UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

Master Degree Project in Management

From "Spaghetti to Lasagna"

Exploring the role of objects in cross-disciplinary collaboration

Patrik Bohlin and Erik Zachrisson

From "Spaghetti to Lasagna"

Exploring the role of objects in cross-disciplinary collaboration

Patrik Bohlin

Master of Science in Management, Graduate School

School of Business, Economics, and Law, University of Gothenburg

Erik Zachrisson

Master of Science in Management, Graduate School

School of Business, Economics, and Law, University of Gothenburg

Abstract

Cross-disciplinary work is an increasing work-form in many organizations. This paper turns to investigate the role of objects and how they affect cross-disciplinary collaboration in an ongoing global IT-project. Through a performative approach and by using four lenses in studying objects as epistemic, boundary, activity and infrastructural, the study's result show how they can be sources of motivation, tensions and shift in importance during the project. Moreover, this paper's result show how actors, processes and objects can have a prominent role separately, but also collectively in deciding the role of objects in collaboration. Since previous research has largely focused on human-agency, or using a single lens on objects when explaining collaboration, this study contributes with new empirical insights and deeper understandings on the role of objects in organizational studies. Further, due to the limited strand of research on this topic, we suggest further studies in practice is needed to observe and study how objects affect and perform. This study can also be useful for practitioners as it sheds light on the different dimensions of objects and show the important role they can have in a collaborative setting.

Introduction

In many global organizations collaborative work amongst cross-disciplinary groups is important as it is a growing way of working (Bechky, 2006; Nicolini, Mengis & Swan, 2012) and can heavily affect team-efficiency (Cole, Cox & Stavros, 2016) as well as performance in various projects (Cross, Ernst, Assimakopoulos & Ranta, 2015). According to Lawson (2004), collaboration may be required during uncertainty or for problem-solving within multiple

groups. As the knowledge requirements increases due to technical complexity in products and services, it is often beyond the knowledge of a single individual or even teams of the same discipline (Cross et al., 2015). Therefore, to address the issue of complex problem-solving, composition of different disciplines is made (Bruns, 2013; Huq, Reay & Chreim, 2016), enabling cross-discipline networks to share knowledge and experience (Cross et al., 2015). However, a lot of organizations have difficulties in performing collaborative work (Boughzala & de Vreede, 2015). Although collaborative work can lead to many advantages, tensions can be a source to why collaborations fail in doing what was originally intended (Cloutier & Langley, 2015). Collaboration becomes complex due to the dynamics between the self-interests of actors and the collective interests, which can create tensions (Lawson, 2004). The actors in a group might have different thoughts on what the purpose of the collaborative work is and this creates ambiguity (Cloutier & Langley, 2015). This ambiguity has been shown to induce for example misunderstandings and frustration among the participants, possibly impeding collaboration. Moreover, collaboration could increase in complexity during longer periods of time because of the necessity to keep the group motivated (Margerum & Robinson, 2016). In the words of Lawson (2004:235) collaboration is "indeed, a special, complex intervention".

Although the phenomenon of cross-disciplinary collaboration is not new (Lee & Amjadi, 2014), research on this topic has tended to focus on the role of humans and to put materiality and objects in the background (Nicolini et al., 2012; Carlile et al., 2014). Not considering the role of materiality has has been criticized by several authors that has also urged researchers to take materiality more seriously in empirical studies to understand how material matters in organizations (Nicolini et al., 2012; Carlile, Nicolini, Langley & Tsoukas, 2014; Orlikowski & Scott, 2015). By acknowledging the matter of materiality and by moving away from the popular approach of human-centered research, it is possible to offer new valuable insights in the field of organizational studies (Orlikowski & Scott, 2015). One strand of previous studies that focus on materialization is the concept of boundary objects as introduced by Star and Griesemer (1989) which highlights how objects can act as bridges between cultural and professional worlds and support collaboration. This concept has been utilized by other researchers to study objects in collaborative settings (Carlile, 2002; 2004; Nicolini et al., 2012, Steger, Hirsch, Evers, Branoff, Petrova, Nielsen-Pincus, Wardropper & Riper, 2018). As we recognize boundary objects as a powerful concept which has enlightened the field of how objects matter in organizational life tremendously, the majority however, of empirical research on boundary objects often focuses on describing their positive nature, forgetting to explain how they work and why (Carlile, 2004). On this topic, Nicolini et al. (2012) further explore the role of objects in collaboration. The authors however argue that boundary objects alone cannot explain sources such as explaining conflicts, tensions and motivation. Hence, they turn to a pluralistic approach, arguing that the theoretical concepts of an object as epistemic, object of activity and objects as material infrastructure in combination with the boundary object lens give a greater analytical depth with researching objects in cross-disciplinary groups.

Further studies on the four lens-perspective presented by Nicolini et al. (2012) seem non-existent in the literature of organizational studies. Despite the introduction of the multiple approach by these authors, the strand of literature today on collaboration and the role of objects, to our knowledge, is still mainly limited to boundary objects (see e.g: Barley, Leonardi & Bailey, 2012; DiBenigno & Kellogg, 2014; Steger et al., 2018). In this study we will take a performative approach as we, like previous authors, (Law & Mol, 1995; Knorr Cetina, 1997; Barad, 2003; Latour, 2005) acknowledge the performative role of objects in social affairs. This means that we will study the processes of objects, helping us to understand how they perform in practice in our particular case. The authors above have in their work shown how objects and materiality play an active role in establishing and maintaining social relationships. Moreover, the question is not whether materiality and objects are involved in performative processes or social aspects of organizations but rather to what degree they are involved and also what capacity they have in terms of agency (Carlile et al., 2014).

We wish to continue on this path to contribute to current organizational literature by studying the role of materiality, more specifically in regards to objects through a multiple-lens approach. Thus, the aim of our study is to describe and analyze how objects affect cross-disciplinary collaboration and our research question is as follows:

RQ: *How do objects affect cross-disciplinary collaboration in practice?*

To answer this question, we draw on a synthesized framework by Nicolini et al. (2012) that is built on the four lenses mentioned above. In order to understand the role of objects, we have conducted a study on a project at a global company on their site in Sweden that wants to implement a new IT-system. By using a pluralistic approach we wish to explain the role objects have in practice in a cross-disciplinary setting. A delimitation in this study is the time-period on site. The project to implement the new IT-system will take approximately two years and we will spend five months studying it. Therefore we are aware that we cannot capture the whole picture of how objects affect and evolve during the project. With this said, we have gained valuable insights as we have been able to see the project unfold from an early start, participating in key events where all project members have been present. As the project is partially of global nature with international project members, where meetings and events taking place in several countries, we have delimited the study to focus on the company's site in Sweden, which is the central place for the project.

The outline of the study is presented as follows: Firstly, we present our theoretical framework discussing literature on the topic of collaboration and materiality before presenting the multi-lens approach used in the case. Secondly the methodology of the study is presented to show how we have gathered data and analyzed it. Thereafter in the empirical section we show our findings from the project followed by an analysis of the findings. Finally, we present our conclusions of the key findings and implications for theory, practice and future research.

Theoretical framework

On collaboration in organizational research

Previous research on the phenomenon of collaboration in organizational science is not scarce. Reay and Hinings (2009) researched organizational change in a health care system, looking at the competing logics of medical professionalism and business-like health care. Their study indicated that physicians and managers, acting by the mentioned different institutional logics, had to work together and showed that the logics can co-exist as the parties collaborated. Finding new ways of collaborating through for example joint innovation solutions for patients, created new organizational structures and systems, enabling physicians and managers to work efficiently, albeit it not being their favorite option to do so. Further, Levine and Prietula (2014) studied open collaboration for innovation on internet platforms and internet communities. Here they investigated the performance of open collaboration where they created a model combining innovation theory with recent evidence on human cooperation reaching to the conclusions that open collaboration performs well even in harsh conditions with few cooperators, free riders and lack of diversity. Moreover, Huq, Reay and Chreim (2017) did a study on collaboration and paradoxes. Their research suggests that by protecting paradoxes in collaboration between professionals they can turn vicious cycles into virtuous cycles. These findings are in contrast to previous research that implies that vicious cycles should be avoided and that they only lead to defensiveness and more tensions. Indeed, collaboration has been studied in various forms and through different theoretical approaches. Although this research has provided great knowledge and better understanding in the field of collaboration, many of them set out on exploring collaboration with focus on humans and how they interact. Therefore, as mentioned in the introduction of this paper, research on collaboration and the role of materiality is still limited.

Introducing the field of materiality

The notion that concepts of materiality and objects are of importance when studying collaboration is not new (Nicolini et al., 2012). It was over a century ago researchers introduced the idea of socio-technical systems which explains the involvement of people, material technologies and artifacts in organizational processes (Carlile et al. 2014). However, the emphasis and focus back then was much more on the technology than materiality, leading to a vast amount of materiality in studies were taken for granted and remained unexplored in the shadows. Although there has been a continuous focus on technology in the past decades, objects and materiality still struggle to get the attention they need in both organizational studies and the social sciences in general (Barad, 2003; Orlikowski, 2007; Carlile et al. 2014). According to Nicolini et al. (2012) there have been studies taken objects into account in collaboration, however these still tend to put focus on the agency of humans as a main source of alignment instead of objects. Also, as they put emphasis on the processes of interpretations between of people from different disciplines, we argue that they might forget objects as a vital part of collaboration that may have significant impact. However, there has been a group of researchers trying to put the spotlight on materiality in organizational life as can be seen in the growing interest of boundary objects (Star, 1989; Carlile, 2002; Bechky, 2003; Nicolini et al,

2012). Thus, to improve the understanding on how collaboration unfolds, this study turns to investigate the role of objects and how they perform in practice.

In order to study objects, we first must define what an object is. According to Star and Griesemer (1989), an object includes everything that is agreed upon or referred to as an object. This can be physical objects such as computers, documents, machines but also abstract objects such as methods, theories and vision statements. Furthermore, objects are also what people act with and towards to, and are not defined by their materiality but from actions rather than their physical structure or "thing"-ness (Star, 2010). Thus, strong objects are not limited to physical objects but also more abstract objects (e.g. theories or methods) can prove to be powerful with material consequences (Swan, Bresnen, Newel & Robertson, 2007).

A multiple approach towards studying objects
Drawing on Nicolini et al's (2012) pluralistic approach to studying objects in cross-disciplinary collaboration we will, instead of just focusing on one theoretical lens, follow these authors' work who propose studying the role of objects through four different lenses to achieve a greater depth when analyzing the objects. The theoretical lenses are boundary objects, epistemic objects, objects of activity and objects as material infrastructure. We will use this approach not only to look upon the *how*, but also *why* and *when* objects play a role in cross-disciplinary collaboration. As the lenses provide their own different view, the authors urge researchers to combine them instead of analyzing through one lens to try to explain everything.

In their article, Nicolini et al. (2012) created a novel analytical framework based on their findings, as seen in the table below.

Table 2 The Role of Objects in Cross-Disciplinary Collaboration

	Main function	Theoretical approach	Examples from the project
Tertiary objects of collaboration	Provide the basic "mundane" infrastructural support of collaboration	Infrastructure theory	E-mail system, phones, documents (project proposal), built environment
Secondary objects of collaboration	Facilitate work across different types of boundaries	Boundary objects	Visual slides, bioreactor, shared analytical methods
Primary objects of collaboration	Trigger/sustain/motivate the cross-disciplinary collaboration	Epistemic objects Activity objects	Bioreactor

Figure 1. The role of objects in cross-disciplinary collaboration (Nicolini et al. 2012).

Here, the authors argue that the role of objects can be structured in a hierarchy of three different levels (Nicolini et. al., 2012). The first level, or tertiary objects, are those of material infrastructure that keep the foundation of collaboration intact through objects such as email, systems or documents. The second level, secondary objects, consists mainly of boundary objects with the purpose of bridging different boundaries. Lastly the third level, primary objects, consists of epistemic and activity objects that motivate and trigger collaboration,

while also answer the question of why collaboration takes place. According to Nicolini et. al. (2012) this framework is not static and the objects within can change and move between the hierarchical levels at different points in time during collaborative work. As it is a synthesized model, we will not go into depth of the concepts and theories behind all the lenses. However, to get a better grasp of the model and the theoretical lenses as a reader, we will explain these briefly below.

Boundary objects
Boundary object theory (Star & Griesemer, 1989; Carlile, 2002; Nicolini et al., 2012) suggests that objects become boundary objects when they act as translation devices at the boundaries between different professional groups and communities. This means that boundary objects are flexible and can have different meanings in these different groups, but that the structure of the object still can be recognized and understood by all. Star and Griesemer (1989) introduced the concept of boundary objects and defines it as:

> They are weakly structured in common use, and become strongly structured in individual-site use. These objects may be abstract or concrete. They have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable, a means of translations. (Star & Griesemer, 1989:7)

Boundary objects can take various sorts of forms including physical objects such as prototypes, documents and IT objects (Nicolini et al., 2012), and more abstract forms such as processes and methods (Swan et al., 2007). Also, because objects and methods mean different things in different worlds and contexts, actors have to converge these meanings if they wish to collaborate. This requires major efforts for all involved as translation, negotiation and simplification are continuously ongoing between the actors.

However, the concept of boundary objects has in recent years been simplified and used as a one-size-fits-all explanation when discussing collaboration across boundaries (Star, 2010). Zeiss and Groenewegen (2009) also explains that by using this broad net of explaining boundary objects, the deeper understanding and complexity of the phenomena collaboration and translation is lost. Nicolini et. al. (2012) argues that by stretching the idea of boundary objects in order to explain everything, it instead comes to the point that nothing is explained. To address this issue they suggest that several different lenses can and should be used together when observing cross-disciplinary collaborations. The authors explain that by not only looking at the role of objects through the "boundary object"-lens, in their words, "offer a more systemized account of the role that objects play in collaboration" (Nicolini et. al., 2012:613). Therefore they suggest, in combination with boundary objects, looking at objects through three other lenses. These are epistemic objects, activity objects and material infrastructural objects.

Epistemic objects

Epistemic objects are defined by their incompleteness and their unfolding character (Knorr Cetina, 1997). The epistemic objects are epistemic because of "what we do not yet know about them" (Rheinberger, 2005:406). This opacity is also what keeps the object interesting for the actors and as the objects are continuously "in the process of being materially defined, they continually acquire new properties and change the ones they have" (Knorr Cetina, 2005:190). She exemplifies computer programs as epistemic objects since programmers can write code in accordance to their interests while simultaneously provide users with updates and new versions, displaying the epistemic objects' unfolding and changing characteristics. While boundary objects can be used to explain *how* groups interact through an object, we can turn to the epistemic objects to understand *why* collaboration take place (Nicolini et. al., 2012). This is because epistemic objects embody a "structure of wanting" (Knorr Cetina, 2005:194) and a lack of completeness which creates interest and motivation from the actors, thus explaining the *why*.

Activity objects

To create a further understanding on the role of objects in collaboration, Nicolini et al. (2012) suggest looking at objects of activity. In a sense, this lense is similar to the concept of epistemic objects as it wishes to answer the *why* question of people's motivation to actions (Engeström, 1995). Using the lens of activity objects, objects in a certain collective activity is what drives and creates meaning for the activity (Nicolini et. al., 2012), it "gains motivating force that gives shape and direction to activity" (Engeström, 1995:397). An activity object is always changing (Miettinen, 2005), yet it does not only serve as a tool of translation like boundary objects, or as a tool to create purpose and meaning like epistemic objects. In fact the object can also act as a source for conflicts and negotiations in collaborative work and can "bite back" (Engeström & Blackler, 2005:310) on the group that created it (Nicolini et al. 2012). The object can act as a source of conflict as three additional characteristics of objects is taken into account from this approach, their emergence, fragmented and constantly expanding nature (Nicolini, 2012). Through these characteristics, it means that the object is constructed through various interests, motives and is under change. However, these conflicts and negotiations does not have to hamper collaboration as they also can create opportunities for learning and improvements (Nicolini et al., 2012).

Material infrastructure

Nicolini et al. (2012) states that the lenses above can explain, in certain point of times, how and why objects can have significant effect on collaboration in cross-disciplinary work, one should not overlook the everyday objects that might have a more background position, so-called infrastructural objects. Also, it seldom occurs that objects take a central role in discussions and practices. In fact, they often blend in and are taken-for-granted in practices as they can be ordinary objects such as email systems, phone list numbers, documents etc. At first glance these objects seem mundane, however without them, collaboration would prove much more difficult. These objects are neither a large motivation factor nor are they boundary spanning in a major way but when considered as objects that supports the daily practices of a project or in a workplace, their importance becomes more visible. Star and Ruhleder (1996)

explains on the note of infrastructure, that objects emerge for people in practice and an important question to ask is "when-not what is an infrastructure" (Star & Ruhleder 1996: 113). Nicolini et al. (2012) further elaborates on this topic and points out that any object at times can become infrastructure and become invisible, or "black-boxed" in one moment but in another become apparent and take a central part of an activity.

Methodology

The case
The case study take place in an ongoing IT project in a global pharmaceutical company. In the project they use an agile methodology called SAFe which is intended for large-scale software projects. The agile framework sets the tone of the project in terms of how they are working, what methods and objects they are using and how the project is planned. This methodology inquires the project members to meet and discuss features of the project and new system during several meetings, some of which we have been able to observe. The purpose of the project is to, within a period of two years, replace an essential IT system that is currently compiled of a multitude of systems into a single unified platform. We have followed the project during the spring of 2019, a time period that started out as a planning phase which now has progressed to a development phase of the system. The new unified platform will affect more than 3500 employees worldwide and the project involve many various actors from different professional groups including project managers, external consultants, IT-developers and end-users. This makes it an interesting case to study for our chosen phenomenon, cross-disciplinary collaboration in practice and to understand the role objects play in this setting.

Research design
According to Flyvbjerg (2006), case studies have received criticism for being non-generalizable and biased but these are misunderstandings. When doing a case study, it allows the researcher to tell a story that includes that complexity of the many voices from the various actors involved in the case. It is in fact by experience with numerous individual case studies where true expertise is created for the human learning. Since we in this report wish to investigate cross-disciplinary collaboration in an IT project in depth, a case study is suitable. To gain insights and an understanding of the role of objects in the project, we argue that observations and interviews are the best method for collecting our data as this qualitative method helped us to see what happens in practice, but also to collect perceptions from various actors (Silverman, 2013). Through the observations and interviews we were able to get in-depth perspectives and thoughts of different actors, as well as the ability to observe the project members in practice, which have helped us to understand the dynamics and underlying mechanisms of objects in cross-disciplinary collaboration during the studied time-frame of the project.

The process of collecting material was conducted over a period of six weeks divided in four phases. In the first phase we had an initial meeting with our contact person at the chosen organization. This was to gain basic knowledge and information about the project and the setting. At this stage we also gained access to internal documents about the structure of the

project, planned meetings and project members. In the second phase we had our first observation of a configuration workshop as well as initiated our first interviews with the top managers and consultants. After these interviews we had a better overview of the project and could then together with our contact person, target suitable respondents from different disciplines needed for our study. The third phase included observation of a large project meeting lasting for three days along with workshops. During this meeting we were able to conduct several interviews with respondents otherwise based in other countries. By this stage we had 15 interviews. In the final phase we reviewed the collected data to analyze what information that was missing and what respondents we needed to interview to fill potential gaps. Thereafter the remaining interviews were finalized and we also participated in one more configuration workshop. Also, throughout the study we continuously collected data in form of internal documents as we had access to the organization intranet. In this intranet platform documents were continuously updated and added during the project and was useful since it provided with new information relating our studied phenomena, the project and the setting.

Data collection
The data collection included ethnographic observations of the workplace, people, meetings and workshops. We were able to join a large meeting that lasted for three days with the purpose to introduce the unified system, align project members and have workshops. This meeting was called PI (Program increment) planning meeting. During this planning meeting we also participated in an iteration workshop, where project members in groups discussed what to add in the new unified platform. In addition to this, we also joined two configuration workshops on separate occasions where project participants joined together to discuss the features of the new system. During these workshops we were also able to have conversations with the workshop participants during lunch and coffee breaks. All in all, we have around 30 hours of active observational data. Watson (2011) argues that to gain insight on what people really do in practice, interviews alone are not sufficient but it requires ethnographic work as well. Not only did we visit our studied company during the mentioned workshops and planning meeting, we also had the opportunity to work at site, enabling us to meet and talk to people and become more familiarized with the organization and environment.

Due to the large scope of the project, we have complemented the observations by conducting 20 interviews to ensure a substantial amount of data. We selected our participants for the study by doing a purposive sampling which, according to Silverman (2013), means that you select your interviewees purposively based on the groups which your research problem addresses. In our case this would be managers, employees, end-users, IT developers and consultants. This method has been important for our case as we have been able to understand different interests and insights from people from different professions and backgrounds. Before the interviews we informed the project members about our purpose, methods, what it means for them to participate and what the research information will be used for. In addition to this considering ethics, we have ensured full confidentiality and anonymity for the respondents and also explained that the interview is voluntary and that they had the option to end the interview at any point at any time. This was made to gain trust and make the respondents more comfortable and improve the chances of receiving honest answers. To

further strengthen these chances, we have also spent a lot of time at the company site so that the interviewees could get familiar to us and feel more at ease. For example, after spending time joining workshops and meetings, the project members recognized us and initiated conversations during breaks. To further uphold ethical standards we have also categorized the respondents into different groups (as shown in table 1) for anonymity reasons.

Observations	Duration
Configuration Meeting 1	8 hours
PI Planning Meeting	20 hours
Iteration Workshop	2 hours
Configuration Meeting 2	1 hour
Total	31 hours
Interviewees	**Number of interviews**
Consultant	1
Consultant	1
Consultant	1
Consultant	1
Consultant	1
Top Manager	1
Top Manager	2
Top Manager	1
Manager	2
Manager	1
Process or System Owner	1
Process or System Owner	1
Process or System Owner	1
IT-Manager	1
IT-Manager	1
IT-Manager	1
Business Analyst	1
Business Analyst	1
Total	20

Table 1. Chart displaying the observations and interviewees and their role in the project.

To clarify the table above, even though roles such as system owners, process owners and IT-managers appear, they can also be seen as end-users, i.e. using the current/final system.

Since it is a global project, we have interviewed people from various countries. This led to that some interviews (seven in total) had to been conducted over calls on Skype. Although we made our sincerest effort to conduct the interview face-to-face to be able to observe expressions and reactions, not all interviewees were able to provide a video-link. The majority of the interviews, (17 in total), were conducted in English whilst the remaining were done in Swedish and were later translated and transcribed in English.

When conducting the interviews we used the technique of snowball sampling, using the participants network (Silverman, 2013). This means that after each interview, we asked the interviewee if he or she could introduce us to a person to interview that could be of relevance for us. By using this technique, we were able to secure interviews with participants that we had not thought about from the beginning, enabling us with more material to understand the processes of the project.

The interviews were semi-structured as according to Bryman and Bell (2013). This involves having a set of prepared question but with the purpose of acting as guidelines more than rigorously followed (Silverman, 2013). The semi-structure is also suitable in our case because we were able ask follow-up questions and it gives the interviewee more freedom to talk about his or her thoughts on the subject which is key for us to better answer our research question. As described earlier, the aim was to allow the interviewee to set the pace and some deviation from the questions is not a problem but should instead be encouraged (Silverman, 2013). When conducting interviews, Kvale (2006) discuss that calling an interview a dialogue can be misleading as the interests for both parties are not mutual, the interest lies in the interviewer's favor and can therefore create power asymmetries. In connection to this, a limitation when doing interviews is that the interviewees can from their side steer the conversation by for example avoiding questions or talk about irrelevant things that are not in line with our questions. During our study this was a rare occurrence, but still happened in two of our interviews where the interviewees to some degree steered away from our questions. Another limitation is that some people have not been available for interviews that we believed were of importance. We have achieved to conduct interviews with a wide range of actors in the project, however we have not been able to secure interviews with people from the team that will develop the new platform. We notice this limitation and to mitigate this as much as possible we have drawn data from observations in local activities such as workshops, hence giving us a sense of their role and how they act in the project.

Lastly, we have had access to hundreds of relevant documents regarding the project. These documents have given us an understanding of the fundamental parts of the project such as information regarding the processes, schedule, people involved and structure of the project.

Data analysis
When analyzing the collected data, we have used grounded theory to help us get a deeper understanding of the material. Grounded theory is an inductive methodology with the purpose to discover suitable theoretical lenses after coding the collected material (Martin & Turner, 1986). The method is a way to make sense of an organization's reality and will be used in this case study as it is suitable when analyzing qualitative material. Instead of deciding on theory directly and testing it, grounded theory enables us to discover a theory from our data and thus we can stay more open minded during the process of collecting empirical material.

As mentioned, our primary sources for the data collection is through observations, semi-interviews with the project members, and through corporate documents and files. Martin and

Turner (1986) argues that grounded theory is useful when dealing with this kind of qualitative data. The reason for this is that these collection methods often produce a lot of nonstandard data, and thus through grounded theory enables the researchers to conduct a deeper analysis in a more systematic way. This in turn also means that when conducting observations, thorough and detailed note-taking is essential for the notes to be as useful as possible. This is also the case for the semi-structured interviews where we after each interview have transcribed them.

Next in the data analysis is the use of concept discovery, or coding (Martin & Turner, 1986). In this stage we took our transcribed material and started to code it with labels such as: *agile*, *user stories* and *functionalities*. In this process we also added our data from observations and project-specific documents. As the coding process is ongoing and nonlinear, it means that we could create labels as we are collecting our data and modify them during the time. In our case, we started by investigating the actual methodology of the project. However, in the process of our interviews, observations and coding of the material, we noticed other elements that captured our interests. These included objects, alignment, collaboration and motivation of the project-participants work which led to a recalibration of focus and aim of our study. Therefore, we shifted focus in the upcoming interviews asking more about how the project-members work in a cross-disciplinary setting. After this process we divided our data into different categories to group the codes. When creating categories, or labels, it is important to balance the abstractness of it (Martin & Turner, 1986). If the label is too abstract, it will likely contain too much information and if the label is too narrow or specific, too few incidents will be collected in it. Based on this, the categories from our codes were created as for example; *collaboration*, *methodology*, *objects* and *system*, enabling us to know the most important parts while at the same time not being too abstract. From these categories we sought to find a suitable theoretical approach, where in our case we deemed that lenses within the field of materiality was highly relevant as objects seemed to have a prominent role in our project.

Empirical findings

A vision of something new
The main goal of the project is to unify the multitude of existing system into a single unified platform, or as communicated metaphorically by top managers: *"to go from spaghetti to lasagna"*. To achieve this goal, a project team was put together consisting of both internal members with different professions and expertise from MedLune, an external consulting company as well as an IT-company that were to provide the new platform. The current systems are used by a wide range of people in MedLune on a global scale, therefore the team from MedLune consists of professionals from different regions from Europe, Asia and North America. The internal professionals have different roles in the project. The main roles are top managers who have an overarching responsibility for the project, business and IT managers who have a range of responsibility from aligning stakeholders to ensure compatibility between the old and new system. Further, there are business analysts who are responsible to collect the needs from users and also system and process owners who are experts in each respective system/process. The external consulting company that MedLune brought in had the task to drive the change in the project through an agile methodology. The chosen firm had

done projects in the past for MedLune through this methodology and was therefore their first choice.

A top manager from MedLune stated how he/she wants everyone in the project to participate and that everyone understands why they are doing this project. It's about engaging the whole organization to create a dialog:

> I'm genuinely interested that everyone actually gets to be involved and contribute. Then my mission is "This is where we are going, and we are going there because...". I want everyone to understand *why* we are doing this. (Top manager)

Another top manager explains that by using an agile framework, end-users are involved in an early stage and are able provide feedback on what they want in the new system:

> So I think the benefit is that you get a system that supports the change. So if you want to kind of build that excitement and get people onboard and to implement and use the new system and be excited about it, getting them involved along the way and having their say and feed back into that build is really important. (Top manager)

The building of the UCP is a continuous process where changes are constantly ongoing. In our first observation of a configuration workshop the IT-developers had a demo where they explained the basics of the system such as how to set up a new study for a drug and how it would look like in the future. Here people could learn how it worked, ask questions and raise concerns about different features. One recurring statement by the IT-developers when discussions became intense was that the system was not yet done, this was just a demo or a glimpse into the future how the UCP could look like.

As we interviewed other project members from various disciplines, we found that they were excited and happy when talking about UCP. Although the system is under development and yet somewhat unknown, the system can act as a drive for motivation:

> The vision is really good. I think the vision is what's going to keep people excited, many people have lived in this multi-system part to use system environment for so long that I think in and of itself the vision sells itself and now they have a chance to make a difference. (Process/System owner)

Although the vision for the new system is perceived as clear and the fact that people are excited, it does not come without potential challenges. A top manager expresses some concern because of the many dependencies and the large scope of the project, as this can lead to challenges in aligning actors as everyone have worked in different ways on different platforms. Hence, to integrate all the systems and dependencies into one unified platform is no easy task. Therefore, to ensure that the project members are aligned and to enable collaboration, a set of activities were planned by the external consultants and top management from MedLune at an early stage.

Activities and methods for creating a collaborative environment
To engage people from the beginning of the project, several activities were planned. These activities were a kick-off meeting, global workshops and configuration workshops with the IT-company that creates the platform and Program Increment (PI) meetings. Another method of engaging the actors is through user stories which we will cover later in the paper.

Not everyone in the project were familiar to work in an agile setting. To align people and create a common understanding a kick-off was held. In November 2018 the members of the project, around 70 people, met for a three-day kick-off meeting at the headquarters of MedLune. This kick-off was organized by the consulting firm together with MedLune to introduce the project, prepare participants for the upcoming activities, and teach them about the agile framework. During the day, the project members were asked by the organizers what they deemed the most important factor for a successful project, upon which the most common answer was "collaboration" followed by "communication" and "engagement". Further, a consultant described how they played a game to engage the project members and to make them understand how an agile project could look like. The project members were divided in teams of five to six persons and they received two paper boxes containing 60 ping pong balls. The task was then to move as many as possible from one box to the other on the condition that everyone touched the balls. The teams got two minutes of preparation time and two minutes to move them and repeated this five times. In the beginning it went slowly, but in the end the teams became much more efficient but less careful and ping pong balls were found in corners of the room. The consultant mentioned how you want to be somewhere in between and that the preparation time is supposed to symbolize the planning of iterations, i.e. a shorter period of time dedicated to develop and implement certain features into the new system.

When asking project members the question what agile means for them, different answers presented themselves depending on the respondents professional group. For example, some consultants viewed it as a method to create and show value in short term (iterations) while the top managers put more emphasis on it being a method to involve members and let them contribute to the system with valuable feedback and engagement. An IT-manager that was already familiar with agile, called it "flavor of the week" and explained that the project was not really agile but rather a hybrid of agile and an old methodology called "waterfall" which is a less flexible method where the development follows a linear, top-down set of phases throughout the project. The IT-manager further explained that disparate views on agile is not uncommon and that you could ask ten people the same question about agile, and get five different answers.

Further, to explain the project to end-users and collect information from them, MedLune set up a couple of workshops in Europe, Asia and North America. One consultant explained the process of these workshops. He went to a workshop to meet the users of the current system that MedLune is using to demonstrate some features and functions of the new system. What they then did was to give clear instructions about the project and the consultant further highlighted the engagement-spirit of the workshops: *"It's done at a high enough level but it's not teaching, it's really just sharing."*. He continued to explain that some people would rather

have a conversation than being spoken to. They then collaborated with the change team and the IT people to try to capture possible issues with the new platform. At the end of each workshop, they shared to the participants what they've found during the day to be transparent on what they discovered.

Another way to engage in discussions and keep up to date in in the project, short everyday-meetings are held. These are typical in agile projects and are called agile release train meetings, or "stand-up"-meetings and are short thirty-minute meetings that are held each day at one o'clock during the project duration. Those meetings mostly consist of a top manager from MedLune and representatives from different professionals such as consultants, IT-managers, process- and system owners that are located in different regions. Here they go through a tight agenda regarding risks, issues and blockers regarding the project. These meetings have several benefits as explained by a consultant. One is that it is fast and makes sure that everyone is up to speed in the project and that all are doing their part. Another is that it reduces the amount of emails which is, according to a consultant; *"probably the single biggest problem in the industry, on how people are doing it, writing one-liner emails and thank you's"*. The consultant points out that people can come to the meetings and instead of writing emails, they can talk about their problems, questions and remove the email traffic, explaining; *"You know I got 600 unread emails, all of which need attention, and just in time when I clear them, there is more."*. This view is also shared by another respondent, explaining that that these "stand-up"-meetings are valuable as you actually do tasks rather than leaving them. Otherwise, the tasks you are not being chased with tends to get dropped to the bottom of the to-do list.

Introducing user stories
An important part in building the new unified IT-platform is through user stories. User stories are collected pieces of information about the system functionality that are desired by users throughout the organization. Each user story is intended to help and enable system implementation and also to provide a better understanding of the system functionalities to both the business people and IT people, while at the same time requiring them to work together. Some user stories involve larger features or functionalities, called epics, which can be broken down into smaller stories.

The process of creating and collecting user stories
In this project over six-hundred user stories were written and collected by business analysts through verbal methods, global workshops, interviews and through emails from various users in the organization ranging from top managers to end-users. The main bulk of user stories were collected in the early phases of the project. However the collection of stories were not only limited to that period of time as new stories are created and collected on regular basis since changes are being made, things are being added and new issues needs to be fixed.

In the process of capturing user stories from end-users, their desired ideas of functionality in the new system materializes into for example post-it notes, Excel spreadsheets or on cards. In most cases the stories are being written down by business analysts, but they can also be

written down by the project member themselves. One example to help the user to write the story is structured as follows: "As a (user), I need to…., In order to….". This format help users to understand who is using the system, what they are doing with it and why they are doing it. According to the agile framework (SAFe, 2018), a story does not have to be overly detailed at first but rather function as promise for a discussion about the story at a later stage. The goal is to discover the most important features for the system and organize them in a structured manner for an easy overview on what needs to be done.

In the global workshops where user stories were collected, a business analyst explained how he went there to try to understand how the end-users work and what they need in the new system in order to accomplish their goals. During the workshop he educated the end-users in how to write stories, telling them what a user story is, how everything is documented and how they will be used in developing the unified platform. However, in this specific project, the analyst expressed that it was more difficult compared to other projects as the end-users were less experienced in how to write user stories.

> So this project, in my opinion, basically had a tougher time getting started or really
> develop those user stories at first because the education and training about agile
> and about user stories, and about this process was not done prior, to actually getting
> involved for core stakeholders. (Business analyst)

Some respondents in the project highlighted how the user stories are a way to keep people engaged *"because they're seeing their user stories, make it into iterations, they're seeing their user stories come out"* (IT-manager). They could now actually see progress and things being done compared other methods where they were not as involved in the process. Another respondent told it was helpful for him/her to provide user stories and other people translating it into requirements rather than him/her doing it:

> ...the idea of collecting the user stories vs the give me the requirement, was actually
> very helpful way for someone like myself to think about it because then it's not my
> responsibility... They got to translate my stories into the requirements rather than
> me trying to figure out the requirements which is not something I'm sure I'm able
> to do in a way that would be understandable. (Manager)

A process/system owner described how he/she gathered stories from end-users of the current system by talking to them at her office where they described what they wanted in the new system. These user stories were then sent from the process/system owner to a business analyst who logged them in an Excel file, before going to a system called Jira. However, due to the large scope of the project and all the different systems and dependencies involved, having knowledge on what is good user stories, or less good, can be challenging. One business analyst explains:

> Yeah, I would say that sometimes the user stories, like, I am not an expert in
> clinical right. So, it's hard for me to say what has value and what doesn't have
> value, I have to do my best, because I was brought in on this project recently right,

to write these user stories, work with the business to try and elicit them, but, you just need to work with the business closely with the project owners to understand what is the priority for each of these user stories and if it is meeting their needs, or jobs to be done right. (Business analyst)

PI-Planning - A key event of the project
Before the start of the system developing iterations, a three-day PI (program increment) planning meeting took place. The meeting took place in a large auditorium on site at MedLune. On the stage of the auditorium, there were panels with user stories printed out on a white card that were to be discussed later in a workshop. In the PI meeting, around 85 project members from various countries and disciplines attended, creating a forum for people to discuss actively about the upcoming months of the project. In addition to going through the project-plan, the meeting was a place for people to engage in a dialogue. In this meeting they had two iteration workshops that lasted around two hours during the first and second day where the participants got to discuss the user stories that will be the foundation of the new system. One manager described the benefits of the meeting saying that these face-to-face meetings are important as it is possible to create friendship and talking to people individually, which would not be possible through for example Skype.

In the PI-meeting the user stories were divided into different iterations, which are shorter time-periods where different parts of the system are implemented. For example, iteration one in our case had 80 user stories that would be implemented first. The project members in the PI-meeting were later divided into two groups, a functional and integrational group which had two separate iteration workshops. In these workshops they evaluated the user stories depending on how much business value it had, but also how complex it was to implement the story in the system. The point system was based on Fibonacci numbers ranging from 1-20 in business value and 1-20 in complexity of implementing the system. Through this process each user story was given a certain number and was then ranked from high importance to low importance by the participants in the workshop.

In these workshops, the participants that had been separated in the functional and integrational team discussed the user stories related to that particular iteration. Before the iteration workshops a consultant that led the PI-meeting explained for everyone through an analogy how the user stories work by comparing them to a Jenga tower and also what the participants should keep in mind when entering the workshops. This was to create an understanding and show the importance of user stories. The consultant explains the metaphor in the meeting:

> A single Jenga block is a single user story. Put these stories into a backlog, a nice pile of bricks. We got the fundamental blocks in the bottom, or else we never get the base and the rest of the tower stacked. What ones can we remove and the tower still stands? If we take some stories away, will you still have a tower or will it all fall over? This is really important. What are the critical, must-haves and nice-to-haves... (Consultant)

In general people were excited at the PI-planning meeting and they believed it was good to meet people face-to-face since it allowed people to get to know each other, establish trust and build teams. People were also able to mingle and discuss various issues and problems regarding the project. They explained their thoughts and views on the meeting and also the purpose of them attending and why it was important for them:

> What I wanted to achieve coming here is to make sure that the important elements of my area are reflected and the way it will be easier for the end-users to actually fulfill the requirements of the process. (Process/System Owner)

Furthermore, the same respondent described his/her reflection and feelings from the PI planning meeting:

> We and other users, like you know we are kind of waiting for our stories and try to make them more important, if they are worth it right, because sometimes it is nice-to-haves so it can wait. But this gives you this feeling you had the chance to streamline and emphasize that this is really important, don't forget about it. That I think is pretty promising. (Process/System Owner)

This view is also shared by other participants who explain that the meeting is a chance for them to raise their voices for their needs in their respective fields or systems. As explained by a manager:

> So with this, given that it is a unified clinical platform and given that it is early stage we thought it would be good opportunity to start getting some of the requirements or special needs of our work into this project right from the very beginning. Having done the experiment previously they tried to just tag them on after the fact that it didn't work so we trying to get it more upfront, so that is what I'm here for. (Manager)

The iteration workshop- Activity through user stories
In our observation of the functional workshop for iteration one there were two project managers, three developers from the IT-company, two business analysts, two consultants and system/process owners. The meeting was intense and a lot of discussions took place about the different user stories but in a good-spirited way as people were friendly, joking, engaged, asking a lot of questions and were respectful to one and another. Each story was printed on a card and were read out loud to the group by two top managers. These managers also have the final say in whether to reject or approve the discussed user stories. If approved, a person in the room would stick it on a wall with the ranking system based on business value and complexity. This required a collaborative effort from all involved parties such as top managers, IT people, consultants, process/system owners, where they had to discuss and agree on what value each story should be assigned. A few stories were quickly disregarded as either not relevant for this particular iteration, others were deemed not relevant enough by the two top managers to put time or effort into.

The workshop lasted for two hours and in the end there were some concerns raised about the user stories from one of the consultants. Some user stories were hard to figure out what they actually meant and took a lot of time and effort trying to decipher. The consultant pointed out that some of the user stories were not describing clear messages and would affect the building of the system. The explanation he gave was if the input of user stories were of poor quality, it will affect the quality of the finalized system. He then tried to explain how to write a user story saying the format "As a (user), I need to…., In order to….", and people in the room asked if he could give an example whereupon he got help from a business analyst and they tried together to give a better explanation. However, due to shortage of time, the meeting had to end abruptly when the discussion took place and no decision was really made and some people were still confused on how to write the stories the way described by the consultant and business analyst. One respondent who participated in the meeting explained afterward that there seemed to be a great need here for people to understand on how to create better user stories:

> So a fundamental core principal, the story, what percentage of the audience understands it? And I heard one of the ladies say that she now is going to get another group in, and she will get them to do the stories. Does she understand it fully to be able to do it? (Manager)

This is also explained by a respondent about how there was some confusion at first on to what extent the user stories were supposed to be delivered. The impression he/she got was that the user stories were supposed to describe the "pain-points", i.e. problems in the current system, and that was, in the respondent's opinion, completely different than describing the functionalities of the system.

> We, perhaps, as a general mass assumed that the basic functionalities would be covered somewhere else… That is not the case. You use stories for everything. (Process/System Owner)

Another IT-manager also expressed some concerns during the workshop regarding gaps in the user stories:

> I think because of the scale of the project that, like we have a lot of user stories but actually when you sit back and look it's nowhere near enough user stories... We're going from something that we have to something that does the same plus more. I think some of the user stories around on what we have today, have been missed because it's been taken as granted that the new system will do it. So as we're looking at the current user stories for the new system, a lot of it is for new functionality aspirational requests and we seem to be missing a lot of the kind of basic functionality that this system needs. So for me it feels like there's a little bit of a gap there. (IT-Manager)

Looking back a month before the iteration workshop, preparation-meetings were held between business analysts and other internal project members that were responsible for

collecting and reviewing the user stories. In these meetings the participants discussed the basic functionalities of the old system that was going to be implemented in the new system. Examples of these basic functionalities could be as simple as name fields, number of characters or what personal/professional titles to choose. Unfortunately some of the discussions of the basic functions seemed not to be captured in user stories, and where therefore not brought up in the iteration workshop. One process/system owner explains:

> I was a little bit surprised because as I said I reviewed a bunch of them before the meeting and my impression after those meetings with business analysts was that okay, if we spend hours during meetings talking about the most basic stuff my assumption was that they would create those user stories for basic stuff. (Process/System owner)

The two issues regarding the user stories about basic functionalities and misunderstanding of how to write a user story seemed to be solved later on in the project. A business analyst that attended the iteration workshop stated that there was some lack of focus in the user stories at first but that it has now change for the better since the workshop:

> Now, we kind of gave them an opportunity to express their pain points and desires as opposed to focus on what actual needs to be done, which was kind of a flaw because we got user stories that were all over the place and wasn't as focused as they probably needed to be, but we have started to do that in the past couple of weeks. We have now really focused on the jobs that needs to be done and the foundational functionality in the system as opposed to the "nice-to-haves. (Business analyst)

To address the second issue of misunderstandings in how to write a user story, a consultant with expertise in writing user stories was brought in after the workshop from the consulting firm to train the business analysts. When the business analysts had a better understanding for writing user stories, the project members could receive better feedback and also learn how a story should look like which resulted in an improved understanding for them as well. This view is shared by respondents and one process/system owner described how after the PI planning expectations became clearer and when editing or creating new user stories it's more structured. Another respondent also mentioned how it now is better and that everyone understands what needs to be done. Not everyone feels the same however. Uncertainties still exist and one manager in a follow up interview mentioned how he/she still is unsure on how to write user stories that bring value:

> I guess I'm not confident that when I do write a user story that it is in fact helpful to the configuration team, and I feel I would need more training, I don't know what the right word is but support to be able to ensure that what I'm contributing and the time I'm putting in is actually worthwhile for the people who need the information. (Manager)

Jira - A project managing and tracking system

As mentioned earlier, Jira is a software system specially designed for agile projects where user stories are tracked and managed. The user stories that were created and captured by business analysts were transferred to Jira where they were reviewed by process/system owners, top managers and IT-developers. This system works as tool for these groups to interact, leave comments and work with the user stories. The different professional groups have different purpose when working in the system where the project managers accept and reject stories, process/system owners work with their set of user stories specifically assigned to them based on their expertise and IT-developers look at how the stories are going to be implemented and decides the complexities of them. In the process of handling user stories there is a continuous discussion between the groups in Jira regarding issues, improvements and clarifications. For example the project managers has close discussions with the IT-developers in the final stage of the user story before it is approved for implementation in the system. According to the respondents, Jira is not yet a smooth, fully functional system for their project. They explain that they change Jira as they go and adapt the system to their way of working. A business analyst explains:

> We have not set up Jira optimally for this kind of communication we must have for different teams… Last week we sat in [city] and talked with two teams how to do this between us. And again, we changed a little so it would work. So already this week we had made a change to the Jira process. (Business Analyst)

Jira was not the original system that was used to log user stories, instead stories were logged in an Excel spreadsheet in the start of the project. However, the spreadsheet had some flaws, as explained by a process/system owner, that some comments made in the spreadsheet were simply lost or not seen and acknowledged by other project members. After the user stories were gathered and collected, they were then logged and on hold for further discussion in the different iteration workshops where the stories were discussed, ranked, and then put back into the system for another review session. In the last stage, user stories are checked for duplicates and then assigned to people working with the specific area related to the story. Then, when the user story fulfills a set of criteria or as described by one top manager, being "fleshed out", meaning that the description of functionality is clear and the acceptance criteria is testable, it is finally assigned to the IT-developers for configuration in the unified clinical platform.

Discussion

As this study aims to understand how objects affect cross-disciplinary collaboration, it seeks to investigate not only *if* objects transition into different roles at different times, but also the underlying reasons on *how* and *what* it is that triggers these transitions in a cross-disciplinary collaborative environment. By drawing upon the synthesized theoretical framework produced by Nicolini et al. (2012), which in turn is based on the lenses of boundary objects, epistemic objects, activity objects and material infrastructure, this study can provide further insights and pinpoint on how, why and when objects play a role in this setting. In this part we discuss our gathered findings with the theoretical framework as a lens in analyzing our data. From this, we identified several objects that distinguished themselves in the project - the Unified Clinical

Platform (UCP), user stories, the agile project methodology, and the system Jira. We have chosen these objects as they have continuously been appearing in the project and has been the objects that most of our respondents have discussed.

In the table below these objects are presented in the analytical framework as introduced by Nicolini et al. (2012) to get an easy overview of the main objects in our case. These objects will be analyzed in depth throughout the discussion.

	Main function	Theoretical approach	Examples from case
Tertiary objects of collaboration	Provide the basic "mundane" infrastructural support of collaboration	Infrastructure theory	Email, Excel, phones
Secondary objects of collaboration	Facilitate work across different types of boundaries	Boundary objects	User stories Agile method Jira
Primary objects of collaboration	Trigger/sustain/motivate the cross-disciplinary collaboration	Epistemic objects Activity objects	UCP User stories

Table 2. Role of objects in cross-disciplinary collaboration in our case based on Nicolini et al., (2012).

The UCP – A source of motivation and collaboration across divisions
As a starting point and to understand what motivates people and induce them into engaging in collaboration from various disciplines in the start-up phase, we decided to initially zoom out and take a wider perspective. In the case of the UCP, the goal of the top managers was to involve and engage actors and project members early on to make sure that they understand and know why they are doing the project. As according to Nicolini et al. (2012), we argue that the UCP acted as an epistemic object (see table 2) and was the drive of motivation and induced collaboration across different professional divisions in the beginning of the project. This was shown by high motivation from the respondents as they were excited for the vision and because they had grown tired of working on a platform with multiple systems. Also, to create the UCP the project members needed to work together towards this unified goal. As this is consistent with what is stated by Nicolini et al. (2012), epistemic objects can explain why people align or collaborate in the first place. The UCP also follows Rheinberger's (1997) definition of an epistemic object as it is an object which "embody what one does not yet know" and can be act as source of interest and motivate people as they are incomplete and a target of development. In this study, the UCP as an object takes its epistemic form as it is not yet a finished product, however there is a vision of what the project members want it to be and they feel like they have a chance to make a difference in the upcoming system. This incompleteness of the UCP appeared in the configuration workshop where the IT developers of the system stated how it was not done yet, but were still able to give a glimpse on what it

can look like in the future, while at the same time involving the project members for discussion. As elegantly explained by Knorr Cetina (1997), it is this lack of incompleteness that generates energy and emotional investment of actors involved.

The project method as an object for bridging professional boundaries
Since the project was set out to work according to an agile methodology, it would therefore have a significant impact on how the project was structured and how people would work in practice. Teams were created and work processes, methods and terminology were used according to the agile framework. This made the agile methodology, as explained by Swan et al. (2007), into a powerful object. An object, that although of immaterial structure, strongly shaped actions from people around it and had material consequences as objects were put in place to facilitate workflows such as user stories and documents. Therefore it was of importance that the project members understood and learned the concept of agile in order to create a shared understanding and enable collaboration among the different professionals. However, far from all were familiar with working agile, and in combination with learning about the project, a kick-off meeting was held where the fundamentals of the agile methodology were introduced. In this kick-off meeting the external consultants explained what working agile meant through for example the ping-pong activity. In this example, we argue that the lens of boundary objects is suitable to explain agile as a boundary object as it enabled people from various disciplines to collaborate. In addition to this, the agile framework was viewed differently by each professional group. For example, as we presented earlier, different professional groups had different interpretation of what working agile is. The consultants viewed it as a method to create and show value, the managers saw it as a method to engage, involve members and get feedback and a process/system owner saw it as a hybrid of agile and waterfall. However, despite the different interpretations in each individual context, the project members still had a shared understanding of the agile methodology and enabled collaboration across the professional boundaries (Nicolini et al., 2012).

The user story to bring people together
From the start of creating user stories the business analysts were set out in different global workshops to not only gather information for creating user stories but also to teach end-users how to write them. At this stage we can discern how an object started to take shape when the project members began to understand what a user story is and how to use it. As defined by Star and Griesemer (1989) and Star (2010), an object is something which is referred to, agreed upon and is something that people act with and towards. In line with Star (2010), the user story in our case initially consisted of fragmented bits of information and ideas but then began to materialize, not in physical form, but nevertheless into an object as the understanding increased, people used it as a point of referral and acted with and around it. However, creating a common understanding towards the user stories, may not has been as easy as initially intended since not everyone was familiar with the concept of user stories or how to write them prior to the workshops. Despite this, user stories transformed from an object into a boundary object as they began to function as objects that coordinated and enabled collaboration in the project between system/process owners, business analysts, IT developers, consultants and project managers. The user stories were weakly structured in common use, but to each

individual group it had other meaning and purpose making it strongly structured in their own context (Star & Griesemer, 1989).

As illustrated between the business analysts and the end-users collaboration, the end-users gave pieces of information based on their expertise and desires of the system to the business analysts who then translated the information into user stories. This proved to be a challenging task for business analysts since they are not, and cannot be, experts in every field and discipline in the project. As one business analyst expressed, it is not easy to decide what is good and bad without deeper knowledge of the particular field. Although Nicolini et al. (2012) implies that boundary objects restrict the need to learn across boundaries and that it is enough that the object carry details that both parties understand for it to work sufficiently in enabling collaboration, it turned out that this lack of knowledge across disciplines led to some tensions in collaboration between project members later on in the iteration workshop. This happened when the user story took the role as an object of activity, which will be discussed more in the section below.

Tensions through activity
Not only can we see that the user story is a boundary object connecting the different project members. We also argue that in some cases, the user story is taking the role as an activity object as well (see table 2). This became more evident in our observation of the iteration workshop during the PI planning meeting that revolved entirely around the user stories, where a consultant also emphasized the importance of them through a Jenga metaphor. The user stories were what shaped and orchestrated (Engeström, 1995) the workshop. The activity object is what drives the energy in the activity which was clearly visible during the workshop as it engaged all participants in active discussion around the user stories. As the user story became materialized by being printed out on a card, the object became a tool for collaboration. The now materialized object presented itself later on in the iteration workshop where the participants could stick the cards on a wall with the purpose of indicating business and complexity value. By being transformed to a physical form, it improved collaboration as the cross-disciplinary group were able discuss and show their thoughts in the way that everyone could see the cards and interact with them on the wall.

According to Zeiss and Groenewegen (2009), the deeper understanding of the complexities of objects is lost when labeling the concept of boundary objects on everything. When looking at the user story as an object of activity instead, the theory highlights that the object not only act as a tool of translation or a tool of motivation, it can act as a source for conflicts and negotiations as well in collective settings (Engeström & Blackler, 2005). The source of conflicts can arise in activity objects because of the objects' emergent, fragmented and evolving nature (Nicolini et al., 2012), meaning that the object is constructed through various interests, motives and that it changes during the process (Nicolini, 2012). For example in our case, the workshop presented an illustration of how an object, here the user story, can create tensions and disrupt collaboration. In the iteration workshop a consultant explained that if the user stories were of poor quality, they will affect the system negatively later. This represents how the activity object can "bite back" (Engeström & Blackler, 2005) in the future because if

the user stories are not well executed when they are brought in to configuration, it will affect the final UCP. It was during the activity, the iteration workshop, where a misunderstanding became apparent. It turned out that not all of the participants understood how to write a user story that had clearly expressed information, putting the workshop on halt, and a consultant and a business analyst tried to solve this tension by exemplifying how to write one, showing a collaborative effort in order to get everyone to understand. Yet, the meeting had to end abruptly due to shortage of time and it was necessary to switch approach in writing the stories, indicating that the user story as an activity object is still fragmented, changing and evolving (Nicolini et al., 2012). The continuous change in the process of writing user stories was shown in the case as MedLune brought in a consultant from the helping firm with expertise on how to write stories and taught the business analysts. According to Nicolini et al. (2012), as the activity object is fragmented it can not only create tensions in collaboration but also create new opportunities for learning and improvements. This was the case when the new expert-consultant joined to teach about how to write stories. This resulted in a better understanding for the end-users as well which is also in line with our respondents' answers that described how to write stories were more clear and that everyone understands. However one respondent in a follow up we made mentioned how it is still somewhat unclear in how to write a user story and that he/she would need more training. The uncertainty that still exist regarding the user stories can show how the activity object might have future consequences and there is a risk of it to "bite back" later on (Engeström & Blackler, 2005).

Another source of tensions regarding the user stories was the lack of basic functionalities that were expressed by several respondents. These were believed to be covered and captured prior to the iteration workshop to be brought up for discussions. However, as this was not the case and participants noticed this during the workshop, it raised concerns and opened up the user stories for further negotiations on how to address this issue. This shows from an activity object lens (Nicolini et al., 2012) that misconception and misunderstanding of user stories can be rooted by factors such as the object is composed by people from various disciplines with different motives, interests and interpretations that may be conflictual. As we can see in our case with business analysts trying to translate the needs of users but missed to cover, according to the respondents, a vital aspect of user stories which are the basic functionalities. This misunderstanding led to tensions between different disciplines, surfacing itself during the PI-planning workshop and hence changing the dynamics of collaboration and opened up for further discussions and meetings on how to fill this gap. Although what may have briefly hampered the collaboration in the first place, afterward led to improvements and refinement of the user stories.

Boundary object as a force to transform the role of infrastructural objects
As argued by Nicolini et al. (2012), one should not overlook the everyday objects that often appear in the background. Without these kinds of objects, collaboration would be much more difficult. In our case there are several objects in the background like phones, computers, email addresses which are deeply embedded in the infrastructure and taken-for-granted. However, an interesting development took place regarding the role of infrastructure objects. In our studied project, we can see that a boundary object, namely the agile methodology of the

project, is interfering with the otherwise taken-for-granted infrastructural objects. For example, email conversation is common in the everyday work tasks. However, emails can also be seen as an obstruction as, explained by a consultant, the email traffic can without a doubt be seen as overwhelming. Therefore "stand-up"-meetings are held to reduce the amount of emails and get everyone up to speed, together and more efficiently. Another example of a mundane infrastructural object is the case of Excel-files. Before the project members had access to Jira, user stories were added in Excel, however as according to a system owner it did not seem as the best tool to comment in. Jira then replaced Excel for working with user stories as Jira is a program designed for agile projects. Thus, we argue that agile as a boundary object creates new activities (stand-up meetings) and objects (Jira) to support collaboration. In fact, Jira could be seen as a boundary object as well as it bridges the worlds of business analysts, IT managers, system/process owners and the top managers to work towards a certain goal. It's enabling them within the system to collaborate by for example commenting on user stories to improve them. As such, agile as an object appears to enter the stage to disrupt the material infrastructure. With this said, agile as an object does not necessarily make them vanish, conversing via email is still standard procedure, and Excel files are used for a lot of other purposes in the project, but it introduces and enables new ways to work together in cross-disciplinary teams.

Transition of objects

As introduced in this paper's theoretical section, we wish to utilize the novel analytical framework by Nicolini et al. (2012) where the authors argue that the role of objects can be illustrated in a hierarchical way, as presented in table 2. The objects of collaboration however they mention, can shift and take new places in the hierarchy. To illustrate the transition of objects in our case, we wish to describe this through figure 2 below which contains the hierarchies, a time frame for our duration in the project and the discussed events.
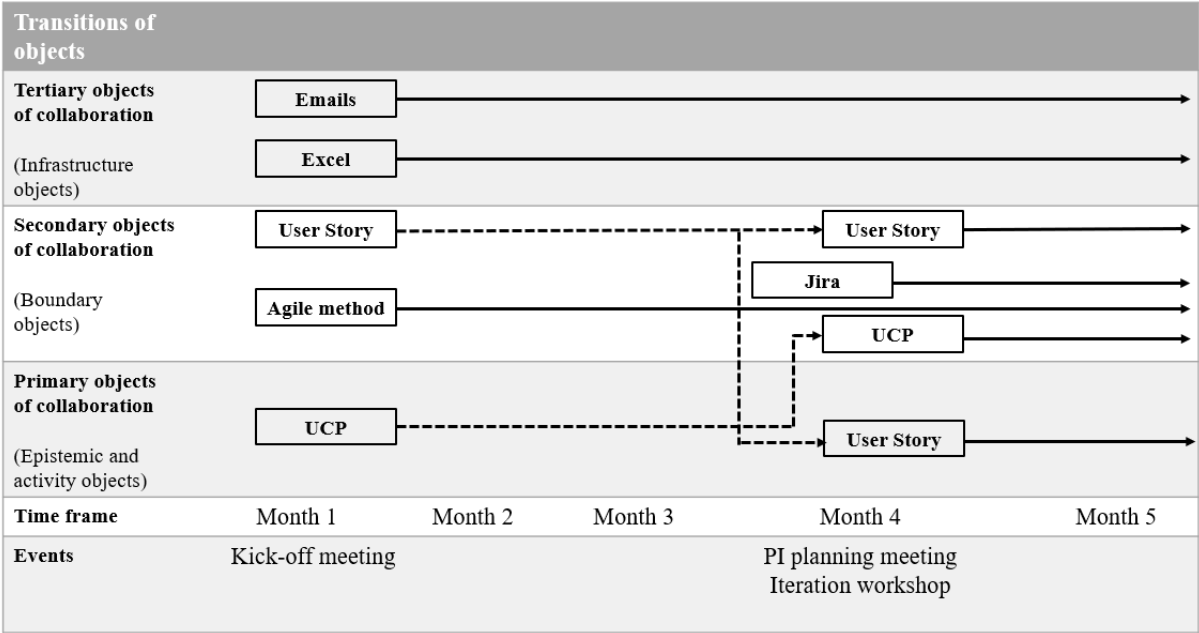
Figure 2. Illustration of transitions of objects in this case based on the hierarchy of objects as presented by Nicolini et al. (2012).

In this study, we could see the transition of the epistemic object (the UCP) move from being a primary epistemic object to become a secondary boundary object. The reason for this is that the UCP took the role as an epistemic object from start to create motivation and bringing people toward a unified goal, but later on in the PI planning meeting, a different object started to take a larger role in the project, the user story. The user story took its place in the spotlight, putting the UCP somewhat in the background like an actor that "disappear behind the scenes" (Nicolini et al., 2012:626). Although the UCP lost the position as primary object, it could still be seen as a secondary object as the main function of it was still to facilitate work across different boundaries (Nicolini et al., 2012). During the PI planning meeting we could see that the source of motivation also stemmed from some project members own interests instead of the main collective interest of creating the UCP. These interests became apparent as they expressed themselves wanting to be able to make a difference in the new system with emphasis on to their own fields and respective systems. These interests were also reflected in workshops where some of them championing their ideas and interests through user stories, making them transition from a secondary boundary object to a primary activity object. This is consistent with Nicolini et al. (2012) that epistemic objects may not be powerful enough to sustain motivation and interest throughout the project, but that these objects can change and other objects (the user stories as activity objects) can overtake and become a primary object, hence providing the fuel for further motivation and energy. Infrastructural objects such as emails and Excel were constantly present in the background and they continued to stay in this form during our presence at MedLune. However, as mentioned in the previous discussion, the agile method as a boundary object forced these two tertiary objects to branch out and create new ways to collaborate, through the software Jira and "stand-up"-meetings. Jira became a new tool to engage the various actors from different professional boundaries and is thus presented as a boundary object. In figure 2, we show the hierarchy of objects in collaboration and their transitions in the project. The arrows represent the processes of objects and how they move over time. Although a lot of the processes were invisible to us researchers, we were however able to observe certain processes/events that triggered shifts in the hierarchy.

Factors deciding the role of objects
We have in this analysis identified how objects affect collaboration in our case. To further build on the analytical framework by Nicolini et al. (2012), we wish to trace and explain the transitions of objects' role in collaboration and what impact this may imply. We have from our findings identified three factors of importance when studying objects in collaboration. These factors are not intended to explain the role of objects already established, but rather to show what it is that *decides* the role of objects. Based on our data and observations we have been able to see factors that triggers and forces shifts on object into primary, secondary and tertiary objects. These factors are objects, processes and actors.

Objects

Objects
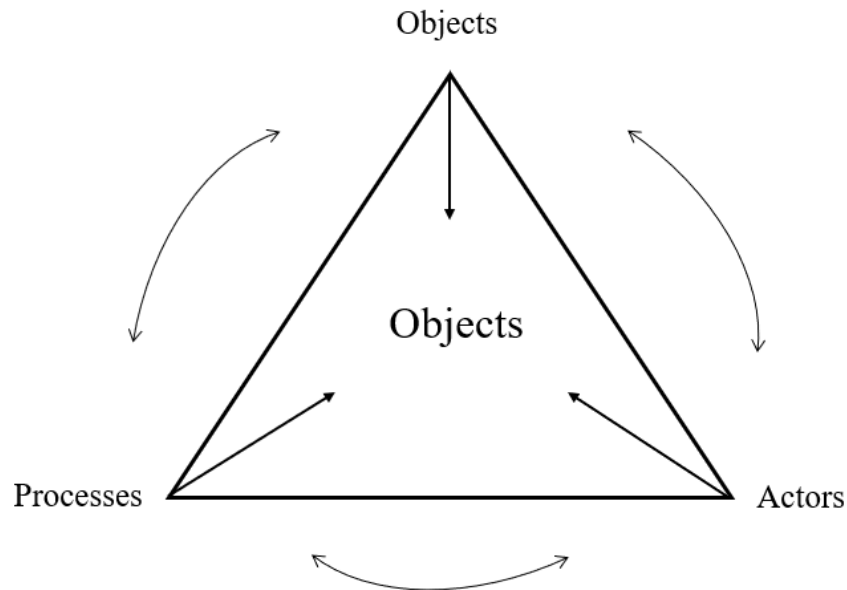
Processes   Actors

Model 1. Model of factors that decides the role of objects in collaboration. (The authors of this study).

The model shows the continuous interactions between objects, processes and actors, and how they in turn affect objects. In our study we could see how the agile methodology as an object forced other objects to become partially replaced (email to "stand-up" meetings and Excel to Jira). We further argue that processes should be taken into consideration. As we are aware that processes are a broad category and many things falls under this, we highlight that some processes have a larger role than others and should be scrutinized and studied more in detail when identified. Examples of larger, more important processes in our case are, for instance, events such as the PI-meeting, the iteration workshop but could also include smaller processes such as the continuous change process of Jira, and the processes of user stories, all of which have affected objects and the hierarchical direction they propel into. The last factor is actors. We could see in our case how actors' interests shifted during the project which led to user stories taking a front role in the project, thus becoming a primary object pushing the UCP to a secondary object of collaboration. This shows that these factors can individually have a more prominent role in deciding the role of objects, indicated by the arrows pointing inwards to the object. However, on a note of clarification, our model not only suggest that these factors are separated but can also be more or less intertwined and together decide the role of objects in collaboration. This can be exemplified by looking at Jira or user stories as focal objects. Jira for example attained its role as a secondary object in the hierarchy through the agile methodology (object) and through project members (actors) using it as a collaborative tool between professional boundaries. User stories attained its primary role through events (processes) and by individual interests (actors). These findings further show and strengthens earlier research that objects alone cannot explain cross-disciplinary work and that the social and materiality are constantly intertwined in organizational life (Orlikowski 2007; Nicolini et al., 2012). Therefore, we argue that this model can help to explain some key factors that

triggers transitions of objects and decides the role they have in collaboration. It can give implications on to what degree of importance their role could impose in this setting depending on the object is acting as a primary, secondary or tertiary object.

Conclusions and implications

The purpose of this paper has been to answer how the role of objects affect cross-disciplinary collaboration in practice. This has been done by following an ongoing global IT-project involving different professional groups. As we took an object-centered perspective in contrast to a human-centered, we were able to gain deeper insights and knowledge of the dynamics of objects in organizational activities and also discern objects that may have otherwise been taken for granted. We conclude that objects affect cross-disciplinary collaboration by acting as tools to facilitate work across different professional boundaries, as enablers for motivation, and as sources of tensions. These different dimensions of objects were possible to investigate by drawing on the multiple-lens approach as introduced by Nicolini et al. (2012). The authors' hierarchical framework that shows objects' as tertiary, secondary or primary has also enabled us to observe the transitions of objects in our studied project. We have been able to demonstrate how, why and when these transitions happened. In our case we saw examples of these transitions take place during certain events such as the PI-planning meeting and the iteration workshop where a primary object, the UCP, took a place in the background and user stories transitioned from a secondary object to a primary object.

Also, by using a pluralistic approach we have seen how objects can interfere and disrupt other types of objects, creating new ways for collaborating. We have further showed how processes and actors themselves can affect an object. These findings led us to design a model consisting of the three mentioned factors, showing how they can have a prominent role separately, but also collectively in deciding the role of objects in the hierarchical framework as presented by Nicolini et al. (2012). This theoretical implication complements not only to the ideas of these authors, but also to the literature of materiality in general in the sense that it gives new understandings of the importance objects play in collaborative settings. Therefore, this model in combination with the framework of Nicolini et al., (2012) could be of use for researchers that wish to deeper explore the underpinning factors that decides the role of objects.

The findings have implications to practitioners suggesting not to underestimate and take objects for granted in cross-disciplinary collaboration. As seen in our case they had an impact on project members in terms of motivation, enabling work across professional boundaries and as sources for tensions. For instance, the misunderstandings of user stories that led to tensions in the collaborative work could potentially affect the new system in the end if not addressed to. Also, by being aware of the transition of objects changing position from primary to secondary during certain points in time, can help practitioners to understand what motivates and keeps project members energized throughout the project. In our case emphasizing on the user stories when they became primary objects, as interest of some project member shifted, could prove beneficial for the project in the long run. Further, and based on the factors presented in our model, we wish to encourage practitioners of the growing and popular agile

methodology not to get lost in the method itself but to take into account how objects, processes and actors all interact and affect collaboration in projects.

The study has not been without limitations. Firstly, we have only been able to observe certain events and processes, being aware that there could have been others of importance taking place in the project that may have been missed. Secondly, it is a single case study and thus limited to this particular project, including its specific processes and ways of working. An interesting road for future research would therefore be to continue on the path of studying objects through a pluralistic approach as it still is an unexplored area and in need of more empirical studies. Finally, as this paper was limited to a specific period of time, we were not able to see the complete road to the finalized system and potential future shifts of objects. Hence, we suggest that it would be fruitful to study objects in cross-disciplinary collaboration during a longer period of time. In addition to this, we believe it would be interesting to see if objects that have shifted return to their initial role, if so why does this happen and under what conditions.

Acknowledgements

References

Barad, K. (2003). Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter. Signs: Journal of Women in Culture and Society, 28(3), 801-831.

Barley, W. C., Leonardi, P. M., & Bailey, D. E. (2012). Engineering Objects For Collaboration: Strategies Of Ambiguity And Clarity At Knowledge Boundaries. Academy of Management Proceedings, 2012 (1), 1-6.

Bechky, B. A. 2006. Talking about machines, thick description, and knowledge work. Organ. Stud. 27(12) 1757-176.

Boughzala, I., & Vreede, G. D. (2015). Evaluating Team Collaboration Quality: The Development and Field Application of a Collaboration Maturity Model. Journal of Management Information Systems, 32(3), 129-157.

Bruns, H. C. (2013). Working Alone Together: Coordination in Collaboration across Domains of Expertise. Academy of Management Journal, 56(1), 62-83.

Bryman, A. & Bell, E. (2013). Företagsekonomiska forskningsmetoder. (2., [rev.] uppl.) Stockholm: Liber.

Carlile, P. R. 2002. A pragmatic view of knowledge and boundaries: Boundary objects in new product development. Organ. Sci. 13(4) 442-45

Carlile, P. R. 2004. Transferring, translating, and transforming: An integrative framework for managing knowledge across boundaries. Organ. Sci. 15(5) 555-5.

Carlile, P. R., Nicolini, D., Langley, A., & Tsoukas, H. (2014). How matter matters: Objects, artifacts, and materiality in organization studies. Oxford: Oxford University Press.

Cloutier, C., & Langley, A. (2015). Negotiating the Moral Aspects of Purpose in Single and Cross-Sectoral Collaborations. Journal of Business Ethics, 141(1), 103-131.

Cole, M. L., Cox, J. D., & Stavros, J. M. (2016). Building collaboration in teams through emotional intelligence: Mediation by SOAR (strengths, opportunities, aspirations, and results). Journal of Management & Organization, 25(02), 263-283.

Cross, R., Ernst, C., Assimakopoulos, D., & Ranta, D. (2015). Investing in boundary-spanning collaboration to drive efficiency and innovation. Organizational Dynamics, 44(3), 204-216.

DiBenigno, J., & Kellogg, K. C. (2014). Beyond Occupational Differences. Administrative Science Quarterly, 59(3), 375-408.

Engeström, Y. 1995. Objects, contradictions and collaboration in medical cognition: An activity theoretical perspective. Artificial Intelligence Medicine 7(5) 395-412.

Engeström, Y., F. Blackler. 2005. On the life of the object. Organization 12(3) 307-330.

Flyvbjerg, B. (2006) Five Misunderstandings About Case-Study Research. Qualitative Inquiry, 12, 219-245.

Huq, J., Reay, T., & Chreim, S. (2016). Protecting the Paradox of Interprofessional Collaboration. Organization Studies, 38(3-4), 513-538.

Knorr Cetina, K. 1997. Sociality with objects. Theory, Culture Soc. 14(4) 1-30.

Knorr Cetina, K. (2005). Objectual practice. In Schatzki, T. R., Knorr Cetina, K., & Savigny, E. (2005). (pp. 184-197). The practice turn in contemporary theory. London: Routledge.

Kvale, S. (2006) Dominance Through Interviews and Dialogues, Qualitative Inquiry, 12(3): 480-500.

Latour, B. (2005). Reassembling the Social: An Introduction to Actor-Network-Theory. Oxford: Oxford University Press.

Law, J., & Mol, A. (1995). Notes on Materiality and Sociality. *The Sociological Review*, *43*(2), 274-294.

Lawson, H. A. (2004). The logic of collaboration in education and the human services. Journal of Interprofessional Care, 18(3), 225-237.

Lee, C., & Amjadi, M. (2014). The role of materiality: Knowing through objects in work practice. European Management Journal, 32(5), 723-734.

Levine, S., & Prietula, M. (2014). Open Collaboration for Innovation: Principles and Performance. *Organization Science*, *25*(5), 1414-1433.

Margerum, R. D., & Robinson, C. J. (2016). The challenges of collaboration in environmental governance: Barriers and responses. Cheltenham, UK: Edward Elgar Publishing.

Martin, P. Y., & Turner, B. A. (1986). Grounded Theory and Organizational Research. The Journal of Applied Behavioral Science,22(2), 141-157

Miettinen, R. 2005. Object of activity and individual motivation. Mind, Culture, Activity 12(1) 53-69.

Nicolini, D., Mengis, J., & Swan, J. (2012). Understanding the Role of Objects in Cross-Disciplinary Collaboration. Organization Science, 23(3), 612-629.

Nicolini, D. (2012). Practice theory, work, and organization: An introduction. Oxford: Oxford University Press.

O'Mahony, S., & Bechky, B. A. (2008). Boundary Organizations: Enabling Collaboration among Unexpected Allies. Administrative Science Quarterly, 53(3), 422-459.

Orlikowski, W. J. (2007). Sociomaterial Practices: Exploring Technology at Work. Organization Studies, 28(9), 1435-1448.

Orlikowski, W. J., & Scott, S. V. (2014). Exploring Material-Discursive Practices. Journal of Management Studies, 52(5), 697-705.

Reay, T., & Hinings, C. (2009). Managing the Rivalry of Competing Institutional Logics. Organization Studies, 30(6), 629-652.

Rheinberger, H.-J. 1997. Toward a History of Epistemic Things: Synthesizing Proteins in the Test Tube. Stanford University Press, Palo Alto, CA.

Rheinberger, H. (2005). A reply to David Bloor: "Toward a sociology of epistemic things." Perspect. Sci. 13(3) 406-410.

SAFe. (2018). Retrieved May 14, 2019, from https://www.scaledagileframework.com/story/

Silverman, David (2013) Doing Qualitative Research, 4th edition. London: SAGE. ISBN: 978-4462-6015-9.

Steger, C., Hirsch, S., Evers, C., Branoff, B., Petrova, M., Nielsen-Pincus, M., Riper, C. J. (2018). Ecosystem Services as Boundary Objects for Transdisciplinary Collaboration. Ecological Economics, 143, 153-160.

Star, S. L., J. R. Griesemer. 1989. Institutional ecology, "translations" and boundary objects: Amateurs and professionals in Berkeley's Museum of Vertebrate Zoology, 1907-1939. Soc. Stud. Sci. 19(3) 389-420.

Star, S. L., K. Ruhleder. 1996. Steps toward an ecology of infrastructure: Design and access for large information spaces. Inform. Systems Res. 7(1) 111-134.

Star, S. L. 2010. This is not a boundary object: Reflections on the origin of a concept. Sci., Tech. Human Values 35(5) 601-617.

Swan, J., M. Bresnen, S. Newell, M. Robertson. 2007. The object of knowledge: The role of objects in biomedical innovation. Human Relations. 60(12) 1809-1837.

Watson, T.J. (2011) Ethnography, Reality, and Truth: The Vital Need for Studies of 'How Things Work' in Organizations and Management. Journal of Management Studies, 1, 202-217.

Zeiss, R., P. Groenewegen. (2009). Engaging boundary objects in OMS and STS? Exploring the subtleties of layered engagement. Organization. 16(1) 81-100.