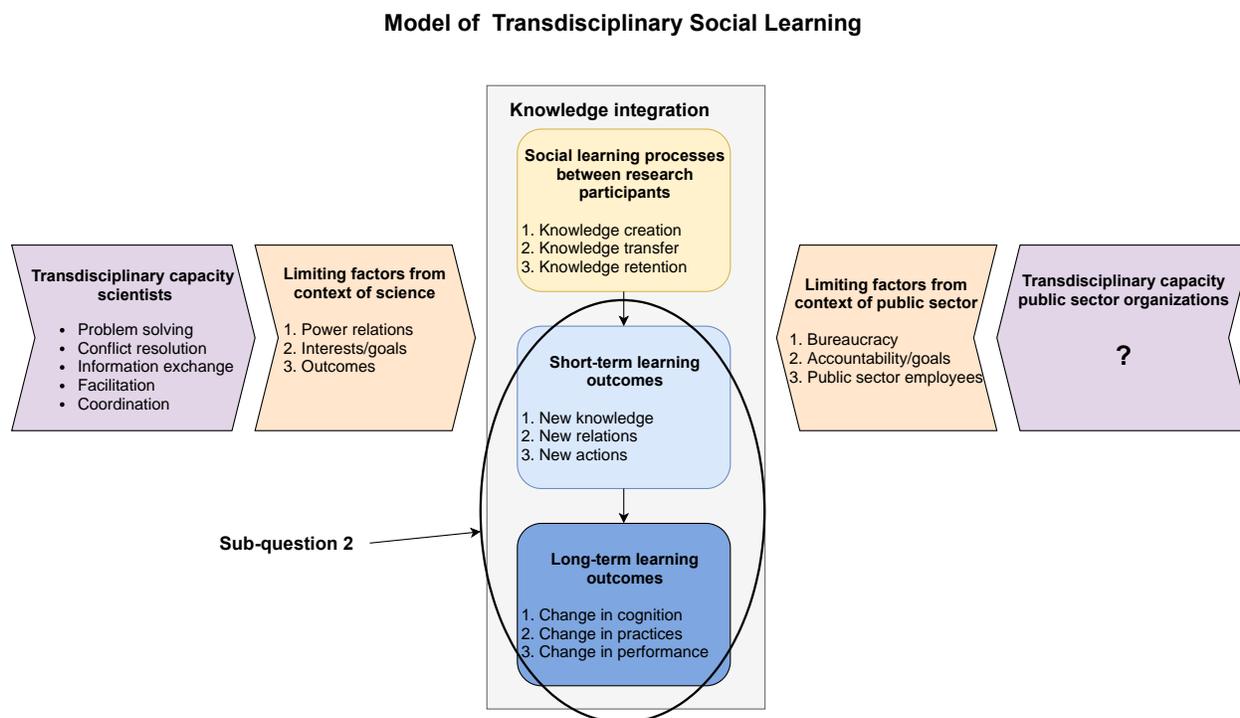
These examples from the Data Team Start workshop show the range of knowledge contributions from the participants to the workshop, including about the subject matter and about their own work activities, and it shows the application of that knowledge to the topic of the workshop. The other workshops were similar in nature; thus, this shows that the planning and the interventions were successfully designed to follow the model of transdisciplinary social learning.

4.2 Do these processes lead to transdisciplinary social learning outcomes and the integration of transdisciplinary knowledge?

This section examines whether the transdisciplinary social learning processes that took place during the empirical research led to social learning outcomes and the integration of transdisciplinary knowledge. Here I examine whether the short-term and long-term social learning outcomes described in the model of transdisciplinary social learning are realized during this case study. These short-term social learning outcomes are new knowledge, new relations, and new actions, and the long-term social learning outcomes are a change in cognition, practices, or performance. It is these long-term social learning outcomes that indicate the integration of the developed transdisciplinary knowledge into the realm of practice.

Figure 10

Area of transdisciplinary social learning model examined in Section 4.2



4.2.1 Short-term social learning outcomes

In this section, I examine how the short-term outcomes of social learning were able to be realized as a result of the social learning processes that took place during the workshops. These short-term social learning outcomes are new knowledge, new relations, and new actions.

4.2.1.1 New knowledge

The first of these short-term social learning outcomes is new knowledge, defined simply as knowledge that is new to a unit (Argote & Miron-Spektor, 2011). What I found is that a range of new knowledge was able to be created during these workshops, including awareness, knowledge about substantive topics, knowledge about new work processes, and knowledge about the tools themselves. This full range of new knowledge was able to be created during the workshop with the Checklist Sharing Data Together, thus I use this as an example, although similar knowledge outcomes were realized in all of the workshops.

During this workshop, participants from the municipality of Amersfoort, the municipality of Gouda, the province of Utrecht, and the RIVM discussed the questions on the Checklist Sharing Data Together in relation to the municipality of Amersfoort's data-sharing project, the Digital Twin. One of the most frequently mentioned learning points during this session was related to the ethical side of data-sharing projects. Participants mentioned gaining awareness about "whether privacy and ethical points of attention are involved" (Participant 9). During the workshop itself, a discussion arose about using Privacy Impact Assessments (PIAs). The tool recommends using a PIA during data-sharing projects, but some participants were not familiar with what a PIA was. One participant from the municipality of Gouda shared his experiences with using PIAs, remarking, "We always use a PIA questionnaire, and we always consult with a lawyer to check whether an extensive PIA is really needed. If so, we will do that in consultation with the legal department" (Field Notes D). What participants also mentioned as a learning point from this workshop was how to use the structure of the Checklist during projects, with one participant mentioning, "I found the Checklist helpful to go through. I recognize most things, but I think it is good for projects to go through these points together to have a shared picture" (Participant 7). This shows that participants found the Checklist useful as a method for approaching data-sharing projects. The final type of new knowledge that was created in this session was about the tool itself, as one participant mentioned, "It was important for me to attend this session so that I have a better idea of the Checklist Sharing Data Together. How this works in practice and what it looks like. I now have a better picture" (Participant 8).

This range of new awareness, new substantive knowledge, new process knowledge, and new knowledge about the tool itself that was created during the workshop Sharing Data Together

was comparable to the outcomes of the other workshops and demonstrates the range of new knowledge that was created as a result of these social learning processes.

4.2.1.2 New relations

A second short-term outcome of social learning is new relations. New relations can include new identities, new roles, or new relationships (Slater & Robinson, 2020). These new relations are caused by knowledge transfer between individuals, which is a type of indirect learning where one person's experience affects the experience of another (Argote et al., 2000) and that often occurs at a boundary (Argote & Miron-Spektor, 2011). In this section I demonstrate how new relations were able to be realized during the workshops by looking at how participants shared and were affected by each other's experiences. This anecdote from the Dashboard workshop at the municipality of Amersfoort provides an example of how participants shared their experiences with each other to develop new relations.

Participants to the workshop were dashboard-builders from different departments and teams within the organization. During the session, they shared their experiences and discussed the extent to which these experiences were similar to or different from each other's. When discussing the similarities, participants really liked hearing that, although they came from different departments of the organization, they encountered similar challenges and employed similar approaches. One participant wrote of his experience, "It was especially nice for me to share experiences. I'm in a different place in the organization than almost everyone else who works with dashboards (and data in a broader sense), so I don't often find myself talking to them about their experiences. For example, it was good to hear how well the data provision and dashboards seem to be in order at the Living Together Department" (Participant 3). Another participant mentioned, "In particular, the gathering of like-minded colleagues was the most valuable thing about this workshop for me" (Participant 4).

However, during this exchange of experiences, the participants also encountered differences in their experiences as dashboard builders, such as in this remark from a participant, "I noticed that the starting points differ per department. For example, the Information Provision Department appears to see dashboards much more as 'objective,' while our department is also very much involved in the interpretation of the figures" (Participant 1). The participants also expressed ways in which they were affected by

hearing about the experiences of the other dashboard builders. For example, one participant remarked, “I found it interesting to learn that an analyst from another department also attends policy advisor meetings where dashboards were used. It seems valuable to me as an analyst to join these types of meetings more often to support the correct interpretation of the data” (Participant 4).

These examples illustrate how the participants to the Dashboard workshop were able to share many of their experiences with each other. This sharing of experiences led participants to feel supported in their own work or triggered to change some of their own work processes based on this exchange. Since knowledge transfer, which builds new relations, is how one unit is affected by the experience of another, this example demonstrates how knowledge was able to be transferred in these workshops, leading to new relations between the participants. This was also the case for the other three workshops, where participants also reflected on each other’s experiences.

4.2.1.3 New actions

A third short-term outcome of social learning is new actions. According to Slater & Robinson (2020), new actions are “collective approaches to shared challenges generated by transdisciplinary (TD) coproduction effort” (p.6). In this section I show how the workshops were able to lead to planned new actions or new approaches for the participants. One example of participants making new plans for action as a result of the social learning process came from the workshop with the Meaningful Digital Collaboration Tool.

Participants to this workshop were all from one team within the municipal organization of Almere. They participated in the workshop as part of their team-building day with the goal of learning about each team member’s preferences for digital working and using these preferences to make new arrangements for hybrid working in the future. One member of the team was responsible for taking notes on the discussion points as well as the ideas that the team came up with for their new hybrid work arrangements (Field Notes E). In this way, the team hoped to retain the knowledge discussed in the workshop to use in the future for new actions. Several team members expressed elements that they hoped to see in their future work situation, and one of these was to have less meetings (Field Notes E). Additionally, they wanted to schedule in more activities where they could meet each other “live” so that they could revive the team feeling that they missed while working from home, for example, planning in live coffee moments, pubquizzes, or bike rides (Field Notes E). An

additional action that they planned to take during the digital workday was to give quieter members of the team a larger voice in meetings by “rotating the chairmanship of meetings” (Field Notes E). Other team members also planned to take individual actions, for example by “setting a block in which I turn off my phone so as not to be disturbed so that I can fully focus on my work” (Participant 16).

This example shows that the interactions that took place as part of the Meaningful Digital Collaboration workshop led to a host of planned new actions for the individuals in this team. This workshop exemplified a pattern seen in the other workshops as well, as the social learning processes that took place in all four workshops also led to plans for new actions.

From these illustrations of the social learning processes that took place during the workshops, we can see that the transdisciplinary social learning that took place as part of this research led to the short-term social learning outcomes of new knowledge, new relations, and new actions for the involved participants. Whether these short-term outcomes were able to be translated into longer-term outcomes such as change in cognition or practices and therefore were able to be integrated into the broader social environment will be discussed in the following section.

4.2.2 Long-term social learning outcomes and the integration of transdisciplinary knowledge

In this paper I categorize the social learning outcomes of changes in cognition or practices as long-term outcomes, meaning that these outcomes are taking place over a longer period of time. They also involve a larger group of practitioners than just the participants to the workshops. Because the integration of transdisciplinary knowledge is the embedding of this knowledge in the realm of practice, these longer-term, group-level outcomes are indicators of transdisciplinary knowledge integration.

The literature on organizational learning often mentions the change in cognition, practices or performance as a way to operationalize organizational learning (Argote & Miron-Spektor, 2011), but because this research took place over a three month-time period, actual changes in cognition and practices were difficult to establish during this time period. Therefore, my analysis looks at potential changes in cognition and practices at the group or organizational level by examining organizational-level plans for these changes to take place. Due to the short timeframe of this research, changes in performance were not explored.

4.2.2.1 Changes in cognition

One of the long-term outcomes of social learning is a change in cognition. Cognition is measured by a change in knowledge (Argote & Miron-Spektor, 2011). Although this definition could also apply to the new knowledge created by participants as a result of the workshops, this section of the analysis looks at changes in knowledge outside the immediate participants of the workshops to look at a change in cognition in the larger group or organizational setting. This is more in line with an outcome that would translate to transdisciplinary knowledge integration.

Looking at planned changes in cognition for a larger group than the individuals who participated in the workshops is important for several reasons. First, the workshops in themselves were quite small, ranging from seven to eleven participants each. “Too bad we didn't reach so many people in the sessions,” mentioned Interview Respondent 4. Therefore, for the new knowledge to be integrated into the organizational environment, it was important for participants to plan ways to share that knowledge within the organization in the future. Here is an example of how participants to the Checklist Sharing Data Together workshop came up with informal plans for sharing their new knowledge within their organization.

The participants from the municipality of Amersfoort made several plans for how to share their new knowledge within their organization. One participant wrote in his response to the follow-up questions, “I didn't know this checklist yet, but I immediately brought it to the attention of some colleagues” (Participant 7). The organizers of the Sharing Data Together workshop at the municipality of Amersfoort also planned to pass on knowledge about the Checklist to any colleague or department in the organization that would like to start a data-sharing project. Interview Respondent 1 mentioned, “We are well known within the municipality of Amersfoort, we as a team, as the people who work with innovation and therefore know a lot about new technology and data, so departments call in our expertise if they want to do something in the field of technology and data. ... so we can also say, yes, this and that are good things to do and we also have a tool available for making agreements about the exchange of data. So, in that regard, I also hope that people know where to find us if they start doing this” (Interview 1).

This example shows that the participants made informal plans for how to share the new knowledge with colleagues outside of the group of participants who attended the Sharing Data

Together Workshop. Practitioners at the municipality of Amersfoort also planned to transfer knowledge about the Dashboard tool within the organization by making a written document.

As a result of the Dashboard workshop, Contact D planned to make a “knowledge document” about the learning points that were discussed during the workshop. Her original plan was to send the document to the workshop participants and their supervisors, but during the course of our interview, she remarked, “I’m also thinking that maybe I should expand that knowledge document... of course to dashboard builders or to a person involved in the front or back of dashboard building, but for example, at the communication department they will also build a dashboard around their customer contact center” (Interview 2).

This example shows that Contact D at the municipality of Amersfoort made plans to transfer the new knowledge in the form of a “knowledge document” to multiple other areas in the organization. Thus, the participants at Amersfoort made plans for sharing and transferring their new knowledge to other parts of the organization both through word-of-mouth and written documents. These plans to share the new knowledge within the organization can potentially lead to a change in the cognition of a wider group of individuals within the organization. This change in cognition in the larger group is a way for this knowledge to be integrated into the organizational environment. It is important to note that these plans for knowledge sharing and potential changes in the cognition of a larger group within the organization did not occur in every organization where a workshop took place. Only the municipality of Amersfoort and the municipality of Gouda had made these sorts of plans at the end of the research period.

4.2.2.2 Changes in practices

Practices are routines or tasks that are repeated over time (Argote & Miron-Spektor, 2011). Therefore, looking at changes in practices involves looking back at the new actions described in Section 4.2.1 to see if participants made plans to include them in routines or to repeat them within the organization. One example of how the outcomes of the workshops were being integrated into the routines of the organization can be seen at the municipality of Gouda.

This municipality planned to use the tools regularly within the organization and, to do this, trained an employee in the organization to be a “trainer” who could teach other employees about their use. Contact E planned for this trainer to lead future workshops with both the

Data Team Start Tool and the Checklist Sharing Data Together (Planning Session 16). The trainer participated in both the workshop with the Data Team Start and the workshop with the Checklist Sharing Data Together to learn about the tools and how a group session with them would work. Contact E and I also held a follow up session with the trainer to answer any additional questions. During this session, the trainer said he felt prepared to lead workshop sessions (Field Notes B). We discussed how this strategy would work within the organization and Contact E and the trainer decided to divide up the roles so that Contact E would be responsible for promoting the workshops and the trainer would be responsible for leading them (Field Notes B). Contact E described this arrangement by saying, "I like that very much because when there is a data project then I would rather participate in the project, and then I would have to supervise the process and I do not find it useful to do both, and certainly, yes [the trainer] he likes to lead sessions and he is good at it too. So I also think it's useful that you could invest this kind of tool with someone who likes to do that. And who also has a bit of a feel for the matter" (Interview 4).

This strategy of finding a trainer within the organization who would then teach others to use the tools as part of each data project shows a plan for changing the practices in the organization. The first new practice then that is planned to take place is that the trainer will lead workshops in the organization. This planned practice means that the knowledge about the tools can continue to be transferred in the organization on a routine-basis, which means that the use of the Data Team Start tool and the Checklist Sharing Data Together could become a second new organizational practice.

Both of these practices, teaching others about the tools and using the tools themselves, can lead to the knowledge from the workshops being retained and transferred in the organization on a long-term basis. This long-term retention and transfer is the equivalent of this transdisciplinary knowledge being integrated into the organization. Thus, in the organizations where they have planned changes in cognition and practices, they have also planned to integrate transdisciplinary knowledge in their organization. The municipality of Gouda is the only organization that made plans for a change in practices as a result of this research.

Table 6*Social learning processes and outcomes per organization*

	Municipality Gouda	Municipality Amersfoort	Municipality Almere	Province Utrecht	Province South Holland	Municipality Zuidplas
Social learning processes						
Workshop	✓	✓	✓			
Short Term Outcomes						
New knowledge	✓	✓	✓	✓		
New relations	✓	✓	✓			
New actions	✓	✓	✓			
Long term Outcomes						
Change in cognition	✓	✓				
Change in practices	✓					

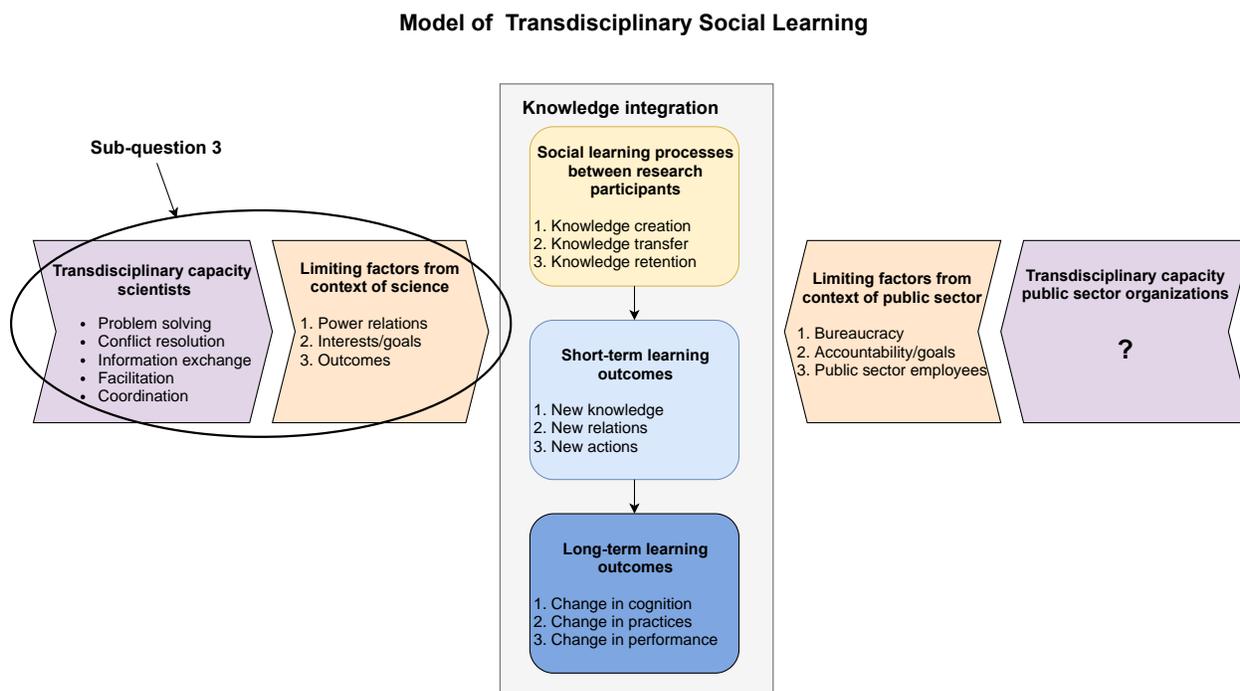
Table 6 gives an overview of the social learning processes and outcomes of transdisciplinary social learning that were able to be realized in the various organizations of the Datawerkplaats. The following sections discuss what factors might have limited these processes and outcomes from taking place in the various organizations.

4.3 How do factors from the scientific context limit transdisciplinary social learning and how can a transdisciplinary capacity of scientists overcome these limitations?

This section examines whether factors from the scientific context limit transdisciplinary social learning processes and outcomes. It also explores whether I was able to overcome these limitations by demonstrating a transdisciplinary capacity. The literature on transdisciplinarity predicts that differences in power relations between scientists and practitioners, differences in interests and objectives in carrying out the research, and differences in preferred outcomes for science and practice will hinder transdisciplinarity (Hanssen & Polk, 2018; Jahn et al., 2012; Klein, 2004; Pohl et al, 2017; Schmidt et al., 2020). This section of the analysis explores how these limitations played a role in this case study of transdisciplinary social learning and how I was able to employ a transdisciplinary capacity to overcome them when they did appear.

Figure 11

Area of transdisciplinary social learning model examined in Section 4.3



4.3.1 Tensions related to roles and power relations

One aspect of the scientific context that may limit transdisciplinary social learning is the power imbalance between the traditional role of the scientist versus that of the societal research participant. In this section I explore whether this tension between the traditional role of the scientist

versus the equal collaboration between scientist and societal actor required by transdisciplinarity was present in this research and whether this tension limited the processes and outcomes of transdisciplinary social learning. I also explore whether I was able to overcome this limitation using the skills described in the literature as transdisciplinary capacity, including problem solving, conflict resolution, information exchange, coordination, and facilitation.

While carrying out the empirical research, I found that there was a tension between what the research participants expected from participating in a workshop with a scientist versus the kind of interaction that we had designed to follow the model of transdisciplinary social learning. This example from the Dashboard workshop illustrates that tension.

In the Dashboard workshop, eight participants reacted to the statements in the tool by sharing their own experiences about building dashboards and engaged in a lively discussion about the topics of interpreting data and the use of dashboards in policy making (Field Notes A). However, several elements of the feedback that I received at the end of the session were about participants' expectations for what a workshop with a researcher should have been. One respondent wrote, "Due to the structure of the session, most of the information shared came from internal colleagues. I would have found it interesting to receive more information about this subject from the Data School (e.g. what are your findings at other municipalities and what is known from research?)" (Participant 4). This shows that Participant 4 was expecting scientific knowledge to take priority over practitioner knowledge during the workshop. Even my primary contact in the organization, who expressly designed the workshop to enable this knowledge sharing, said afterwards, "I personally thought it was valuable to have the dialogue, but the other way around I do have the idea that people want to attend a workshop as a kind of lesson material that they learn from, that tells them 'if you build this, do it then so and so and pay attention to this' and they'd like examples of what went well but especially examples of where things go wrong" (Interview 2). She went on to explain that practitioners are used to attending trainings where they receive printouts with attractive graphics and steps to follow and then they listen to a lecture (Interview 2).

This feedback from participants after the workshop shows that this tension between the traditional role of the scientist as an expert versus the equality between scientist and practitioner advocated by transdisciplinary research was present in this case study. This tension can be seen in

the workshop participants' expectations for what should occur in a workshop with a scientist. However, it appeared that this limiting factor was able to be overcome in that it did not prevent transdisciplinary social learning from taking place. Despite participants' expectations for what should occur in a workshop with a researcher, transdisciplinary social learning processes and outcomes were still able to take place in this organization, as demonstrated in Table 6.

One way I was able to overcome this difference in expectations about power relations and roles was by using several of the skills of transdisciplinary capacity, including information exchange and facilitation.

During the Dashboard workshop, the participants rated the different statements using Mentimeter. However, before I opened the discussion about each statement, I asked participants if they understood the statement or would like to share how they interpret the statement. Often, they asked me to further explain what was meant by a statement. I would then try to give a short explanation of the idea behind the statement as well as a possible example. For example, one statement read, "Decisions should be based on data." Participants asked me to explain this, and, to do this, I asked a follow up question, "Is it clear how decision-makers make decisions and what kind of input they use for those decisions?" I gave an example about how front-line workers might use their experience in the field in addition to data to make decisions (Field Notes A). This additional information helped participants to discuss the multiple kinds of inputs that can inform decision-making. My role in this example demonstrates the skills of information exchange and facilitation, because I gave more information about the scientific research that the statement was based on, and I also helped to steer the discussion through the use of a critical question which asked participants to consider other sources of input for decisions in addition to data.

These examples from the Dashboard workshop demonstrate, first, that there was a tension between what the participants to the workshop expected the role of the scientist to be versus the equal roles of scientists and practitioners in transdisciplinary work. However, these examples also show that this tension did not prevent transdisciplinary social learning from taking place, as social learning processes and outcomes were still able to be realized. I find that I was able to balance this tension by using several of the skills of transdisciplinary capacity, namely information exchange and facilitation.

4.3.2 Tensions related to interests and objectives of scientist and practitioners

In this section I explore whether a tension existed between the interests and objectives of the scientific and practitioner participants to this research and how these differences may have limited transdisciplinary social learning. I also explore how I was able to overcome these limitations by using elements of transdisciplinary capacity. One example where the interests and objectives differed between practitioners and myself was at the municipality of Almere.

In Almere, Contact A and I decided to try to link the use of the Meaningful Digital Collaboration tool with a specific program within the organization, Vital and Hybrid for the Future. I wrote a short informational text about the tool, and Contact A contacted one of her colleagues that worked with this program to try and generate enthusiasm. She explained the tool and its use, but after repeated attempts to find a link with this program, it appeared that this program was too busy with its own objectives to spend time on the Meaningful Digital Collaboration tool. Interview Respondent 2 described this difference in objectives by saying, “They have their own agenda, so at a certain point they work in sprints, they work in a scrum way, so they determine a goal for two weeks, each time. And that just wasn't in their goals, and it just wasn't in their project. Also, I don't think they understood it well enough either because I once had contact with the program manager of that team, and he just didn't understand it either, and that was because he didn't have time or he thought it was too abstract. So yes, again, it is very unfortunate but there has been a shortage of time, of people, of resources and there was already an agenda, and yes, then they go for their own thing” (Interview 2).

In this instance, my objective as a scientist was to have the existing tool adopted by a program within the municipal organization of Almere. Therefore, my objective was not to design a tool from scratch that might have fit better with the program's project plans, but to adapt an existing tool. In contrast, the practitioners in the Vital and Hybrid for the Future program were only interested in pursuing the objectives and goals of their existing agenda and were not willing to consider adapting an already-developed tool for their purposes. This difference in objectives between myself and these practitioners prevented the tool from being linked to a program within the organization. Thus, although a workshop with the Meaningful Digital Collaboration tool did take place in this organization, the long-term outcomes of a change in cognition or practices were not able to be realized because of this missing link to a program. No plans were made to further

transfer the knowledge developed in the workshop to other areas of the organization. This example demonstrates that these differences in interests and objectives limited transdisciplinary social learning.

However, in other organizations, I was able to balance these differences in interests and objectives by adapting the tools to the organization and using the transdisciplinary capacity skills of problem solving and coordination. An example of this comes from the Data Team Start workshop with the municipality of Gouda.

The municipality of Gouda had two goals for the workshop with the Data Team Start tool. The first was to train their trainer to lead workshops with the tool, and the second was to show employees within the organization how to use the tool (Planning Session 16). However, the objective of the tool, and therefore the scientific objective, was to help a data project team determine which employees and competencies are necessary at the beginning of a data project (Utrecht Data School, 2021). I was able to reconcile these differing objectives, those of the organization and those built into the scientific instrument, by adapting the tool and the workshop session to the organization's goals. Contact E and I decided that we would use a hypothetical project, the Vacancy Project, to give participants a feel for what it would be like to use the tool. This allowed us to follow the specific exercises of the tool such as the stakeholder analysis, the risk analysis, and the competencies challenge with a diverse group of participants from around the organization, thus fulfilling the scientific objectives of the tool. At the same time, this approach meant that these participants could all apply their knowledge to a project that they were not actually working on, the Vacancy Project, in order to understand the tool, which was their objective. This adaptation to meet both the scientific and organizational goals shows that I was able to use the transdisciplinary capacity skills of problem solving and coordination to balance these competing objectives and allow transdisciplinary social learning to take place. Interview Respondent 4 confirmed these skills when she said, "Yes, I'm happy with how that went. I think you handled that very neatly and that we also looked in advance at what we will do and what we will not do, because that was of course clear that it was not all going to fit in 1.5 hours, so I think that that has been fine and that we have also coordinated well with each other" (Interview 4).

This example from the Data Team Start workshop shows that, in this instance, I was able to overcome the limitation of having differing objectives from science and practice by adapting the scientific instrument to the goals of the organization. I did this using the transdisciplinary capacity skills of problem solving and coordinating.

4.3.3 Tensions related to the outcomes valued by science and practice

In this section I explore whether the participants from the municipal organizations valued different outcomes of the workshops than I did as a researcher, and whether this acted as a limiting factor for transdisciplinary social learning. I find that there was a tension between the outcomes that I valued as a scientist versus those that practitioners valued, and that this tension sometimes led to conflict. Below are two examples where this tension existed and where it appeared I was able to overcome this tension because it did not prevent transdisciplinary social learning from taking place. This first example comes from the planning of the Checklist Sharing Data Together.

Both the municipality of Amersfoort and the municipality of Gouda had chosen to work with the Checklist Sharing Data Together. From the first meetings with these organizations, they expressed an interest in learning from and connecting to other organizations during this process (Planning Session 9; Planning Session 16). We originally planned to hold separate workshops with the tool for each organization, but closer to the dates of the planned workshops, it turned out that both organizations had to cancel their workshops with the Checklist because of internal scheduling conflicts (Planning Session 15; Planning Session 20). Therefore, in the middle of May and close to the end of the research period, both organizations were struggling to find a new date and time for the workshop. I suggested that we could hold one combined workshop, as from my perspective, this would still achieve the desired scientific outcomes that both organizations would learn about the tool and they could connect with each other. Both organizations initially agreed to hold a joint workshop session. However, before the workshop, one organization contacted me to try to cancel the joint workshop and to hold their own separate workshop instead, because they feared sharing the workshop would waste time that could be devoted to their own project by having to explain the project to the other organization (Planning Session 14). I was able to resolve this conflict by setting boundaries about what was possible to do during the timeframe of this research (with the help of my supervisor), as well as making sure to include the desired outcomes of each organization in the design of the session. When I

asked Interview Respondent 4 about my approach to balancing these outcomes, she said, “Yes, I think that works best....Now you occasionally asked me [in the workshop], for example, ‘well, how is that in Gouda?’, and that is of course another track. I thought it was fine that you did that because that way you get the groups involved in the process.” Thus, it seems that I was able to balance these outcomes for the organizations. However, within the same interview, this respondent also seemed to criticize my compromise of addressing two separate goals during the same workshop, saying “But of course that actually costs some extra time. If you really want to do a session for a project then you don't want to carry that kind of ballast. Then you really want to focus on a project in order to be able to make good steps for that project. And I think that's the most fun and that also gives you more involvement in the session itself from the people who are there” (Interview 4).

This example demonstrates, first, that a tension existed between outcomes that were valuable to science versus outcomes that were valuable to practice. It also appeared that I was able to balance this tension between outcomes that were relevant for science versus those that were relevant for practitioners by using conflict resolution skills. However, even with these skills and balancing the outcomes wanted by the different organizations, there was a difference between the outcomes that practitioners said that they valued versus the outcomes that they actually valued when time was restricted. Although the organizations *said* from the beginning that they valued connecting with other organizations, when this outcome conflicted with outcomes that would benefit their specific organization, they tended to choose the outcomes that would benefit their own organization.

This tension between outcomes that are valuable for science versus outcomes that are valuable for practice is also evident in the research that has been conducted by the Datawerkplaats itself. Over the past two-and-a-half years, most of the research time has been spent on conducting new research, rather than on following up and implementing the tools. This shows that new research is what is valued by science. However, my previous research evaluation of the Datawerkplaats collaboration showed that the partner organizations of the Datawerkplaats have all expressed an interest in having help with the implementation of the tools; therefore, they value the implementation and use of the tools as an outcome. The research that I conducted and describe in

this paper is an example of trying to balance this tension. I use the transdisciplinary skill of problem solving to find an innovative way to balance these two outcomes in this master's thesis research.

4.3.4 Overcoming these limitations by a transdisciplinary capacity of scientists

In this section I will explore how I overcame some of the limiting factors to transdisciplinary social learning from the scientific context by using the skills of transdisciplinary capacity. The literature describes transdisciplinary capacity as skills that scientists should possess to navigate the complexities of transdisciplinary research, including problem solving, conflict resolution, information exchange, coordination, and facilitation (Gray, 2008; Hoffman et al., 2017; Schuppenlehner-Kloyber & Penker, 2015). In the examples in the previous sub-sections, I demonstrated how I used several of these skills of transdisciplinary capacity to overcome these limitations. I will give a short summary below.

In the Dashboard workshop I overcame the limitation of power imbalances between scientists and participants by exchanging information with participants and facilitating the group discussion by asking questions and clarifying the tool. In the Data Team Start workshop I overcame the differences in interests and objectives between science and practice by problem solving with my contact at this organization and adapting the tool for the organization. For the Checklist Sharing Data Together workshop I was able to overcome the tension between the valued outcomes for science and practice by resolving the conflict between the organizations and myself. I was also able to facilitate the workshop to lead to outcomes that would be useful for both organizations and for myself as a researcher.

Overall, what these examples demonstrate is that the potentially limiting factors from the scientific context of transdisciplinary work were present in this case study about transdisciplinary social learning. However, through the design of my research and by demonstrating a transdisciplinary capacity by using several of the process skills recommended in the literature, it appeared that I was able to overcome these limitations in several instances to allow transdisciplinary social learning to take place. However, even though I conducted all of the research in this case study myself, and I therefore employed these same skills relatively consistently throughout the research process, the transdisciplinary social learning did not always lead to the same outcomes.

In fact, following the transdisciplinary social learning model and employing a transdisciplinary capacity led to a range of outcomes in the participating organizations. In several organizations, such as the province of Utrecht, the municipality of Zuidplas, and the province of South Holland, we were not able to organize any workshops, although participants from the province of Utrecht participated in workshops at other municipalities. Thus, transdisciplinary social learning was not able to take place in these organizations. In other instances, such as the meaningful Digital Collaboration Workshop with the municipality of Almere, the transdisciplinary social learning processes only led to short-term social learning outcomes such as new knowledge, new relations, and new actions. In contrast, the Dashboard workshop and the Checklist Sharing Data Together workshop led to long-term outcomes such as a planned change in cognition at the municipality of Amersfoort, but not a planned change in practices, while this same Checklist workshop led to both a planned change in cognition and practices at the municipality of Gouda. Finally, the Data Team Start workshop at the municipality of Gouda led to long-term outcomes such as a planned change in cognition and a planned change in practices within the organization. That the outcomes varied so much while my transdisciplinary capacity as a researcher stayed the same throughout this research period led me to explore whether other factors might play a role in transdisciplinary social learning. In the following section, I examine whether the public sector context has its own set of limiting factors to transdisciplinary social learning and whether a transdisciplinary capacity of public sector organizations is also needed to overcome these limitations to lead to transdisciplinary knowledge integration in the public sector.

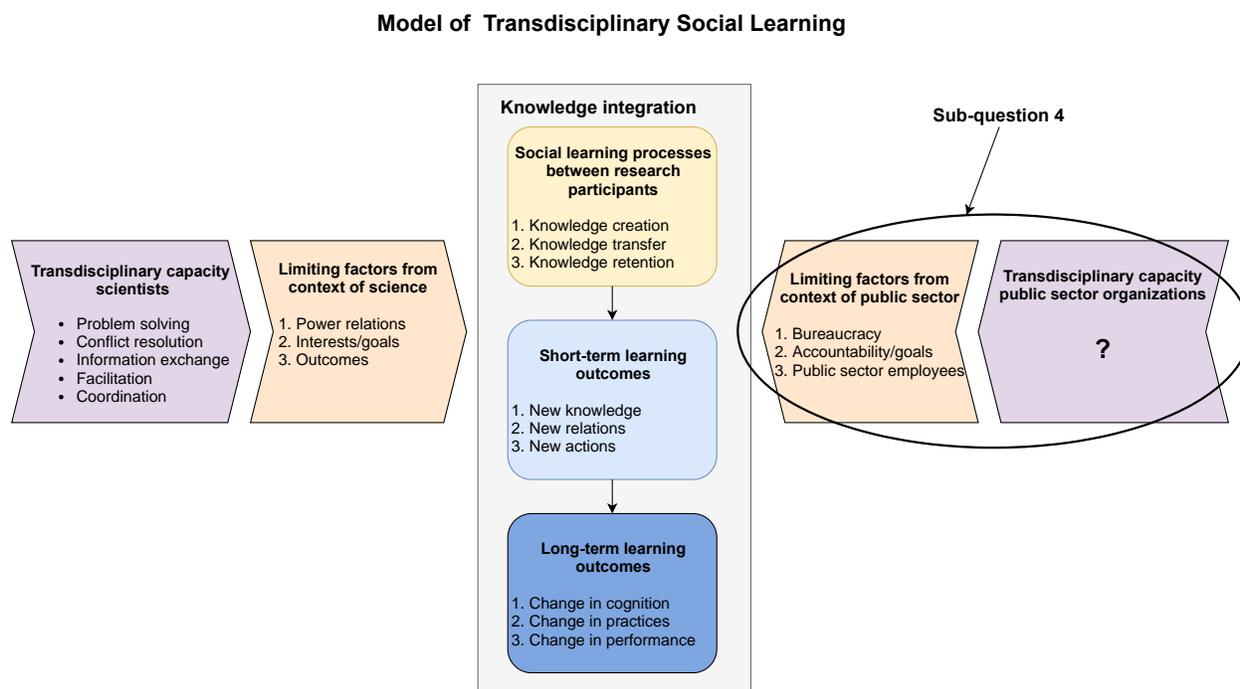
4.4 How do factors from the public sector context limit transdisciplinary social learning and how can a transdisciplinary capacity of public sector organizations overcome these limitations?

This section explores how elements of the public sector context limited the ability of transdisciplinary social learning to take place. The specific elements of the public sector context that I investigate include the bureaucratic nature of public sector organizations, the mixed accountability and goals faced by these organizations, and the specific qualities of public sector employees. This section also explores how these limitations were able to be overcome by a transdisciplinary capacity in public sector organizations.

I propose that public sector organizations also require a transdisciplinary capacity to engage in transdisciplinary social learning because, in this case study, the model of transdisciplinary social learning sometimes led to the integration of transdisciplinary knowledge in these public sector organizations and sometimes it did not. However, the factors that should contribute to or limit this integration related to the scientific context stayed relatively constant throughout the research, as I was the only researcher and I employed a relatively consistent skill set during this research. This would suggest that there were other factors that played a role in the integration of transdisciplinary knowledge in these organizations. This section examines how elements of the public sector context may have been responsible for the range of outcomes related to this transdisciplinary social learning.

Figure 12

Area of transdisciplinary social learning model examined in Section 4.4



4.4.1 Bureaucracy

In this section I explore how the bureaucratic nature of public sector organizations might limit transdisciplinary social learning. I find that this element played a role in the often slow decision-making process in these public sector organizations, which sometimes prevented transdisciplinary social learning from taking place. This slow decision-making process was especially evident in the organizations where workshops was not able to be organized.

An example of the delays caused by a slow decision-making process can be seen at the Province of South Holland. My first meeting at this organization was towards the end of March with a mid-level practitioner, Contact I. During this meeting, I explained the five tools of the Datawerkplaats to Contact I and he indicated interest in using several of the tools in his organization (Planning Session 24). Contact I planned to check with colleagues and come back to me with a decision about which two tools they would like to work with. After one month, a decision had still not been made, despite the follow-up emails and information I had sent about how other organizations were working with the tools (Planning Session 25). I scheduled a follow-up meeting with Contact I around this time,

and the decision was made to work with the Data Ethics Awareness Test. However, Contact I was still waiting to hear back from teams within the organization if there was interest in the Data Team Start or the Meaningful Digital Collaboration Tool in addition to the DEAT. Two and a half weeks later the decision was finally made that I would concentrate only on the DEAT tool within this organization. Overall, this decision-making process took 6.5 weeks and prevented work with the tools from taking place during the research period.

This example shows that a long time-period was needed to reach a decision about which tools to use within this organization. This slow decision-making process prevented transdisciplinary social learning from taking place in the province of South Holland during the research period. Examples from other organizations show that this limitation of a slow decision-making process was present in the other organizations as well. However, examples from the organizations that succeeded in organizing transdisciplinary social learning give additional insights into what contributed to this slow decision-making process and how these organizations overcame this limitation.

One example where this limitation was overcome comes from the municipality of Amersfoort. It appeared that this organization struggled to get decisions approved because of the layers of hierarchy in the organization when organizing workshops over the three months of the research period, as described by Interview Respondent 1.

“Yes, three months is quite short. Considering how many levels of decision-making things have to go through, for a data workshop, that's not a decision I can make on my own, or that Contact D can make on her own. That must be coordinated and agreed with others. And Contact D and I see each other very closely, but we also have to align with our supervisor. And he does not have the financing 1-2-3 available, so he is looking for where he can get the budget from, and this also needs coordination and agreement again, plus we try to fit it into a strategy for the coming years. So yes, I think for us three months is quite short and, especially if you want to bring groups together and make an agenda appointment, that is terrible, we always say do at least two months in advance... And I don't know if that is specific to Amersfoort, but it is necessary” (Interview 1).

This quotation shows the difficulty of navigating the bureaucracy within the organization of Amersfoort, including the difficulty of coordinating and getting permission from multiple layers

of the organization, which may also provide insight as to why the decision-making process was slow in other organizations. However, despite this limitation from the bureaucratic nature of the organization, the municipality of Amersfoort was able to organize two separate workshops within the research period. It appeared that this organization was able to overcome the limitations of bureaucratic decision-making because of the ability within the organization to work in a horizontal and multidisciplinary way, as described below.

“Well, what are factors that can contribute to the use of these tools? What I mentioned earlier, that has to do with an organization's ability to form multidisciplinary teams. And also the willingness to seek horizontal cooperation. So you have those silo's in the organization with sectors - civil affairs, taxes, living environment - but the point is that, at an organization-wide level, you have a group of people that says, 'yes, for this purpose I need people from such and such and that sector and I am going to put them together.' That is a multidisciplinary team and each member looks at the subject from his own angle. Because you also have political and administrative matters, for example, and that is very different from someone who technically works with that data and before you can get those people together, (luckily it is easier with us these days), but in many organizations those people often don't even know each other” (Interview 1).

This practitioner credits the success of her organization to engage in transdisciplinary social learning to the organization's capacity to work in a multidisciplinary and horizontal way. This capacity helps to overcome the limitations of the bureaucratic nature of public sector organizations.

4.4.2 Conflicting accountability and goals

The second element of the public sector that I investigated as a possible limitation to transdisciplinary social learning was the mixed accountability and goals that public sector organizations face. Public organizations face increased pressure, especially because of the public scrutiny and expectations that they are subject to (Rainey et al., 1976). This mixed accountability can lead to conflicting goals as well as a risk-averse organizational culture (Boyne, 2002; Bozeman & Kingsley, 1998; Rainey et al., 1976). I find that having this mixed accountability and conflicting goals limited transdisciplinary social learning in these public sector organizations. An example of this limitation comes from the municipality of Almere.

The municipality of Almere worked with the Meaningful Digital Collaboration tool. Contact A and I tried to generate enthusiasm and interest in the tool within the organization. I wrote a text about the tool to be distributed in a newsletter and on the intranet, Contact A collected quotes from team leaders who had already worked with the tool, we tried to find a trainer within the organization, and we tried to link the tool to a program within the organization, Vital and Hybrid Towards the Future. As described earlier in the paper, this link with the program Vital and Hybrid Towards the Future was not able to be realized, as described by Interview Respondent 3, “It really just rested on, look, when you do something like that you want to connect with a movement in the organization and, of course, we had a Vital and Hybrid Towards the Future team, and it would have fit very nicely there, but they already had their own agenda and they found it interesting, but they didn't adopt it. So that was a shame. If they had adopted it, then we would have gone further. In the meantime, there have been three teams that have worked with the Meaningful Collaboration tool, haven't they? Yeah, so I think I devoted three or four emails to this and talked about it with my colleague who's on the Vital and Hybrid team, but you know, and we didn't get any further, and then I thought, well, just stop. And that's just a bit of a shame that, despite all our effort, we haven't been able to secure it within the organization. But, yes again, that's not because of you and I think also not because of me either, but comes down to the moment, the available people, so, that all fell not quite in the right place” (Interview 3).

In the previous section, I discussed how this program's goals deviated from my own as a scientist. But what I want to highlight in this example is that in addition to these differences, there were conflicting goals within the organization itself, namely one goal of working with the Datawerkplaats tools and the separate goals of the Vital and Hybrid Towards the Future Program. This program was not willing to deviate from its own goals, which created a goal conflict. As Interview Respondent 3 described, this meant that the tool was not able to be linked to a program within the organization, which prevented the knowledge from being integrated within the organization.

This limitation did not prevent all organizations from realizing transdisciplinary social learning, even though most organizations had similar experiences with conflicting goals and high work pressures. It appeared that one way that organizations overcame this limitation was by giving

the responsibility of organizing these processes to a specific program or team within the organization. The municipality of Amersfoort was one organization that faced the limitation of having multiples goals and levels of accountability as well as a very high work pressure. However, this organization managed to overcome these limitations by giving the responsibility for organizing the work with each tool to a specific team and program within the organization.

This was described by Interview Respondent 2, who remarked, “Yes, I do think it works very well because you did indeed discuss with the three of us and inform us about what tools there were, and this was where we could choose something, and I think it was clear that Contact B, like me, really felt responsible for those subjects, you understand? Then you can really choose one of those tools of which you think, ‘yes, this is really useful to talk about this with each other.’ Instead of our supervisor choosing it, which he is also able to do, but he is a higher-level boss, and then it becomes further from the person who has to perform it. Then it becomes a little more difficult because he [our boss] does not see completely how it can be used, do you understand? While now, like Contact B, she has chosen one [tool] that she herself immediately had an idea of, ‘yes that is very good, we are also working on that, then I at least know that those colleagues participate.’ I thought that myself with those dashboards, and I think that indeed has to do with the position, with our position and the responsibility, so that it is useful not only to have a manager that is ultimately responsible for it at the first meeting, but also people who are a little closer to the implementation and that they may choose” (Interview 2).

In this organization, the responsibility or ownership by a specific program or team within the organization appeared to help navigate the conflicting goals and pressures in the organization that limited transdisciplinary social learning from taking place in other organizations. Giving one program responsibility for the Datawerkplaats tool prevented this work from becoming just another conflicting organizational goal and helped to align the transdisciplinary social learning goals with the program’s existing goals. This demonstrates that ownership by a team or program within the organization may help to overcome this limiting factor from the public sector context.

4.4.3 Public sector employees – PSM and turnover

The third public sector element that I examined is related to the characteristics of employees in the public sector. According to Boyne (2002), public sector employees will have less

organizational commitment, resulting in higher turnover rates, but more public service motivation. What I found is that these limiting factors related to public sector employees played a role in transdisciplinary social learning. The high turnover rates that plague public sector organizations appeared to prevent transdisciplinary social learning from taking place in some of these organizations. One example comes from the municipality of Almere.

In Almere, one employee who worked as a career counselor had been chosen to become a trainer for the Meaningful Digital Collaboration tool within the organization. He had been in touch with a researcher from the Datawerkplaats previously and had attended an informational session about the tool. I met with this employee to discuss training him in its use, but he informed me that he would be leaving this job and could no longer take on this responsibility (Planning Session 3). This occurred because the organization was downsizing from three career counselors to one, and therefore the employee who had the most time in his schedule to take on this trainer task also feared that he would be the one let go, as explained by Interview Respondent 3. “One person will fall away...so he is therefore looking for another job...Yes, and this change is intended to happen...so I can imagine that it is difficult for him to commit to something like this [training]” (Interview 3).

In this organization, the entire strategy for transferring the knowledge of the tool to the organization depended on one employee functioning as a trainer. When this employee decided to change jobs right before the scheduled workshop, this strategy fell through. This example shows that employee turnover in the organization can be a limitation for transdisciplinary social learning, especially if it is dependent on one employee. The remaining career counselors in the organization did not have time in their schedules to take on this task. This high work pressure and lack of time to complete their tasks was mentioned by respondents in all of the organizations (Field Notes B; Field Notes E; Field Notes F; Interview 1; Interview 3; Interview 4). Additionally, the tasks related to datafication and data-driven working often fell outside of employees’ official responsibilities, adding to the already high work pressures (Interview 3; Interview 4).

For these overly busy public employees, it appeared that their public sector motivation initially helped the transdisciplinary social learning processes to take place. Many employees participated in the Datawerkplaats work outside of their normal tasks and responsibilities because they had an interest in the topic or wanted to contribute to change in the organization, showing they were motivated by factors other than money. For example, Interview Respondent 4 wrote,

“Yes, that's something extra. Actually that whole part of data-driven working is something extra and for me the Datawerkplaats falls under this, data-driven working, helping the organization with that, all of that comes in addition to my job as a researcher, and that is the work I normally do and that I was hired to do, that just goes on as usual. In the past there were about two of us for that [research] and nowadays I'm the only researcher and this data-driven working is an extra task” (Interview 4).

However, this reliance on public sector motivation meant that the employees were often over-stretched by these tasks which they took on outside of their assigned tasks – which in some organizations meant that they could not always find time for meetings or to attend the workshops. Employees seemed to miss direction from their organization on how they should fit these extra tasks into their schedules.

“Well, with us, I do notice that it's very random, such as, ‘Are you going to do this?’ then, ‘Yes, you are going to do that.’ But little is said about ‘Yes, we see this as part of your job, so we want you to do that.’ We don't do that within our organization” (Interview 3).

Thus, for over-burdened public sector workers, their public service motivation allowed them to take on extra tasks and responsibilities such as transdisciplinary social learning. However, this public service motivation seemed to only carry them so far, as they still ran into a shortage of time and capacity in their schedules. The organizations that were able to successfully carry out transdisciplinary social learning seemed to overcome this limitation by having a strategy from the top of the organization that gave priority to these tasks related to transdisciplinary social learning. It is significant that the municipality of Gouda was able to find an employee who could make time in his schedule to be a trainer for these tools. The organization ensured that this new practice of training an employee within the organization to lead workshops would take place because of an organization-wide strategy for data-driven working.

Contact E shared a vision document that she wrote with me, which has been approved by the direction of the organization, which explains the organization's plans to systematically approach data-driven working (Document A). This “concrete plan” (Interview 4) contains three tracks for how to build the capacity of the organization to work in a data-driven way. The first track labelled “Concrete themes are leading in data projects” contains a recommendation for employees to use the Data Team Start and the Checklist Sharing Data

Together at the start of all data projects or data collaborations with other organizations (Document A; Interview 4). Although the tools' use is recommended, not mandatory, it is interesting to note that there seemed to be widespread knowledge about this document within the organization as multiple workshop participants from the municipality referred to it as either "our manual for working with data" (Participant 8) or "the protocol for data project methods" (Field Notes C).

This strategy for data-driven working within the municipal organization led to employees being willing to participate in workshops about the tools as well as to invest time in leading workshops as a trainer.

In conclusion, the high turnover rates of public sector employees and the public service motivation of employees were both factors that limited the ability of transdisciplinary social learning to take place. Although public service motivation appeared initially to help transdisciplinary social learning in the short-term, the overly full schedules of public employees reached a point where they were too busy to be overcome by this motivation. Organizations that were able to overcome these limitations appeared to do so by having a strategy from the top of the organization that gave priority to the tasks around transdisciplinary social learning.

4.4.4 Overcoming these limitations by a transdisciplinary capacity of public organizations

In the previous sub-sections, I demonstrated that several characteristics of the public sector could limit the ability of transdisciplinary knowledge to be integrated by limiting the ability of transdisciplinary social learning to take place. However, I worked with six public sector organizations, and these limitations did not prevent transdisciplinary social learning in all cases. What I found was that these characteristics of the public sector did not completely prevent transdisciplinary social learning, but they did seem to increase the difficulty of accomplishing it. By looking at the successful instances of transdisciplinary social learning, I was able to distill a set of factors within the organizations which appeared to help overcome these limitations of the public sector context. These organizational factors include the ability to work horizontally and in a multidisciplinary way, ownership by a program within the organization, a fit with the organization, and a strategy from the top of the organization. The literature on transdisciplinarity specifies a set of skills that scientists need to be able to overcome potential limiting factors from the scientific context in the integration of transdisciplinary knowledge and calls these skills "transdisciplinary capacity" (Klein, 2004). I therefore classify the factors that help the transdisciplinary social

learning processes take place in these public sector organizations as the “transdisciplinary capacity” of public sector organizations. I discuss these factors in greater detail below.

Table 7

Transdisciplinary capacity of public sector organizations

1. Ability to work horizontally and in a multidisciplinary way
 2. Ownership by a program within the organization
 3. Organizational fit
 4. Strategy from the top of the organization
-

The first element of the transdisciplinary capacity of public sector organizations is the ability to work in a horizontal and multidisciplinary way. As illustrated in the example from the municipality of Amersfoort in section 4.4.1, this ability to work in a horizontal and multidisciplinary way helped their organization overcome the limitation of bureaucratic decision-making that plagued several of the other organizations. Because of this ability, they were able to make the necessary decisions to plan and carry out two workshops during the research period, enabling transdisciplinary social learning to take place within their organization.

The second element of the transdisciplinary capacity of public sector organizations is ownership of the transdisciplinary social learning by a specific program or team within the organization. This ownership and responsibility by a specific program in the organization appeared to help overcome the conflicting goals present in these public sector organizations, because it gave those employees closest to the goals the responsibility of carrying out the transdisciplinary work. This was demonstrated in the example from the municipality of Amersfoort in section 4.4.2, where mid-level employees took responsibility for the transdisciplinary social learning. These mid-level employees chose which tools they would work with, and this helped them align the tools with their program and organizational goals. The absence of this ownership within an organization, such as at the municipality of Almere, appeared to prevent the long-term outcomes of transdisciplinary social learning from taking place.

The third factor that helped these organizations realize transdisciplinary social learning and the broader integration of the tools within these public sector organizations appeared to be related to the fit with the specific organization. Contact B drew attention to this organizational fit as a

factor that was missing from my initial findings during the group session, remarking, “All municipalities are at a different phase in the development process with data” (Field Notes F). What this points to is the need for organizations to align the phase of their development process with their goals for transdisciplinary social learning so that the transdisciplinary social learning fits with their organization.

This factor could help explain why the municipality of Zuidplas did not end up participating in this transdisciplinary social learning process, as they explained in their first meeting that they were in the stage of walking in “children’s shoes” with data-driven working and were not yet ready to start data projects where these tools could be implemented (Planning Session 27).

The municipality of Zuidplas recognized that it was not yet ready to integrate the knowledge of the tools into their organization because of the stage they were in of their data-driven work development. They focused their attention instead on other transdisciplinary work with researchers of the Datawerkplaats. This is in contrast to organizations such as Amersfoort and Gouda where they already had small groups within the organization that regularly experimented with new ways of organizing data-driven working. These organizations approached our collaboration from the stance of wanting to systematize how the organization structurally approached data-driven working, which matched with the goals of the transdisciplinary social learning around the tools of the Datawerkplaats.

The last element that I classify as part of the transdisciplinary capacity of the public sector is having a top-down strategy for how the outcomes of transdisciplinary social learning should be used and retained within the organization. Having this strategy appeared to improve the ability of organizations to navigate the bureaucratic decision-making process and allocate the organizational resources necessary for this transdisciplinary learning process, which were obstacles for other organizations that lacked this top-down strategy. Both the organizations of Amersfoort and Almere mention that they missed having a top-down strategy in their organizations, as a strategy for data-driven working had not yet landed at the level of the direction in either organization.

The Smart City Program in Amersfoort, one of the programs which took ownership of the work with the Datawerkplaats and which is now in the portfolio of Governance, Strategy, and Security, is in the process of changing to the portfolio of the Chief Information Officer

(Interview 1). It is hoped that this move will provide a structural place within the organization for its programming, including data-driven working (Interview 1). However, because this is still in development, the Smart City Program feels less secure of how it fits into the organizational strategy and has less access to organizational resources because of it. "Data-driven working is a development, and so far, it has had little priority at management level, so little money has been made available, which is why there are actually fewer people there than you would need. This also makes it very difficult for us to keep track of the agenda and that we constantly have to balance what we do and what we don't do" (Interview 1).

This lack of a top-down organizational strategy for data-driven working limits the ability of transdisciplinary social learning to take place, as in the municipality of Amersfoort where this lack of strategy limits the resources available for this kind of work. This is in contrast to the municipality of Gouda, which was earlier described as having a top-down strategy.

The municipality of Gouda created a vision document for data-driven working within the organization over the coming years (Document A). This vision document outlined an organization-wide strategy for the next three years about what the organization hopes to achieve in terms of data-driven working (Document A). It provides a background of where the organization currently is in its path to data-driven working and recommends a set of three tracks for how the organization will achieve its goals for 2023. Because this vision document is approved by the direction, there was a broad awareness of it within the organization (Field Notes C; Participant 8). This contributed to members of the organization participating in the workshops and fitting these tasks into their schedules, as they felt these tasks were given priority by their organization. The trainer in this organization was also able to take on this task of leading workshops with the tools because of this strategy from the top of the organization (Field Notes B).

This example demonstrates how having a top-down strategy helps transdisciplinary social learning to be realized within an organization. The municipality of Gouda was the only organization to have this element of transdisciplinary capacity, this strategy, and it was the only organization where the transdisciplinary social learning led to planned changes in both cognition and practices within the organization.

In summary, I categorize several organizational elements as the transdisciplinary capacity of public sector organizations, including the ability to work in a horizontal way, ownership by a program within the organization, alignment with the phase of the organization's development, and the presence of a top-down strategy that supports transdisciplinary social learning. Just as the transdisciplinary capacity of researchers helps to overcome the limiting factors from the context of science, the transdisciplinary capacity of public sector organizations helps to overcome the limiting factors to transdisciplinary social learning from the public sector context.

Chapter 5: Discussion

The previous chapter provided rich empirical illustrations of the data that I collected and analyzed during this research. These rich illustrations answered four sub-questions that guided my empirical research through the theoretical model of transdisciplinary social learning. I will briefly summarize the answers to these four sub-questions below before discussing my two main findings.

5.1 Following the model of transdisciplinary social learning through the empirical analysis

5.1.1. Do transdisciplinary social learning processes take place in this research?

The first sub-question examined whether transdisciplinary social learning processes took place in this research to establish whether the action research that I designed and executed fit the theoretical model's description of transdisciplinary social learning. The transdisciplinary nature of the action research can be seen in its co-collaborative and reflective qualities, as practitioners and I adapted the tools to the needs of the participating organizations. The workshops themselves can be considered productive social interactions because of the range of knowledge that participants contributed to the interactions as well as how they applied that knowledge to the shared tasks in the workshops. *Therefore, the answer to the first sub-question is, yes, transdisciplinary social learning processes take place in this case study.* Establishing this helped create a base from which to explore whether following the model of transdisciplinary social learning would lead to the proposed social learning outcomes.

5.1.2 Do these transdisciplinary social learning processes lead to transdisciplinary social learning outcomes and the integration of transdisciplinary knowledge?

The second sub-question explored whether the transdisciplinary social learning processes led to the proposed social learning outcomes and thereby the integration of transdisciplinary knowledge. In investigating the social learning outcomes, I divided them into short-term social learning outcomes such as new knowledge, new relations, and new actions, and long-term social learning outcomes such as a change in cognition or a change in practices. First, I found that all four workshops led to the short-term social learning outcomes described in the model. All four workshops led to a range of new knowledge being created, including new substantive knowledge, new process knowledge, and new knowledge about the tools themselves. I also found that all four workshops were able to lead to new relations between the participants, as participants shared experiences and reflected on the similarities and differences of these experiences. Finally, I found

that the workshops also led to plans for new actions for the workshop participants. While these short-term social learning outcomes were quite prevalent, the long-term social learning outcomes appeared less frequently.

The long-term social learning outcomes that were able to be achieved through these social learning processes were a planned change in cognition and practices. I found that both the Dashboard workshop and the Checklist Sharing Data Together Workshop were able to lead to planned changes in cognition for a larger group of employees within the organizations than just the participants to the workshop, as the participants made plans for sharing this knowledge within their organizations. However, only the municipality of Gouda made plans for a change in practices, as it organized a trainer to lead workshops with the tools. This planned new practice will help transfer the knowledge within the organization. This continued knowledge transfer was part of an organizational strategy for the tools to be used as resources to build the organization's capacity to work in a data-driven way. Thus, the continued use of these tools within the organization is also a planned change in practices.

An important aspect of the integration of transdisciplinary knowledge is its embedding in the organizational or socio-ecological environment. Therefore, these long-term social learning outcomes of changed cognition or practices at the organizational level are indicators of this knowledge integration. These planned long-term social learning outcomes, a change in cognition and practices, show that the integration of transdisciplinary knowledge will potentially take place in these organizations. *Therefore, the answer to this sub-question is, yes, these transdisciplinary social learning processes can potentially lead to long-term social learning outcomes and therefore transdisciplinary knowledge integration in these public sector organizations.*

5.1.3 How do factors from the scientific context limit transdisciplinary social learning and how can a transdisciplinary capacity of scientists overcome these limitations?

For the third sub-question, I explored how factors from the scientific context might limit transdisciplinary social learning and how a transdisciplinary capacity of scientists could overcome these limitations. The literature on transdisciplinarity alludes to contextual factors from the scientific environment that prevent transdisciplinary knowledge from being integrated. These factors are a power imbalance between the roles of scientist versus practitioner, a tension between objectives and interests of scientists and practitioners, and a tension between the valued outcomes of science and practice (Gray, 2008; Klein, 2004; Jahn et al., 2012; Pohl et al., 2017). What I

found was that these limiting factors from the scientific context were present in this case study, and, in some instances, they did limit transdisciplinary social learning. However, I also found that these limiting factors did not prevent transdisciplinary social learning from taking place. Although I did encounter elements of power and role imbalances, differences in interests and objectives, and tensions between the valued outcomes for science and practice, I also found that through the process skills advocated as part of “transdisciplinary capacity” (Klein, 2004), I could mediate these tensions. I was able to employ skills of transdisciplinary capacity such as problem solving, conflict resolution, information exchange, coordination, and facilitation to overcome the limitations of the scientific context of the work. *Thus, the answer to this sub-question is that, although factors from the scientific context can act as limitations to transdisciplinary social learning, having a transdisciplinary capacity as a scientist can help overcome these limitations.*

What I found while exploring this sub-question was that, although I used the same transdisciplinary skill set to conduct the research interventions within this case study, in some organizations transdisciplinary social learning did take place and led to social learning outcomes, while in other organizations it did not. I began my empirical work by meeting with the six organizations of the Datawerkplaats. This means that there was the possibility for twelve separate action research interventions to take place. However, only four interventions were able to be organized during the timeframe of this research, and from these four interventions, only two organizations were able to plan for the long-term outcomes of transdisciplinary social learning. Yet, I approached this research in all the organizations with the same transdisciplinary capacity, as I carried out all the research myself. Therefore, if my own capacity stayed relatively constant during all of the research interventions, it meant that I had to look elsewhere for an explanation of why these processes led to such a variation in the range of outcomes.

5.1.4 How do factors from the public sector context limit transdisciplinary social learning and how can a transdisciplinary capacity of public sector organizations overcome these limitations?

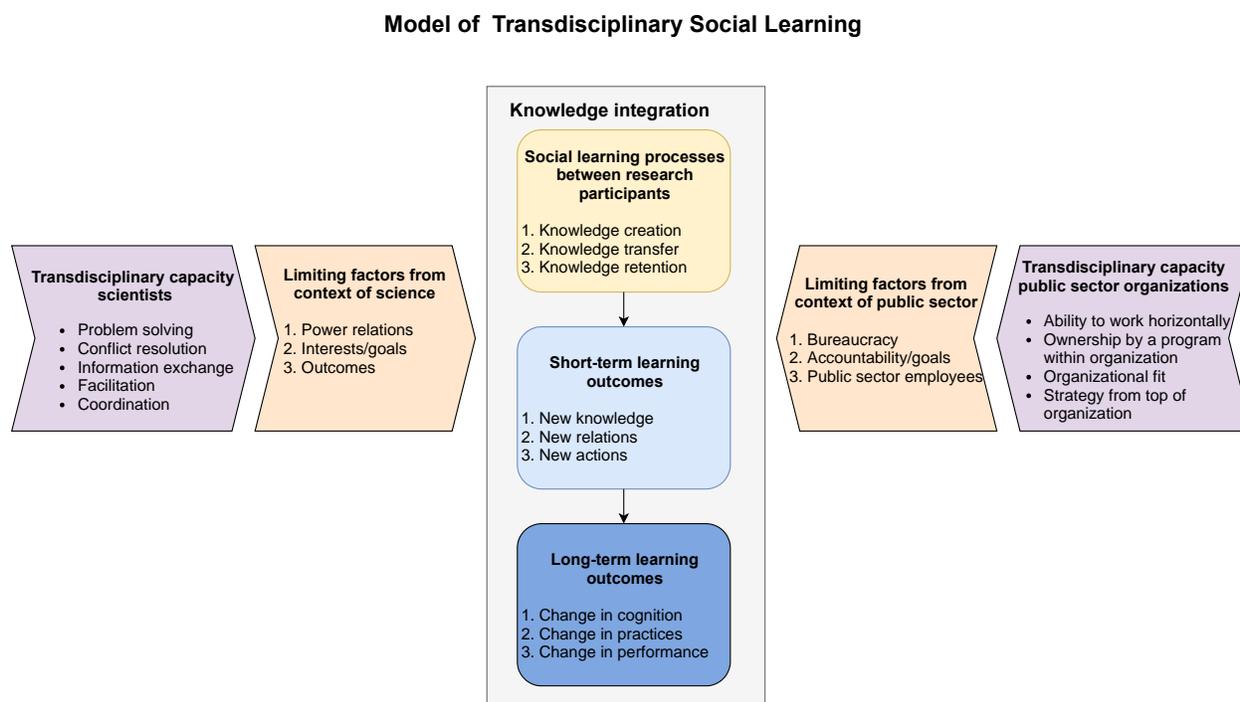
For the final sub-question, I explored whether elements of the public sector context might limit the ability of transdisciplinary social learning to take place and, if so, how public sector organizations can overcome these limitations. What I found is that the bureaucratic nature of decision-making in the public sector, the pressures of mixed accountability and conflicting goals in these public organizations, as well as the qualities of public sector employees in being highly

motivated to work in the public sector but less committed to a specific organization all presented additional challenges to transdisciplinary social learning. Therefore, I found that factors from the public sector context can act as limitations to transdisciplinary social learning

In some of the organizations, these limitations related to the context of public sector were able to be overcome. What I found is that organizations that were able to realize transdisciplinary social learning possessed a combination of capacities, including that they worked horizontally across the organization, gave ownership of the transdisciplinary social learning to a program within the organization, ensured an organizational fit by aligning the organization's goals with the goals of transdisciplinary social learning, and had a strategy from the top of the organization to support transdisciplinary social learning. Mirroring the existing work on the scientific side of the transdisciplinary social learning model, I combined these elements to propose a transdisciplinary capacity of public sector organizations. *Therefore, the answer to this sub-question is that factors from the public sector context can act as limitations to transdisciplinary social learning but having a transdisciplinary capacity as a public sector organization can help overcome these limitations.*

5.2 Applying these findings to the model of transdisciplinary social learning

Answering these four sub-questions led to a final model of transdisciplinary social learning, shown below in Figure 13. This completed model adds to my initial model of transdisciplinary social learning by affirming the limiting factors from the context of the public sector while also including specific elements of the transdisciplinary capacity that public sector organizations needed to achieve transdisciplinary social learning in this case study.

Figure 13*Final model of transdisciplinary social learning*

5.3 Significant findings

One significant finding from applying this model of transdisciplinary social learning to the case study of the Datawerkplaats is that the short-term, individual social learning outcomes appeared easier to achieve than the long-term outcomes. This could be considered a methodological problem because my research took place over a three-month period; thus, it is more likely that short-term outcomes could be seen during this timeframe. However, my analysis of the long-term outcomes of social learning looked at whether the organizations had made plans for transferring and retaining the knowledge outcomes on a long-term basis. While all four workshops led to short-term learning outcomes in the form of new knowledge, relations, and planned actions for the individuals who participated in the research, there were fewer examples of plans for achieving the long-term outcomes such as a change in cognition or practices at the group or organizational level.

Only two organizations seemed to make plans for these long-term outcomes. The first of these long-term outcomes was a change in cognition. The municipality of Amersfoort established two strategies for sharing the knowledge with employees in the organization who had not attended

one of the workshops: by plans for employees of the Smart City Program to pass knowledge about the Checklist Sharing Data Together on to others in the organization by word-of-mouth and by plans to distribute a knowledge document about the Dashboard workshop to employees in the organization. This shows that the organization made plans to change the cognition of a larger group of employees within the organization. Although these plans were made to transfer the knowledge to other areas of the organization, at the end of the research period there was not yet a plan to use this new knowledge in new practices or routines within the organization.

In fact, for the long-term outcome of a change in practices, only one organization was able to organize plans for new routines and new practices to take place the organization. The municipality of Gouda accomplished this by first enabling the knowledge about the tools to be transferred to a trainer in the organization who would continue to transfer this information to employees in the organization in the future. The municipality also linked the future use of the tools to an organizational strategy for data-driven working that was supported by the top of the organization. Linking the use of the tools to the data-driven work strategy in the organization seemed essential to establishing their use in new practices within the organization because it made resources within the organization available. Employees were aware of this strategy and chose to participate in the workshops because of it, and the trainer was also able to make time available in his schedule because leading these workshops became part of his organizational responsibilities. It is unlikely that the tools would be given this interest and priority without this endorsement by the organizational strategy.

Therefore, a significant finding of this research is the continued difficulty in achieving long-term social learning outcomes as a result of transdisciplinary social learning in public sector organizations. Although the transdisciplinary social learning model that I developed does provide a more detailed guide to the social learning processes and outcomes that should occur during the knowledge integration phase of transdisciplinarity, it does face limitations. These limitations include factors from both the scientific context and public sector context of the participants. Therefore, what I find is that *transdisciplinary knowledge integration remains difficult to achieve because of the complexity of the contexts where this transdisciplinary work takes place.*

This leads to the second significant finding of this research, that a transdisciplinary capacity is needed to overcome the limiting factors from both the context of science and context of the public sector. Although the literature on transdisciplinarity stresses the necessity of a

transdisciplinary capacity for scientists, the capacity of public sector organizations to support this kind of work is often overlooked. However, when looking at the organizations that achieved long-term social learning outcomes and transdisciplinary knowledge integration, this transdisciplinary capacity in their organization seemed to make the difference between achieving these outcomes or falling short. What this demonstrates is that researchers can possess a transdisciplinary capacity and do their work well but that they still will not be able to achieve transdisciplinary knowledge integration without a corresponding transdisciplinary capacity in these public sector organizations. *Therefore, I find that transdisciplinary social learning requires a transdisciplinary capacity of public sector organizations.*

A related finding is to what extent the whole organization needs to possess these elements of transdisciplinary capacity to achieve transdisciplinary social learning. In my analysis, I noticed that these elements of public sector transdisciplinary capacity also seemed to vary in their degree of prevalence within an organization. While horizontal working and ownership by a program could potentially be achieved by a smaller group within the organization, it appeared much more difficult to develop a top-down strategy within the organization without a more widespread organizational capacity. This can be seen in the smaller “club” within the municipality of Amersfoort that managed to carry out the transdisciplinary social learning described in this organization, versus the broad knowledge of the data-driven strategy within the municipality of Gouda that seemed to drive the transdisciplinary social learning processes in that organization. The organization of Amersfoort, in its ability to work horizontally and bestow ownership of the transdisciplinary social learning on a specific program in the organization was able to realize a change in cognition in parts of its organization, whereas the municipality of Gouda was able to achieve this planned change in cognition as well as a planned change in organizational practices by adding a top-down strategy to the mix. This could mean that organizations where these capacities only exist in specific programs or departments may be able to realize the shorter-term learning outcomes but might still struggle to achieve longer-term transdisciplinary social learning outcomes. Thus, achieving the processes and outcomes of transdisciplinary social learning to result in transdisciplinary knowledge integration asks for a transdisciplinary capacity of the whole organization, not just small pockets of individuals within the organization.

5.3 Limitations of this research

In this section I discuss the potential limitations to this research, including the limitations due to the timeframe and style of research, the causality of my findings, and the generalizability of my findings.

One limitation of this research is its timeframe. As this research was part of my master's thesis, I worked on this research from February 2021 through July 2021. However, the actual contact with these organizations took place during March, April, May, and the beginning of June. Although I examined both short-term and long-term outcomes of transdisciplinary social learning, the long-term outcomes that I analyzed were actually planned long-term changes, such as planned changes in cognition or practices of the organizations involved. Therefore, I cannot say based on this research whether these changes took place in these organizations, only that they are planned to take place. This limitation could be addressed by future research that investigates the integration of transdisciplinary knowledge by conducting longitudinal studies, for example, evaluating whether these planned changes do indeed take place over the next two years of the Datawerkplaats collaboration. Research with a longer timeframe might also be more in alignment with the schedules of these public sector organizations. Most of these municipal and provincial organizations struggled with aspects of bureaucratic decision-making. Therefore, organizations which were not able to organize transdisciplinary social learning during this three-month timeframe might succeed in organizing it given a longer period. Conducting this type of research over a longer period might give insight into additional limitations stemming from the public sector context or it could provide insight into whether additional transdisciplinary capacities are needed when bureaucracy is not the main obstacle to overcome.

Related to this limitation is the difficulty of conducting this type of participatory action research in public sector organizations. It turned out to be incredibly time-intensive, requiring four to eight planning meetings as well as many emails and other communications to organize each intervention in each organization. My original ambition was to carry out more interventions, and, although these did not take place due to limitations within these public sector organizations, it might not have been possible to carry out many more than four interventions in a three-month period because of how time- and contact-intensive it was for me as a researcher.

Another limitation of this research is causality. The elements that I assign to the transdisciplinary capacity of public sector organizations are distilled from the successful instances

of transdisciplinary social learning within this case study. Because of the explorative nature of this study, I cannot prove that these specific limitations and capacities cause the transdisciplinary social learning outcomes; I can only say that this mix of factors correlates with these outcomes. In general, explorative case studies are stronger at developing potential theories or hypotheses, rather than proving causality (Gerring, 2004). This limitation could be addressed in future research, for example, via comparative case studies, which could be conducted to establish more of a link between these factors and the integration of transdisciplinary knowledge.

The final limitation of this research is its generalizability. The findings of this case study cannot be directly generalized to all cases of transdisciplinary social learning because of the specificity required by the case study approach (Yin, 2011). My findings are very specific to local and regional government organizations in the Netherlands around topics of datafication. Generalizability is also a limitation of action research, in that the interventions are context-specific because of both the specific organizational environment where they take place as well as the involvement of the researcher (Eden & Huxham, 1996). This is what makes action research well-suited for theory development, but not theory testing (Eden & Huxham, 1996; Stringer, 2007).

What *is* able to be generalized from action research is the theory that is developed as a result (Eden & Huxham, 1996). Yin (2011) also recommends focusing on analytic generalization from case study research, which means focusing on how a case adds to or challenges existing theory and how this theory can then pertain to other situations. Following these recommendations, my research develops and adds to theory about transdisciplinary social learning in the public sector. It is this theory that can be generalized to similar contexts. Thus, my additions to theory about the processes of social learning that should take place during transdisciplinary knowledge integration, the difficulties of achieving this integration in the context of the public sector, and the need for a transdisciplinary capacity in public sector organizations are all elements of theory that can be generalized to other cases of transdisciplinary social learning, even though the specific capacities that I found in these organizations of the Datawerkplaats may differ from the capacities needed by other organizations in other contexts.

Chapter 6: Conclusion

In this research I strove to answer the question of how the challenge of transdisciplinary knowledge integration could be overcome in a process of social learning. To answer this question, I created a dynamic model of transdisciplinary knowledge integration, which I called transdisciplinary social learning, that detailed the social learning processes and outcomes necessary for transdisciplinary knowledge to be integrated into public sector organizations. This model also included factors from the scientific context and the public sector context that might limit these social learning processes and outcomes. Mirroring work in the literature that found that limiting factors from the scientific context could be overcome by a transdisciplinary capacity of researchers (Klein, 2004), I proposed that public sector organizations could also possess a transdisciplinary capacity for overcoming these potentially limiting characteristics of the public sector.

I applied this model to an empirical case study of transdisciplinarity, the Datawerkplaats. This case study provided rich empirical data about the processes and outcomes of transdisciplinary social learning around topics of datafication in local and regional government organizations and about how these processes could lead to the integration of transdisciplinary knowledge in the public sector. This led to two significant findings. The first significant finding was the difficulty of achieving transdisciplinary social learning due to limiting factors from the public sector context. The second significant finding was that overcoming these limitations from the public sector context to achieve transdisciplinary social learning requires a transdisciplinary capacity of public sector organizations. *Therefore, in answer to the overarching research question, I found that the challenge of transdisciplinary knowledge integration could be overcome in a process of transdisciplinary social learning that relies on a transdisciplinary capacity of public sector organizations and scientists to overcome limitations from its scientific and public sector contexts.*

My research contributes to the academic debate about transdisciplinarity in several ways. One set of contributions relates to the development of theory about transdisciplinarity. I approached the challenge of transdisciplinary knowledge integration through the lens of social learning and developed an innovative model of transdisciplinary social learning in the public sector. This model responds to a gap in the literature by detailing the social learning processes and outcomes that should occur to integrate transdisciplinary knowledge into the public sector. This model also contributes to the academic debate by emphasizing the context of the public sector and

the difficulty that this context can create for the integration of transdisciplinary knowledge. My research also contributes to theory about transdisciplinary knowledge integration by proposing a transdisciplinary capacity of public sector organizations. Much of the previous work on transdisciplinarity focuses on the capacity and skills of scientists to engage in transdisciplinary work; therefore, an important contribution of my research is its focus on the capacity of public sector organizations to engage in transdisciplinary work.

The second academic contribution of this research is its innovative methodology. The action research that I conducted was very time and participation intensive. However, the advantage of action research is that it provides an in-depth look at the processes that occur in these public sector organizations. It is for this reason that Lewin (1946) believed that one could not fully understand an organization without trying to change it (Schein, 1996). This on-the-ground, in-the-organization research approach led to rich and in-depth findings in this case study research. This rich empirical data is the third academic contribution of this research, as it answers a call in the transdisciplinary literature for more empirical work on transdisciplinary knowledge integration by providing detailed insights into the processes that take place while conducting transdisciplinary work in these public sector organizations.

This research also achieved practical outcomes for the involved organizations. Its primary practical goal was to help these local and regional governments organizations implement the tools of the Datawerkplaats. I held four workshops which were attended by 37 practitioners from these organizations. These workshops led to both short-term and long-term learning outcomes for these organizations. Thus, in addition to helping to integrate transdisciplinary knowledge in the form of the Datawerkplaats tools into these organizations, the workshops led to the creation of new knowledge about the topic of datafication, about processes for working in a data-driven way, and about the tools themselves. As part of the long-term social learning outcomes, several of these organizations also made plans for how they could continue to transfer and retain this new knowledge within their organizations, helping to build the capacity of these organizations to work in a data-driven way. An additional goal of these organizations was to increase their connections to other organizations in the Datawerkplaats, and as several of the organizations participated in workshops and groups sessions with each other during this research process, I hope that these contacts have also laid the foundation for a stronger connection in the future.

In conclusion, transdisciplinarity is increasingly advocated as an approach for solving wicked problems such as the increasing datafication of society. It makes sense that public sector organizations which want to deliver public value and improve the delivery of public services in a datafied society would look to transdisciplinarity. However, what my research highlights is that transdisciplinary work is not easy. It requires scientists to engage with the tensions of collaborating with practitioners, and it also requires public sector organizations to develop their own capacities for engaging in transdisciplinary work, as their organizations are where this knowledge needs to be integrated. What my research shows is that there is not a simple solution to overcoming the complexities of transdisciplinarity; it requires work from both sides.

The findings of this research answer the dual purpose of transdisciplinary research: developing outcomes that are relevant for science as well as outcomes that are relevant for the public sector. My model of transdisciplinary social learning provides a detailed process for both researchers and practitioners to follow while designing and conducting transdisciplinary research as well as draws attention to the potential limitations to transdisciplinarity and the capacities needed to integrate transdisciplinary knowledge into the public sector. The limitations that the scientific and public sector contexts pose for transdisciplinary social learning also demonstrate that achieving the equilibrium between these scientific and practical outcomes in transdisciplinary research remains a balancing act for the researchers and practitioners involved and requires a transdisciplinary capacity of both.

References

- Andrews, L. (2019). Public administration, public leadership and the construction of public value in the age of the algorithm and ‘big data.’ *Public Administration*, 97(2), 296–310.
<https://doi.org/10.1111/padm.12534>
- Argote, L., & Ingram, P. (2000). Knowledge transfer: A basis for competitive advantage in firms. *Organizational Behavior and Human Decision Processes*, 82(1), 150–169.
<https://doi.org/10.1006/obhd.2000.2893>
- Argote, L., Ingram, P., Levine, J. M., & Moreland, R. L. (2000). Knowledge transfer in organizations: Learning from the experience of others. *Organizational Behavior and Human Decision Processes*, 82(1), 1–8. <https://doi.org/10.1006/obhd.2000.2883>
- Argote, L., & Miron-Spektor, E. (2011). Organizational learning: From experience to knowledge. *Organization Science*, 22(5), 1123–1137.
<https://doi.org/10.1287/orsc.1100.0621>
- Argyris, C., & Schön, D. A. (1996). *Organizational learning*. Addison-Wesley Pub. Co.
- Bannink, D., & Trommel, W. (2019). Intelligent modes of imperfect governance. *Policy and Society*, 38(2), 198–217. <https://doi.org/10.1080/14494035.2019.1572576>
- Bergmann, M., Brohmann, B., Hoffmann, E., Loibl, M. C., Rehaag, R., Schramm, E., & Voß, J.-P. (2005). *Quality criteria of transdisciplinary research. A guide for the formative evaluation of research projects*. Frankfurt am Main: Institute for Social-Ecological Research (ISOE).
- Boeije, H. (2010). *Analysis in qualitative research*. SAGE.
- Boyne, G. A. (2002). Public and private management: What’s the difference? *Journal of Management Studies*, 39(1), 97–122. <https://doi.org/10.1111/1467-6486.00284>
- Bozeman, B., & Kingsley, G. (1998). Risk culture in public and private organizations. *Public Administration Review*, 58(2), 109. <https://doi.org/10.2307/976358>

- Bruscaglioni, L. (2016). Theorizing in grounded theory and creative abduction. *Quality & Quantity*, 50(5), 2009–2024. <https://doi.org/10.1007/s11135-015-0248-3>
- Buchy, M., & Ahmed, S. (2007). Social Learning, academics and NGOs: Can the collaborative formula work? *Action Research*, 5(4), 358–377.
<https://doi.org/10.1177/1476750307083712>
- Bulten, E., Hessels, L. K., Hordijk, M., & Segrave, A. J. (2021). Conflicting roles of researchers in sustainability transitions: Balancing action and reflection. *Sustainability Science*, 16(4), 1269–1283. <https://doi.org/10.1007/s11625-021-00938-7>
- Coghlan, D., & Shani, A.B.R. (2005). Roles, politics, and ethics in action research design. *Systemic Practice and Action Research*, 18(6), 533–546. <https://doi.org/10.1007/s11213-005-9465-3>
- Eden, C., & Huxham, C. (1996). Action research for management research. *British Journal of Management*, 7(1), 75–86. <https://doi.org/10.1111/j.1467-8551.1996.tb00107.x>
- Friedman, V.J., & Rogers, T. (2008). Action science: Linking causal theory and meaning making in action research. In Reason, P., & Bradbury, H. (Eds.), *The SAGE Handbook of Action Research* (pp.252-265). London: Sage Publications.
<https://doi.org/10.4135/9781848607934>
- Gray, B. (2008). Enhancing transdisciplinary research through collaborative leadership. *American Journal of Preventive Medicine*, 35(2), S124–S132.
<https://doi.org/10.1016/j.amepre.2008.03.037>
- Gerring, J. (2004). What is a case study and what is it good for? *The American Political Science Review*, 98(2), 341–354. <http://www.jstor.org/stable/4145316>

- Hansson, S., & Polk, M. (2018). Assessing the impact of transdisciplinary research: The usefulness of relevance, credibility, and legitimacy for understanding the link between process and impact. *Research Evaluation*, 27(2), 132–144.
<https://doi.org/10.1093/reseval/rvy004>
- Hoffmann, S., Pohl, C., & Hering, J. G. (2017). Methods and procedures of transdisciplinary knowledge integration: Empirical insights from four thematic synthesis processes. *Ecology and Society*, 22(1), art27. <https://doi.org/10.5751/ES-08955-220127>
- Jahn, T., Bergmann, M., & Keil, F. (2012). Transdisciplinarity: Between mainstreaming and marginalization. *Ecological Economics*, 79, 1–10.
<https://doi.org/10.1016/j.ecolecon.2012.04.017>
- Janowicz-Panjaitan, M., & Noorderhaven, N. G. (2008). Formal and informal interorganizational learning within strategic alliances. *Research Policy*, 37(8), 1337–1355.
<https://doi.org/10.1016/j.respol.2008.04.025>
- Kale, P., Singh, H., & Perlmutter, H. (2000). Learning and protection of proprietary assets in strategic alliances: Building relational capital. *Strategic Management Journal*, 21(3), 217–237. <http://www.jstor.org/stable/3094186>
- Klag, M., & Langley, A. (2013). Approaching the conceptual leap in qualitative research. *International Journal of Management Reviews*, 15(2), 149–166.
<https://doi.org/10.1111/j.1468-2370.2012.00349.x>
- Klein, J.T. (2004). Prospects for transdisciplinarity. *Futures*, 36(4), 515–526.
<https://doi.org/10.1016/j.futures.2003.10.007>
- Klijn, E.H., & Koppenjan, J.F.M. (2016). *Governance networks in the public sector*. Routledge.

- Kim, G.-H., Trimi, S., & Chung, J.-H. (2014). Big-data applications in the government sector. *Communications of the ACM*, 57(3), 78–85. <https://doi.org/10.1145/2500873>
- Kitchin, R. (2014). *The data revolution: Big data, open data, data infrastructures & their consequences*. SAGE Publications.
- Lang, D. J., Wiek, A., Bergmann, M., Stauffacher, M., Martens, P., Moll, P., Swilling, M., & Thomas, C. J. (2012). Transdisciplinary research in sustainability science: Practice, principles, and challenges. *Sustainability Science*, 7(S1), 25–43. <https://doi.org/10.1007/s11625-011-0149-x>
- Lewin, K. (1946). Action research and minority problems. *Journal of Social Issues*, 2(4), 34–46. <https://doi.org/10.1111/j.1540-4560.1946.tb02295.x>
- Lüscher, L. S., & Lewis, M.W. (2008). Organizational change and managerial sensemaking: Working through paradox. *Academy of Management Journal*, 51(2), 221–240. <https://doi.org/10.5465/amj.2008.31767217>
- Maciejewski, M. (2017). To do more, better, faster and more cheaply: Using big data in public administration. *International Review of Administrative Sciences*, 83(1_suppl), 120–135. <https://doi.org/10.1177/0020852316640058>
- Micheli, M., Ponti, M., Craglia, M., & Berti Suman, A. (2020). Emerging models of data governance in the age of datafication. *Big Data & Society*, 7(2), 205395172094808. <https://doi.org/10.1177/2053951720948087>
- Mobjörk, M. (2010). Consulting versus participatory transdisciplinarity: A refined classification of transdisciplinary research. *Futures*, 42(8), 866–873. <https://doi.org/10.1016/j.futures.2010.03.003>

- OECD. (2020, December 9). *Focus on social challenges*. <https://www-oecd-org.proxy.library.uu.nl/coronavirus/en/themes/social-challenges>
- Ospina, S., Dodge, J., Foldy, E.G., & Hofmann-Pinilla, A. (2008). Taking the action turn: Lessons from bringing participation to qualitative research. In Reason, P., & Bradbury, H. (Eds.), *The SAGE Handbook of Action Research* (pp.420-434). London: Sage Publications.
- Parker, R., & Bradley, L. (2000). Organisational culture in the public sector: Evidence from six organisations. *International Journal of Public Sector Management*, *13*(2), 125–141. <https://doi.org/10.1108/09513550010338773>
- Perry, J. L. (1996). Measuring public service motivation: An assessment of construct reliability and validity. *Journal of Public Administration Research and Theory*, *6*(1), 5–22. <https://doi.org/10.1093/oxfordjournals.jpart.a024303>
- Rainey, H. G., Backoff, R. W., & Levine, C. H. (1976). Comparing public and private organizations. *Public Administration Review*, *36*(2), 233. <https://doi.org/10.2307/975145>
- Redden, J. (2018). Democratic governance in an age of datafication: Lessons from mapping government discourses and practices. *Big Data & Society*, *5*(2), 205395171880914. <https://doi.org/10.1177/2053951718809145>
- Reed, M., Evely, A., Cundill, G., Fazey, I., Glass, J., Laing, A., Newig, J., Parrish, B., Prell, C., Raymond, C., & Stringer, L. (2010). Ecology and society: What is social learning? *Ecology and Society*, *15*(4). <https://doi.org/10.5751/ES-03564-1504r01>
- Russell, A. W., Wickson, F., & Carew, A. L. (2008). Transdisciplinarity: Context, contradictions and capacity. *Futures*, *40*(5), 460–472. <https://doi.org/10.1016/j.futures.2007.10.005>
- Schauppenlehner-Kloyber, E., & Penker, M. (2015). Managing group processes in transdisciplinary future studies: How to facilitate social learning and capacity building for

self-organised action towards sustainable urban development? *Futures*, 65, 57–71.

<https://doi.org/10.1016/j.futures.2014.08.012>

Schein, E. H. (1996). Kurt Lewin's change theory in the field and in the classroom: Notes toward a model of managed learning. *Systems Practice*, 9(1), 27–47.

<https://doi.org/10.1007/BF02173417>

Schmidt, L., Falk, T., Siegmund-Schultze, M., & Spangenberg, J. H. (2020). The objectives of stakeholder involvement in transdisciplinary research. A conceptual framework for a reflective and reflexive practise. *Ecological Economics*, 176, 106751.

<https://doi.org/10.1016/j.ecolecon.2020.106751>

Scholz, R. W. (2020). Transdisciplinarity: Science for and with society in light of the university's roles and functions. *Sustainability Science*, 15(4), 1033–1049.

<https://doi.org/10.1007/s11625-020-00794-x>

Shani, A.B., & Pasmore, W.A. (1982). Towards a new model of the action research process. *Academy of Management Proceedings*, 1982(1), 208–212.

<https://doi.org/10.5465/ambpp.1982.4976570>

Slater, K., & Robinson, J. (2020). Social learning and transdisciplinary co-production: A social practice approach. *Sustainability*, 12(18), 7511. <https://doi.org/10.3390/su12187511>

Spaapen, J., & van Drooge, L. (2011). Introducing “productive interactions” in social impact assessment. *Research Evaluation*, 20(3), 211–218.

<https://doi.org/10.3152/095820211X12941371876742>

Stringer, E. T. (2007). *Action research* (3rd ed). Sage Publications.

Susman, G. I., & Evered, R. D. (1978). An assessment of the scientific merits of action research.

Administrative Science Quarterly, 23(4), 582–603. <https://doi.org/10.2307/2392581>

- Timmermans, S., & Tavory, I. (2012). Theory construction in qualitative research: From grounded theory to abductive analysis. *Sociological Theory*, 30(3), 167–186.
<https://doi.org/10.1177/0735275112457914>
- Utrecht Data School. (2021). Datawerkplaats Producten en tools.
<https://dataschool.nl/samenwerken/datawerkplaats/producten-en-tools/>
- Van der Wal, Z. (2017). *The 21st century public manager: Challenges, people and strategies*. Palgrave Macmillan Education.
- Wenger, E. (2000). Communities of practice and social learning systems. *Organization*, 7(2), 225–246. <https://doi.org/10.1177/135050840072002>
- Wicks, P.G., Reason, P., & Bradbury, H. (2008). Living inquiry: Personal, political and philosophical groundings for action research practice. In Reason, P., & Bradbury, H. (Eds.), *The SAGE Handbook of Action Research* (pp.15-30). London: Sage Publications.
- Yin, R. K. (2011). *Qualitative research from start to finish*. Guilford Press.

Appendix A: A brief description of the planning and interventions in each Datawerkplaats organization

This section contains a brief description of the planning and interventions that took place in each of the participating organizations of the Datawerkplaats. These case descriptions are designed to give an overview of the process in each of the six organizations and are based on the field notes from the 27 planning meetings. The planning process took place in six organizations and resulted in four completed interventions.

Municipality of Almere

In Almere, the planning phase began with a meeting with the organization's coordinator for the Datawerkplaats, who is a mid-level employee, from now on referred to as Contact A. The top-level employee who previously coordinated the Datawerkplaats activities for this organization changed jobs, and Contact A performs the responsibilities of both coordinator and daily supervisor for Datawerkplaats activities. A new top-level employee to replace the previous coordinator has not been appointed.

In our first meeting, Contact A unilaterally made the decision to work with the Meaningful Digital Collaboration Tool due to a familiarity with and history of working with it within the organization. Contact A wanted to link this tool to an ongoing program within the organization, Vital and Hybrid Towards the Future. She had already chosen a strategy for how to retain and transfer the knowledge of this tool to the organization, namely by finding a trainer within the organization who could be trained to lead workshops with the tool. The trainer, who she had already found, already had some knowledge of the tool from previous contact with Datawerkplaats researchers.

Contact A wanted to offer more information about the tool to the organization accompanied by the offer for teams within the organization to work with the trainer. Our goals during this planning phase were, first, to prepare information via a newsletter for the organization using testimony from previous employee experiences with the tool and, second, to hold a workshop with the tool for a team within the organization. The goal of this workshop was both to train the trainer and generate enthusiasm for the tool within the organization. We agreed to meet every two to three weeks with each other to make plans for how to progress these goals.

During the course of this collaboration, the employee chosen to work as a trainer changed jobs and was no longer available to take on this task. Contact A was not able to find any other

employees willing to take on the task of trainer. Additionally, friction arose with the Vital Towards the Future Program, and they declined to adopt the tool as part of their program, despite multiple attempts by Contact A. In the meantime, the learning intervention in the form of a workshop about the Meaningful Digital Collaboration tool had already been arranged to take place with a team from within the organization. As the trainer dropped out and Contact A continued to try to find other employees to act as trainer at very short notice before the workshop, the workshop did take place with 11 participants from the team General Local Ordinance & Markets.

Municipality of Amersfoort

The municipality of Amersfoort was one of the newer members of the Datawerkplaats, joining the collaboration in 2021. I contacted the organization's coordinator for the Datawerkplaats, who is a top-level employee, to set up an initial meeting. This top-level employee invited two mid-level employees, Contacts B and D, both members of the Data-Driven Working group within the organization, to this first meeting to learn about the tools of the Datawerkplaats. During the first meeting, Contacts B and D were asked to contribute to the choice of tools for the organization. Contact B chose to work with the Checklist Sharing Data Together and already had a project in mind with which to use it. Contact D chose to work with the Dashboards with Value for the Whole Organization Tool.

For the next planning session for the Checklist Sharing Data Together, Contact B invited another mid-level employee with more knowledge about specific uses for the tool, Contact C, to the planning session. Contact C and B decided to use the tool as part of a project, Digital Twin, that involved many sub-projects where data is shared with other organizations. They planned to use the tool in a session with their data-sharing partners for one of these sub-projects in order to gain experience in using the tool and to see if it could be used to work more systematically in future data-sharing projects. They organized their learning intervention in the form of a workshop with participants from several other organizations including the province of Utrecht and The National Institute for Public Health and Environment (the RIVM), but shortly before the intervention requested to re-schedule the intervention. Contacts B and C had difficulties finding a new date and time that would fall within the scope of the research period, so we decided to combine the learning intervention around this tool with the learning intervention around this tool planned by the municipality of Gouda. This workshop eventually took place with nine participants from

the municipality of Amersfoort, the province of Utrecht, The RIVM, and the municipality of Gouda.

In planning the intervention for the Dashboard tool, Contact D indicated that her goal was to learn about the use of dashboards within the organization to contribute to internal knowledge and possibly future guidelines or trainings about the use of dashboards. Rather than adhering to the original intention of the tool to be used with one project team, Contact D preferred to bring together employees from different departments that were involved in making dashboards for the workshop session to learn from their experiences and create a “knowledge document” based on the learning outcomes from the workshop. The workshop about Dashboards took place with eight participants from the municipality of Amersfoort.

Municipality of Gouda

In my first meeting with the municipality of Gouda, I met with the organization’s coordinator for the Datawerkplaats, who is a mid-level employee, Contact E. The top-level employee who previously coordinated the Datawerkplaats activities for this organization recently left the organization, and at the time of our first meeting, Contact E performed the responsibilities of both coordinator and daily supervisor for Datawerkplaats activities. Since our initial contact, a top-level employee has taken over these Datawerkplaats coordinator responsibilities, leaving Contact E responsible for oversight of daily activities.

In our first meeting, Contact E unilaterally made the decision to work with the Data Team Start tool and the Checklist Sharing Data Together because of familiarity and existing knowledge of these two tools. These tools were also already linked to a plan within the organization for data-driven working and were explicitly mentioned in this plan as resources for employees within the organization to use. Contact E had also already chosen a strategy for how to retain and transfer the knowledge of this tool to the organization, by finding a trainer within the organization who could lead future workshops with the tool. She already had a trainer in mind during this first meeting. During the session Contact E already chose the dates for a workshop with each tool. We decided to meet every two weeks to develop the plan for these sessions.

The Data Team Start workshop took place with six participants, including the future trainer for this tool as well as Contact F from the province of Utrecht. As previously mentioned, the Checklist Sharing Data Together workshop took place with nine participants, from the

municipality of Amersfoort, the province of Utrecht, The RIVM, and the municipality of Gouda, including the trainer.

Province of Utrecht

The province of Utrecht was one of the newer members of the Datawerkplaats, joining the collaboration in 2021. I met with the organization's coordinator for the Datawerkplaats, who is a top-level employee. This top-level employee invited five mid-level employees to attend our first meeting where I presented information about the instruments of the Datawerkplaats. This top-level employee decided to consult with the others and let me know the decision for choice of tools the following week. After two weeks, I received an email that they had chosen the Data Team Start tool and the Data Ethical Awareness Test, and the contact person for both was a mid-level employee, Contact F.

In my first scheduled meeting with contact F, she invited another mid-level employee, Contact G, to discuss how the DEAT could be used within their organization. Contact G wanted to incorporate the DEAT into part of a serious game that the provincial organization was planning as a way to increase the digital skills and awareness of employees within the organization. This idea led to further meetings with two more mid-level employees who had specific knowledge related to how the serious game would be carried out. They were interested in using aspects of the DEAT in their serious game but indicated that the organization would not begin this phase of the serious game until fall 2021, thus it would take place outside the scope of this research.

In our initial meeting, Contact F was very interested in using the Data Team Start tool as part of her own program to standardize how the organization works with data. However, she had just been hired by the provincial organization to start this new program and did not yet have any team members. I suggested the strategy of having one of the team members trained as a trainer for leading workshops with the tool, but since Contact F had not yet hired any team members, we could not move forward with this strategy. Contact F attended the workshop about the Data Team Start tool hosted by the municipality of Gouda to learn about the tool and experience how it would work in practice. She expressed interest in hosting a similar session within the organization of the province of Utrecht, but she was unable to find a willing team before the end of the research period. It is hoped that a workshop will take place in this organization in the fall of 2021, but because of this timeline, it is outside the scope of this research.

Province of South Holland

The Province of South Holland was an existing member of the Datawerkplaats. When I contacted the top-level employee for this organization, he referred me directly to the mid-level employee, Contact I, in order to meet and organize our work with the tools. I met with Contact I who had recently taken over as the mid-level contact person for this organization and therefore did not have much previous knowledge about the Datawerkplaats tools and work but expressed interest in the information that I shared about the tools as relevant for the organization. Contact I was also interested in connections with the other organizations. During this initial meeting, Contact I had initial ideas about which tools the organization should work with but wanted to check with others in the organization. Contact I asked to use my informational powerpoint to share with others and then get back to me with a decision as soon as possible.

One month later, a decision still had not been made about which tools the organization would like to work with. I had sent follow up emails during this time along with examples of what other organizations were planning to do with tools. In a second meeting, Contact I informed me that they would like to work with the DEAT, and referred me to another mid-level employee, Contact J, whose program was closely linked to the subject matter of the DEAT and who had already worked with this tool during its development. Contact I also planned to make a decision about using either the Data Team Start or the Meaningful Digital Collaboration tool by the end of the week, depending on feedback from another colleague. Eventually, it was decided that the focus would be the DEAT because of lack of interest from other teams.

I met with Contact J to discuss the plans for implementing the DEAT. It took an additional three weeks to arrange this meeting, as the plans for this meeting were delayed three times. In this meeting, it appeared that Contact J initially had a different idea of what the DEAT was, but during the course of the meeting Contact J decided to use the DEAT to do a second measurement of ethical sensitivity within the organization in order to measure the change within the organization after the implementation of their ethical programs. Due to the late nature of this decision in the research timeline, it was decided that another researcher of the Datawerkplaats would work with the DEAT and this organization, most likely in the fall of 2021. Therefore, the implementation of this tool falls outside the scope of this research.

Municipality of Zuidplas

The municipality of Zuidplas was one of the newer members of the Datawerkplaats, joining the collaboration in 2021. I met with a top-level employee who also invited a mid-level employee who would be coordinator for the Datawerkplaats, Contact K, to our initial meeting. In this meeting they explained that their organization was in the beginning phases of data-driven working and that their main goal as an organization was to learn about the possibilities of data. They expressed interest in the information that I presented about the tools and mentioned that they saw future applications for several of them, especially over the coming two years. However, they emphasized that working with these tools appeared to be a second step in the process of data-driven working, after the first step of developing questions for how and what their organization wanted to accomplish by working in a data-driven way. This first step would take place with other researchers of the Datawerkplaats, and then they would contact me to take the second step of working with the tools and concrete projects. The organization remained very busy with this first step, and they never contacted me to work with the tools. Therefore, the implementation of the tools did not take place in this organization.

Appendix B: Follow-up question list for workshop participants

English Translation

1. What did you learn from participating in this session? Can you give a specific example?
2. Do you think you were able to contribute to the session from your own knowledge and experience? Can you give an example again?
3. How can you use the knowledge gained during this session in your daily work? What are you thinking about specifically?
4. Do you have any other comments about the workshop session about _____ as a way to strengthen the capacity of the municipality/province?

Dutch version

Beste deelnemer,

Bedankt voor uw deelname aan de workshopsessie _____. Als onderdeel van mijn masterscriptie, onderzoek ik het proces van capaciteitsopbouw bij gemeenten en provincies met betrekking tot dataficatie en hoe leerprocessen tussen universiteiten en lokale overheden aan dit capaciteitsopbouw kunnen bijdragen. Voor dit onderzoek wil ik u graag enkele vervolgvragen stellen over uw ervaringen met deelname aan de workshop.

1. Wat heeft u geleerd van deelname aan deze sessie? Kunt u een specifiek voorbeeld geven?
2. Vindt u dat u in staat was om vanuit uw eigen kennis en ervaring bij te dragen aan de sessie? Kunt u wederom een voorbeeld geven?
3. Hoe kunt u de kennis die u tijdens deze sessie hebt opgedaan in uw dagelijkse werk gebruiken? Waar denkt u concreet aan?
4. Heeft u nog andere opmerkingen over de workshopsessie over _____ als manier om de capaciteit van de gemeente/provincie te versterken?

Ik waardeer het dat u de tijd neemt om mij te helpen door deze vragen te beantwoorden. Uw antwoorden worden vertrouwelijk behandeld en alleen gebruikt voor dit onderzoek.

Aarzel niet om contact met mij op te nemen voor vragen over de workshop of mijn onderzoek.

Meer informatie over de Datawerkplaats vindt u

hier: <https://dataschool.nl/samenwerken/datawerkplaats/>

Appendix C: In-depth qualitative coding process

This appendix details the qualitative coding process that I used in analyzing my empirical data.

I first used abduction to analyze the field notes from the 27 planning meetings to generate an overview of the process that had taken place in planning and executing these interventions and then worked backwards to develop possible reasons for why these processes had led to different outcomes for the different organizations. I then evaluated these initial theories with my primary contacts during the semi-structured interviews. Next, I began the qualitative coding process. I began by coding the open responses from the email question-lists that I had sent as follow-up to the workshop participants, the field notes from the interventions, the transcriptions of the semi-structured interviews, and the field notes from my follow-up session with the trainer. I began this qualitative coding process by using open coding to code at the most specific level, as open coding is the process of segmenting and breaking down the data (Boeije, 2010). Open coding is characterized by having “low levels of abstraction” (Boeije, 2010, p.105). I first began by coding the data from one specific intervention, then I continued the open coding process for all four interventions.

The second step in my qualitative coding process was a process of axial coding. While open coding is the process of segmenting the data, axial coding is the process of putting it back together, therefore, it should involve both checking the existing codes as well beginning to create categories within these codes (Boeije, 2010). The purpose of my second round of coding was to start to organize the open coding, by making a second layer of codes, as well as by consolidating and re-naming codes. As I continued to axial code, the categories present in my second level of coding also reflected some of my initial theories from the abductive analysis, along with additions from the data. Thus, during this second round of coding, there was a back and forth between my specific codes coming from the data and the initial theories from my abductive analysis. I started to find that these transdisciplinary social learning processes required specific skills or characteristics from the scientific side and also from the organizations themselves. This matches with observations from the literature that categories in this phase of axial coding can arise either from the theoretical concepts from the literature or from initial findings from the research (Boeije, 2010; Bruscalioni, 2016). In addition to categorizing the codes during this axial coding step, I also went back through the coded data to eliminate redundancies and re-name some of the codes, for example, changing the wording *link with an organization* to *ownership*. During this coding

process, I also wrote memos, as Boeije (2010) recommends writing memos during the coding process in order to keep track of ideas and concepts that can be used in the more abstract-level analysis later on.

Next, I participated in a third layer of coding, selective coding, in order to generate relevant themes and to find the overall picture of what happened during this research. Selective coding is the most abstract level of coding and is intended for theory generation and drawing out the core themes from the data (Boeije, 2010). Boeije (2010) recommends using the following elements to draw out the core concepts during selective coding: the research question and purpose, the literature, the data, fascination, and actuality. It is also important during this theory building to check if negative data can still be understood as part of the framework (Boeije, 2010).

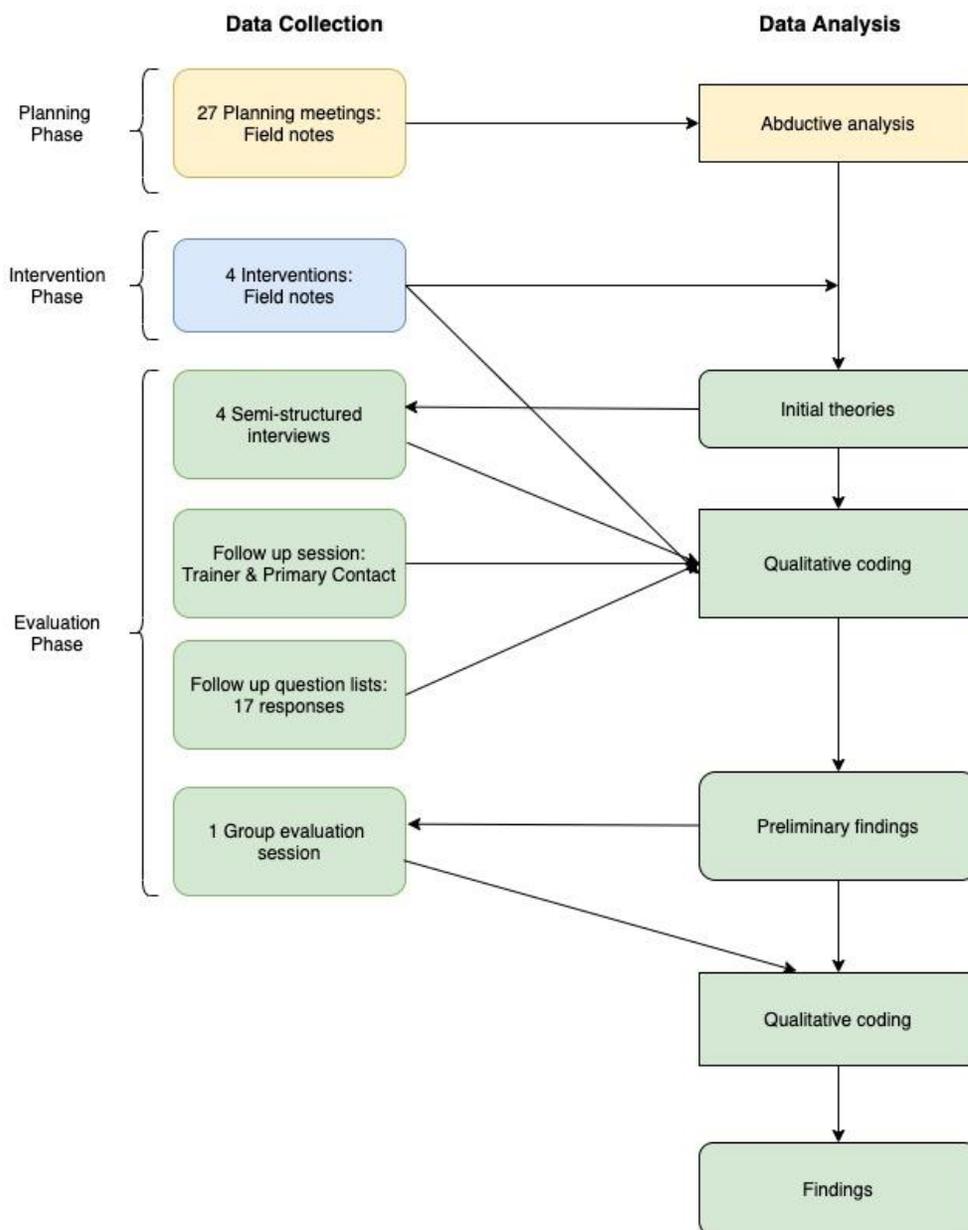
Klag & Langley (2013) recommend several approaches for how to further engage with the data in the selective coding process of the qualitative analysis in order to make what they refer to as a “conceptual leap,” including working in alternative formats, writing a narrative, and drawing. Following these recommendations, during the second and third round of coding, I also started to work in a word processing document to make and update an outline of the coding tree. As I did this, I added narrative words to the coding tree in order to write a coherent narrative. I initially created this narrative in order to share my preliminary findings with the participants in the final group session of my empirical work. Because I felt quite limited by the vertical nature of both NVivo and Microsoft Word’s coding trees, I also decided to draw with pen and paper so that I could develop a model and further categorize the coding tree as part of this final coding phase. This helped me to further refine categories within each category of coding. As I continued to try to put these findings and categories in narrative form to present to the participants at the end session, the act of writing this out in words also helped to define the titles for several of the categories that better summarized the codes in that larger category.

After this qualitative coding, I presented these preliminary results to the participants of the final group session. A separate researcher from the Datawerkplaats attended this session to take field notes, and I added these field notes, as well as any additional participant responses to the follow-up questions that I received during this time, to my qualitative data in NVivo. With the addition of these data sources, I went through the data and codes again in order to refine them according to the addition of the new data. This back and forth between data collection and analysis is recommended as part of the methodology of constant comparison (Boeije, 2010; Timmerman &

Tavory, 2012). During this round of coding, I also analyzed the data in terms of the sub-research questions to see how the coding categories from the data answered these questions. The overlap between the data collection and analysis in this research can be seen in Figure 8. I provide another copy of Figure 8 below.

Figure 8

Detailed data collection and analysis process



Appendix D: Qualitative coding tree

This is the coding tree that I developed during my qualitative coding in NVivo 12 for Mac.

A. Planning Phase

1. Science

- a. Attention to implementation
- b. Individual qualities
- c. Information
 1. Information or text
 2. Too much information
- d. Progress
- e. Time/availability of researcher
- f. Tools
 - Abstract
 - Closer to work floor
 - Lack of understanding
 - Link with data
 - Specific to organization

2. Practice

- a. Available time or resources
 1. Structure within organization
 2. Way of working
 - a. Horizontal/multidisciplinary
 - b. role
 3. Work or time pressure
 - a. control own agenda
 - b. personnel
 - Available people
 - Dependent on one person
 - Not difficult to find people
 - c. vacations
 - d. work pressure
 - Corona
 - Time pressure
 - Not too much work pressure
- b. Decision-making
 1. Connections within the organization
 2. Needs approval
 3. Slow
 4. Timeframe of the research
- c. Fit with organization
 1. Phase in process
 2. Close to organization
- d. Link to program
 1. Chose for own programs
 - a. Community building

- b. Professionalization
 - c. Training portal
 - 2. Responsibility
 - a. Enthusiasm
 - b. Not part of their job tasks
 - c. Own choice
 - d. Spoke with colleagues
 - 3. Earlier commitment
 - 4. Social domain
 - e. Momentum
 - 1. Interest from residents
 - 2. Previous knowledge of Datawerkplaats
 - f. Strategy
 - 1. Data-driven working
 - 2. Support from the top
 - 3. Priority
 - 4. Not enough priority
 - 5. In development
 - g. Other factor
- 3. Together**
- a. Adapted to participants
 - b. Adapted the tool
 - c. Agreed ahead of time
 - d. Flexibility
 - e. Good collaboration
- 4. Set up of Workshop**
- a. Goals
 - 1. Connections
 - a. Within organization
 - b. With other organizations
 - 2. Example project
 - a. Concrete project
 - b. Relevance of topic
 - 3. Too many goals
 - a. organizations are different from each other
 - b. Participants
 - 1. choice
 - 2. diversity
 - a. chosen for diversity
 - b. from an external organization
 - c. similar job function
 - d. within one team
 - 3. participants missing
 - 4. polite tone
 - c. Online/offline
 - 1. Hybrid working

2. Longer session needed
3. Missed start
4. Online easier
 - Jamboard
 - Mentimeter
 - Qualtrics
5. Technical difficulties

B. During Workshop

1. Input from participants

- a. Input from contact person
 1. Could participate self
 2. Facilitator
 3. Project information
 4. translation
- b. Input from other participants
 1. about the tools
 - a. high quality tool
 - b. knowledge of tool
 - c. understands the application
 1. how to use the tool
 2. recognize the dilemmas
 3. relation to other knowledge participants have, i.e. risk and privacy
 - d. ideas about how to attract workshop participants
 - e. tool is not about data
 - f. order of the tool
 - g. tool is not often used
 - h. use in the Social Domain versus other domains
 2. about the subject matter
 - a. general
 1. Data analysis
 2. Decision-making
 3. Make data sharing easier
 4. Stakeholder analysis
 - b. Specific
 1. Dashboards
 - a. Dashboards are tools
 - b. Internal dashboards
 - c. Objectivity
 - d. Usefulness of data
 2. Digital working
 - a. emails
 - b. less contact
 - c. less spontaneity
 - d. no development
 - e. physical

- f. not seen as a dilemma
 - g. positive aspects of working from home
 - 3. about the example project
 - a. Data & Kennis Hub
 - b. goal of the project
 - c. reason for problem
 - d. solutions
 - 4. knowledge from their own roles
 - a. enough knowledge
 - b. knowledge about leading projects
 - c. participants shared input
 - d. experienced lack of understanding
 - 5. about a way of working
 - a. data not seen as project
 - b. expectation management
 - c. flexibility
 - d. goal of learning
 - e. scaling up
 - f. technical challenges

2. Knowledge from Science

- a. Expectations
 - 1. What participants are used to
 - 2. Lecture
 - 3. Want more information
- b. Facilitating role
 - 1. Adapt to participants
 - 2. Facilitation
 - 3. Leading workshop
 - 4. Someone external
 - 5. Ran out of time
- c. Good presentation
 - 1. Introduction
 - 2. Anticipate questions
 - 3. Applause
- d. Information
 - 1. Additional information
 - 2. Gave explanations to questions
 - 3. Clearer explanation research

C. Outcomes

1. Short-term

- a. Knowledge
 - 1. Awareness
 - a. Bias
 - b. Interest in outcomes
 - c. Involvement in interpretation

- d. Leads to discussion
 - e. No change/not clear
 - 2. subject knowledge
 - a. ethics
 - b. use of dashboards
 - c. positive aspects of digital working
 - d. privacy
 - e. sharing data
 - f. risk analysis
 - g. stakeholder analysis
 - 3. Way of working
 - a. Combined knowledge participant already had
 - b. Leading a project
 - c. Problem solving as a team
 - 4. Knowledge of tool
 - a. What domain it is relevant for
 - b. When it can be used
 - 5. did not learn
 - b. Relations
 - 1. Experience of others
 - a. Similarities
 - b. Differences
 - 1. within the organization
 - 2. with other organizations
 - 2. Led to relationships
 - a. continued collaboration
 - b. new people within the organization
 - c. future collaboration
 - c. Actions
 - 1. Concrete arrangements
 - 2. Starting a project
 - 3. Use in own work
 - a. Use in own project
 - b. Use in own team
 - c. Use in interpreting data
 - 4. About specific subjects
 - a. Communication
 - b. Ethics
 - c. transparency
 - 5. Needs follow up
- 2. Long-term**
- a. Cognition
 - 1. Retain in team
 - 2. “Kennis document”
 - b. Practice
 - 1. Agreements for sharing data

2. An approach to work (structure)
 3. Change processes
 4. Use for future projects
- c. Future transfer strategies
1. Informal sharing within the organization
 - a. Share with direct colleagues
 - b. Share with other teams
 - c. Share with team leaders
 2. Trainer
 3. Possible use in future trainings
 4. Datawerkplaats trainer pool
- d. Future retention
1. keep repeating
 2. not yet decided
 3. capacity building
 - a. strategy from the top of the organization
 - b. “tool in the toolbox”
 4. no follow up