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Connecting the Needs of Interdisciplinary Teams
-
A General Framework for Management

by

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Abstract

Interdisciplinary teams are considered to be of great importance for addressing complex problems of the present and future, as they are able to address the complexity of society's most pressing issues such as climate change, or healthcare solutions. They can be found in multiple areas concerned with future-related problems. Research on specific fields such as healthcare and social work suggests that these teams face specific challenges and needs within their specific sector. However, research on the *common* needs these teams may have has not been conducted yet, leaving the manager of interdisciplinary teams in without any guidelines.

The aim of this study was to find out whether the different field-specific needs of interdisciplinary teams can be combined into a general model of common needs for interdisciplinary teams concerned with future-complex problems, and to create a comprehensible framework explaining relevant needs.

The method to reach this insight was the development of a theoretical framework that combined field-specific needs of interdisciplinary teams from the fields of healthcare, academic research, social work, and innovative settings. Ten semi-structured interviews were conducted in diverse fields of complex future problems, namely business, IT, and innovation consulting, as well as urban development. With the template method, relevant themes from the theoretical framework were tested and further developed to reach a final framework combining existent theory and new data from the investigated fields.

The results of this endeavor were that interdisciplinary teams have some common needs, which are also highly interconnected. While some themes appeared to be of central relevance for interdisciplinary teams in general, others were seen as dependent on the specific field. The most crucial needs of interdisciplinary teams were found to be the needs for knowledge exchange, shared language, shared work approaches, an understanding of each discipline's competencies, and equal status of disciplines.

Concluding the study, it was argued that interdisciplinary teams are special team constellations with specific needs which they do not have in common with other kinds of teams. Thus, a managerial approach specifically addressing the interdisciplinary nature of these teams - their needs and interconnections - seems crucial for the success of these teams.

Keywords: interdisciplinary teams, academic background, diverse teams, team management

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1 Introduction

In this introductory chapter, the background of what interdisciplinary teams are and why they are important will be given. The research gap explains the need for this study, before the aim and objectives as well as the research purpose is presented.

1.1 Background

A psychologist, a business graduate and an information technology expert work collaboratively on the project of developing a strategy for the reduction of toxic emission of a large corporation. This is an example of how individuals from different disciplinary backgrounds join together in a project to solve a complex future-related problem. This type of constellation, where two or more individuals from different disciplines work together in a team, is commonly referred to as an *interdisciplinary team.*

The central concept of this thesis is the *discipline* of individuals. Discipline is generally defined as the academic or professional background of an individual in which they were mainly educated or trained (Cambridge University Press, 2019). While this work is mainly referring to academic background with the term discipline, it also includes other types of trainings outside of academia as disciplinary background.

The rationale why the interdisciplinary team constellation is of relevance is because it has the potential to create solutions that go beyond what any single one discipline can develop - it can approach the complex problems of the world with the creativity and innovative potential of the diversity from multiple perspectives (Blackwell, Boulton, Knell, Street & Wilson, 2009). Some "problems are much too complex to be judged appropriately, much less solved, merely with the subject-knowledge of a single discipline" (Klein, 2004, p. 2). In this regard, an interdisciplinary approach is needed. In fact, interdisciplinary collaboration appears in many different fields concerned with complex future problems, such as fighting environmental challenges (Mansilla, 2006), or developing medical solutions (Gohar, Maschmeyer, Mfarrej, Lemaire, Roncarolo, Wedderburn & Royen, 2019).

When referring to complex *future* problems, it can be argued that these problems are not only the problems of the future, but already existent in the contemporary world. This way, future problems relate to complexities that may already occur, but will also have a substantial relevance to the future world. The term

future problem therefore includes contemporary and future problems, focusing on the impact of the problem being relevance in the future.

In order to dive deeper into the connection between complex future problems with interdisciplinary teams, some explanations on this connection shall be given. Mansilla (2006) observes that the most crucial cultural and environmental challenges are addressed at the intersection of different disciplines. Cateano, Curado & Jacquinet (2000) also stress the importance of interdisciplinary[1] methods to deal with emerging problems of our complex reality. They argue that methods of single-discipline solutions are often a reduction of the phenomenon to one dimension, while interdisciplinary methods acknowledge a multiplicity of disciplinary methodologies and knowledge (Cateano, Curado & Jacquinet, 2000). Moreover, interdisciplinary teams are considered a relevant approach for solving complex problems in the medical field (Gohar et al. 2019):

> Because these groups have members with different skills and perspectives, they have the potential to tackle broad issues, select problems that go beyond the confines of any one discipline, answer complex questions, frame problems with greater accuracy and breadth of understanding, combine resources and capitalize on differing skills in pursuing solutions to problems, and develop innovative solutions to problems (Derry & Donnell, 2005, p. 51).

As shown, interdisciplinary collaboration is not only an approach of the future. In fact, it already takes place in governments, industry and academics, addressing intricate problems of the real world that are failed to be understood by a single disciplinary perspective (Derry & Schunn, 2005). In terms of academic research, the great impact of interdisciplinary teams is also highlighted:

> Interdisciplinary research (IDR) can be one of the most productive and inspiring of human pursuits - one that provides a format for conversations and connections that lead to expansion of new knowledge. As a mode of discovery and education, it has delivered much already and promises more - a sustainable environment, healthier and more prosperous lives, new discoveries and technologies to inspire young minds, and a deeper understanding of our place in space and time (National Academy of Sciences, National Academy of Engineering, and Institute of Medicine, 2005).

[1] Cateano, Curado & Jacquinet (2000) originally use the concept of transdisciplinarity. In the conceptual framework it will be argued that the term *interdisciplinary teams* shall also include the terms *trans*- and *multidisciplinary teams*. Therefore, the term *interdisciplinary teams* is used here.

It becomes visible that interdisciplinary approaches are crucial for the solving of challenging future problems in many different fields. Thus, interdisciplinary collaboration appears to be a key answer to creating a more prosperous future by providing more diverse and exceptional solutions. The full complexity of such problems cannot only be approached more appropriately in interdisciplinary approaches, but advanced problems deeply require interdisciplinary approaches.

Interdisciplinary teams, however, do not only provide special solutions, but may also be confronted with specific internal challenges and needs, that single-disciplinary teams do not face (Blackwell et al. 2009; Klein, 2004). When scanning the research landscape on interdisciplinary teams, it has become very clear that interdisciplinary teams have specific *needs* in their specific fields. Arguments for special needs of interdisciplinary teams could be found in healthcare (Ariss, Booth, Enderby, Nancarrow, Roots & Smith, 2013; McGill, Blonde, Chan, Khunti, Lavalle & Bailey, 2017; Youngwerth & Twaddle, 2011), academic research (Epstein, 2005; O'Connor, Rice, Peters, & Veryzer, 2003; Klein, 2005), social work (Abramson & Mizrahi, 1996; Bronstein, 2003; Rumping, Boendermaker & Ruyter, 2019), and generally innovational settings (Delgado & Åm &, 2018; Blackwell et al. 2009; Gohar et al. 2019).

In order for managers to foster favorable collaboration in interdisciplinary teams, it appears crucial to investigate the internal *needs* such teams have to cooperate in an ideal manner. With that said, an interest in having a general framework for common needs of interdisciplinary teams emerges. The term *general*, thereby, refers to the aim of creating a framework that is applicable to all contexts of concern with complex future problems. This explicitly excludes other fields where interdisciplinary teams may be found but stand in no relation to complex future problems.

In should be considered that interdisciplinary teams can be found in all kinds of environments that are not necessarily concerned with complex future problems. However, in this study only settings were considered in which the interdisciplinary team is directly concerned with complex future problem. As introduced, interdisciplinary teams are especially considered to be beneficial in solving complex *future* problems, which require solutions that are *not* compliant with forms of discipline-bound knowledge (Blackwell et al. 2009). Due to the grand impact of complex future problems and the special ability of interdisciplinary teams to solve them, these kinds of problems were chosen as a focus.

1.2 Research Gap

To observe the research gap and the corresponding relevance of this study, an examination of the literary landscape was conducted. There is a considerable body of research on interdisciplinary teams in the fields of healthcare (Ariss et al. 2013; McGill et al. 2017; Youngwerth & Twaddle, 2011), social work (Abramson & Mizrahi, 1996; Bronstein, 2003; Rumping, Boendermaker & Ruyter, 2019) and academic research Epstein, 2005; O'Connor et al. 2003; Klein, 2005). There are also some insights on interdisciplinary collaboration in innovative settings that, however, do not show the same depth of discussion (Delgado & Åm, 2018; Blackwell et al. 2009; Gohar et al. 2019). This body of research is to be presented in the literature review. However, none of them address *needs* of interdisciplinary teams that go *beyond* their specific field: they do not address the aforementioned established interest in finding a general framework for common needs of all kinds of interdisciplinary teams concerned with complex future problems.

In research on interdisciplinary healthcare teams, some direct evidence for the need of a common framework was detected. Ariss, Booth, Campbell, Nancarrow, Enderby, Smith & Campbell (2012), proposed and tested an interdisciplinary management tool incorporating aspects affecting the performance of interdisciplinary teams. Some of these aspects of influence were, for example, role clarity within the team and role autonomy. They, however, observe that their results cannot be generalized to be relevant for all kinds of interdisciplinary teams (Ariss et al. 2012). Their framework has yet to be validated in interdisciplinary teams in different contexts in order to detect "the level of transferability to other teams and contexts" (Ariss et al. 2012, p. 10).

In academic research, innovative settings and social work, a need for a general framework of common needs of interdisciplinary teams is not explicitly stated. However, the need for a general framework can be detected when observing the following authors' arguments. As Klein (2004) describes, subsystems of society become more and more interconnected; hence a framework that spans across subsystems and industries appears to be relevant. In the context of academic research, Barry, Born & Weszkalnys (2008) argue for a future trend of scientific research spreading in other areas of society. In the field of social work, social workers are considered to create interdisciplinary teams wherever they go - in institutions like schools, hospitals, psychiatric facilities, courts or prisons (Bronstein, 2003). These insights should serve as a description of how professions mingle with other professions and their settings to the point where it may not be possible to clearly label projects as, for example, *social work projects* or *healthcare projects.* In these cases, the relevance of a general framework emerges that can address all these fields, their interconnections, and other fields concerned with complex future problems.

The authors, after an extensive literature review, could not find any research on general challenges and needs of interdisciplinary teams, nor on the managerial implications of general needs. The general framework to be developed has the potential to depict needs shared by all kinds of teams engaged with complex future problems. It should also aim demonstrate possible interconnection of identified common needs. As Ariss et al. (2013) observe, the interconnection of aspects of interdisciplinary teams can be relevant - a factor which they have not considered in their work and explicitly suggest to be of interest for further study (Ariss et al. 2013). With that having said, the possible transferability of field specific insights on interdisciplinary needs is a relevant endeavor. A possible connection of needs, as observed by Ariss et al. (2013), are included as another main aspect of the research gap on interdisciplinary teams.

1.3 Purpose & Aim

The purpose of this thesis is to identify possible common needs of interdisciplinary teams working with complex future problems. The aim is to develop a framework of common needs for interdisciplinary teams based on literature, and further test and develop the framework with empirical data.

1.4 Research Questions

Based on the introduction, the following research questions serve as a point of orientation in this study and shall be answered throughout the research process.

RQ1: Do general/common needs of interdisciplinary teams exist? If yes, what are they?
RQ2: In what way are common needs connected to each other?
RQ3: What are the managerial implications of the identified needs?

2 Conceptual and Theoretical Framework

This chapter firstly offers an overview of the key concepts of interdisciplinary teams in the form of a conceptual framework. Further, a theoretical framework is developed that serves as the main element for the analysis of the empirical data. The theoretical framework depicts all identified needs of interdisciplinary teams and their interconnections.

2.1 Key Concepts

As shown, no research has been conducted on interdisciplinary teams in general, only research in very specific fields of work was found; therefore, definitively defining concepts is difficult. As Bell & Bryman (2011) suggest, definite concepts in qualitative research should only give a general sense of the phenomenon they are describing. Thus, fixed definitions of the key concepts regarding interdisciplinary teams do not seem beneficial. Blackwell et al. (2009) add that some researchers refuse to use fixed definitions for the concepts used in the study of interdisciplinary teams. On the other side, too broad definitions of relevant concepts can make the investigation of the concepts complicated, and hypotheses derived from them difficult to verify (Bell & Bryman, 2011).

The researchers aim to satisfy both concerns as they present preliminary definitions of main concepts, but also continuously discuss the concepts and their possible definitions throughout the research process. The option to modify concepts shall remain open throughout the research process. This approach is adequate because it allows openly exploring the little-researched nature of interdisciplinary teams. Therefore, all main concepts were defined in a preliminary way and explored continuously.

2.1.1 Teams

Before introducing concepts specifically important to interdisciplinary teams, it appears essential to firstly offer a basic definition of what the researchers acknowledge as a *team*, as this discourse is involved with the phenomenon of (interdisciplinary) teams. The term team can be defined in numerous ways (Gilley, Morris, Waite, Coates & Veliquette, 2010). For the sake of simplicity, the researchers define teams as a group of at least two or more individuals with complementary skills, who are accountable for achieving common goals or objectives for the team (Clutterbuck, 2007; Giley et al. 2010; Katzenbach & Smith, 2003). The researchers exclude settings from this in which groups of two or more may work at the same physical location but do not interact and share information with each other.

2.1.2 Multi-, Inter- and Transdisciplinary Teams

In the literary landscape, a discord on what interdisciplinary teams should be defined as can be observed. Some research efforts differentiate between the concepts of multi-, inter-, and transdisciplinary teams (Youngwerth & Twaddle, 2011; Klein & Mitcham, 2010), while others offer definitions for the concept of interdisciplinary teams without a comparison to multi- and transdisciplinary teams (Blackwell et al. 2009; Hacklin & Wallin, 2013;). In the scopes of this study, an open definition of interdisciplinary teams is adopted, that also includes trans- and multidisciplinary teams. To give an overview, short considerations are, however, displayed to introduce how inter-, trans-, and multidisciplinary teams may be seen as inherently different from each other.

In *multidisciplinary teams*, each member has a clearly-established place in the team (Youngwerth & Twaddle, 2011). However, team members may be somewhat isolated from each other (Youngwerth & Twaddle, 2011). This can take place in the form of a "juxtaposition of various disciplines, sometimes with no apparent connection between them" (Chettiparamb, 2007, p. 19). It is to be noted that this definition would contradict with the researchers' definition of a team.

In comparison to interdisciplinary and multidisciplinary, team members have less defined roles in *transdisciplinary teams* (Youngwerth & Twaddle, 2011). Individuals usually come from unrelated disciplines and do not all have an academic background: "Team members' expertise will blur across roles and systematically cross discipline boundaries" (Youngwerth & Twaddle, 2011, p. 650).

Lastly, a point of orientation is introduced to how *interdisciplinary teams* are defined. Very importantly, the distinction between multi-, inter- and transdisciplinary teams was not be adopted. Blackwell et al. (2009) disregard the theoretical differentiation of multi-, inter- and transdisciplinary teams, as they draw interdisciplinary teams as a phenomenon that is experienced by people "navigating around and across professional knowledge boundaries" (Blackwell et al. 2009, p. 8). A set definition of interdisciplinary teams is considered to hinder innovative interdisciplinary processes (Blackwell et al. 2009). It is, as a result of this, suggested that interdisciplinary teams can take place in many shapes, blending into the concepts of multi- and transdisciplinary teams on many occasions (Blackwell et al. 2009). It can combine all three concepts in the sense that it incorporates knowledge from various disciplines to address complex problems in the process of problem-solving with the sharing of information, skills, and responsibilities (Zubaroglu & Popescu, 2015; Youngwerth & Twaddle, 2011). This argumentation was adopted, and the concepts multi-, inter- and transdisciplinary teams were all be included under the term of interdisciplinary teams.

Definitions of interdisciplinary teams often include the connection of particular challenges that come with it (Hacklin & Wallin, 2013). However, there is no consensus on what these challenges are and how interdisciplinary teams should be managed in the most effective way possible (Ravet, 2012). And neither does one single answer exist to the question of what the characteristics of a well-functioning interdisciplinary team are (Ariss et al. 2013). Therefore, no specific definitions of what challenges these teams encounter or how they are usually managed were included in a definition that proceeds literature analysis.

Finally, a definition of interdisciplinary teams adopted in this discourse shall be introduced. Firstly, interdisciplinary teams are not limited to academic disciplines; instead, they include disciplines also in the sense of functional background, as it is often the case in healthcare literature (Ariss et al. 2013). A team is to be considered interdisciplinary if two or more different disciplines work together in a team. In the scopes of this work, these characteristics were accepted as guidelines of what interdisciplinary teams are, and most importantly, have been used as a filter for the selection of interdisciplinary practitioners under investigation with the interviews.

2.1.3 Disciplinary and Professional Background

In the scopes of this paper, the term disciplinary background includes both academic and professional backgrounds. Of course, a difference between profession and academic discipline may apply in other contexts, but in the field of interdisciplinary teams, this distinction does not lead to a helpful refinement of the subject. This is especially visible when considering the study participants that Blackwell et al. (2009) encountered when studying radical innovation. They conclude that all the participants were, at some point, trained within a discipline in higher education or professional life (Blackwell et al. 2009). The very boundary that constitutes a discipline was not constructed equally in different sectors, and neither did all participants refer to the same phenomenon when using the term discipline (Blackwell et al. 2009). However,

> without exception, they spoke of themselves as belonging in some sense to that discipline from which they came, sometimes describing it as a ‘home’ or ‘native’ discipline. Early educational and professional experiences clearly shape individual values and intellectual styles, in a way that is preserved even as a person moves between sectors (Blackwell et al. 2009, p. 17).

This account demonstrates the redundancy of differentiation between the terms of disciplinary background and professional background. Ariss et al. (2012) confirm that, in their study on interdisciplinary healthcare teams, a distinction between profession and discipline was not relevant. Still, they identify scholars that

distinguished these concepts (Ariss et al. 2012). This again demonstrates the divergence of understandings of basic concepts in the discourse.

2.2 Systematic Literature Review: A Theoretical Framework of Needs

In the case of interdisciplinary teams concerned with complex future problems, there is no existing base of literature that could be considered as a point of orientation. All accounts on the needs of interdisciplinary needs were clearly related to a specific field of work. After careful consideration of all identified resources, the fields of healthcare, academic research, social work, and innovative settings were identified as main fields of research on interdisciplinary teams' needs. All found accounts from these fields were combined so that a theoretical basis could be developed. This way, the authors have created their very own theoretical framework, which was tested and developed later within the data collection.

For each field, a separate thematic analysis was conducted to identify common themes. Then, the field-specific themes were again analyzed across the fields to create a common framework of needs. The finished framework was moreover translated into codes for the creation of the template used as a basis for interview questions, and the analysis of the data (King, 2002).

Because the main aim of this study was to find common challenges and needs, themes had to overlap in at least two fields to be considered relevant and to be included in the framework. Single conclusions from just one author were disregarded. However, single explanations to the common themes were included because there was seldomly a true consistency of explanations of the themes.

In the literature on interdisciplinary teams, some themes were also identified to be the core needs of all kinds of general teams. The term general team refers to all sorts of different teams that are not necessarily interdisciplinary in nature. Interdisciplinary teams, of course, have some needs in common with other types of teams. These, however, cannot be seen as equally relevant to specific needs connected to the interdisciplinary nature of a team. Interdisciplinary teams overlap with general teams' needs, mainly in their needs for team evaluation, shared vision, goals and values, and leadership (see table 1). Regardless, these needs were still explored in the literature review and empirical data collection to see if a more detailed analysis could show peculiarities of these themes in interdisciplinary teams. For example, to see if some specific leadership is needed in interdisciplinary teams, rather than just *some* kind of leadership. Or if the need for team evaluation is especially strong in interdisciplinary teams. However, if data is to show no strong specific need for these themes, they are to be disregarded. *Table 1* shows the overlapping needs in

interdisciplinary and general teams, and *table 2* shows the needs of interdisciplinary teams that were specifically connected to the particular nature of these teams.

Table 1: Overlapping Needs in Interdisciplinary and General Teams

Interdisciplinary Teams' Needs	**General Teams' Needs**
Shared vision, goals and values	Shared vision and goals (Gilley et al. 2010; Hackman, 2002)
Team Evaluation	Team Evaluation (Gilley et al. 2010; Salas, Stagl & Burke, 2004; Hackman, 2002)
Leadership	Leadership in general (Gilley et al. 2010; Salas, Stagl & Burke, 2004; Hackman, 2002; Levi, 2007)

Table 2: Specific Interdisciplinary Teams' Needs

Specific Interdisciplinary Teams' Needs	
Shared Work Approaches	Knowledge Exchange
Understanding of Competencies	Role Clarity
Equal Status	Flexibility
Shared Language	Increased Time
Team Composition	Co-location

2.2.1 Specific Interdisciplinary Teams' Needs

Knowledge Exchange

Knowledge exchange or the exchange of discipline-specific information was described as a relevant but challenging aspect in interdisciplinary collaboration in social work, as well as healthcare. The challenge in knowledge exchange is that tensions can arise when individuals have to share disciplinary knowledge that used to be exclusive (Abramson & Mizrahi, 2003). Therefore, information is still often withheld across disciplines (Abramson & Mizrahi, 1996).

Knowledge exchange appeared to be influenced by other aspects of interdisciplinary work. Exchange of information or knowledge is hindered in climates of strong status competition (Derry & O'Donnel, 2005). Equality in status is characterized by respect and high perceived value of each member's knowledge regardless of their background (Youngwerth & Twaddle, 2011). Less hierarchical structures were also suggested as an environment that prevents status competition and by that, encourages developing a room where every team member can share their insights (Bronstein, 2003). It appears crucial that the team climate encourages valuation and trust in the contribution of different disciplines (Ariss et al. 2013; Brewer, 1999). In an interdisciplinary team everyone should have the chance to participate (McGill, 2017; O'Connor et al. 2003). Exchange of information was also seen as positively influenced by a shared space or co-location of the team members (Ambrose-Miller & Ashcroft, 2016).

Shared Work Approaches

In all investigated fields, the problem of differences in work approaches was described. There were concrete considerations on why *shared work approaches* are especially needed in interdisciplinary teams and how they can be created. It is suggested that disciplinary approaches for problem-solving often differ (Klein, 2005) and that each approach neglects insights from other disciplines (Blackwell et al. 2009). Individuals in the interdisciplinary team were believed to often seek information within their worlds of knowledge when confronted with unknown situations, leading to the exclusion of knowledge (Dougherty, 1992).

Brewer (1999) explained this preference for using one's own methods with different frames of reference that different disciplinary cultures possess. To allow some flexibility to these frames of references, each discipline should be involved in the discussion on the fundamental nature of the subject under investigation (Bendersky & McGinn, 2007). This was connected to the idea that there are often different interpretations of the task or problem (O'Connor et al. 2003). Common interpretations of the phenomenon under investigation should be created from the beginning because solitary interpretations can cause problematically strong opinions and polarizations (O'Connor et al. 2003).

Understanding of Competencies

The relevance of *understanding competencies* was highlighted in the fields of social work, healthcare, and academic research. A lack of recognition of other disciplines' skills seems to be a problem as it hinders the negotiation of work methods and knowledge (Abramson & Mizrahi, 1996). There was a need identified for a common understanding of the knowledge and the different disciplines' skills for fostering collaboration (Derry & O'Donnel, 2005).

Misunderstandings of competencies were believed to become especially problematic when the socialization process within a discipline creates different disciplinary values that can be misunderstood by other disciplines as interpersonal dynamics (Abramson & Mizrahi, 1996). Then the conflict does not appear to be based on disciplinary education but more on interpersonal mismatching of team members (Abramson & Mizrahi, 1996).

As established in the section on knowledge exchange, the combination of different forms of knowledge is crucial in the interdisciplinary team. The integration of different types of knowledge requires a shared understanding of the value of each other's competencies (Abramson & Mizrahi, 1996). For true collaboration to be formed, there is a need for a shared understanding of each other's expertise and relevance of the common work (Abramson & Mizrahi, 2003). Each individual's contribution should be valued equally, regardless of their disciplinary background (Youngwerth & Twaddle, 2011). A shared understanding of competencies was thereby considered crucial to recognize the relevance of each other's findings (Bendersky & McGinn, 2007). This is where the connection to equal status appeared, as the understanding of the others' disciplinary knowledge influences the recognition of different types of knowledge and sets the groundwork for considering all perspectives equally (Abramson & Mizrahi, 1996).

Equal Status

In academic research, social work, and healthcare, the issue of status competition and hierarchy was described. While an in-depth analysis of the status issues in interdisciplinary teams seems to be a more complex endeavor, it was possible to identify consensus on the specific need for equal status of disciplines within the interdisciplinary team.

Ambrose-Miller and Ashcroft (2016) differentiated into *overt* and *covert* power differentials acting as a barrier for collaboration. While overt power can be found in structural authority, covert power can often be detected in the dynamics of interaction (Ambrose-Miller & Ashcroft, 2016). Informal power dynamics were considered sometimes to be more powerful than structural power (Ambrose-Miller & Ashcroft, 2016). Some authors explicitly concentrated on the covert power differentials more, as they focused on the interactional level (Derry & O'Donnel, 2005; Klein, 2005).

According to Derry & O'Donnel (2005), status differences exist, as most groups have competencies that are internally considered more relevant for the task, while other competencies are considered less relevant. Traditionally prestigious disciplines may dominate the discourse and be perceived of higher status (Klein,

2005). Also, the initiator of the project is also often seen as of higher status than later on added disciplines (Klein, 2005).

Status boundaries can lead to a limited exchange of information as the participation in interactions may differ according to one's status (Derry & O'Donnel, 2005). Individuals with lesser perceived status participate less in interactions (Derry & O'Donnel, 2005). It became visible that, generally, hierarchical structures with status differences hinder collaboration (Youngwerth & Twaddle, 2011). Differences in status arise easily because interdisciplinary teams often lack a shared understanding of the competencies of other disciplines and, thereby, lack in recognition of other disciplines' skills (Abramson & Mizrahi, 1996). This way, the dominance of some discipline(s) is often visible (Abramson & Mizrahi, 1996).

Equal status could, in turn, lead to a more equal distribution of responsibility and decision-making (Abramson & Mizrahi, 1996). When decisions are only done by the dominant discipline, conflict can arise (Abramson & Mizrahi, 1996). Having shared responsibility is suggested to reduce frustration and instead establishes support and interdependence amongst team members (Abramson & Mizrahi, 2008; Bronstein, 2003). It also fosters effectiveness of team collaboration (Rumping, Boendermaker & Ruyter, 2019), increases trust, and aligns expectations on the collaboration (Bronstein, 2003).

Shared Language

In the fields of innovational settings and academic research, the challenge of disciplinary language was discovered. It was argued that within each disciplinary education, a specific language or terminology is usually developed (Epstein, 2005; Klein, 2005; Brewer, 1999). When different disciplines come together in an interdisciplinary team, these languages can clash: discipline-specific terms are used that other disciplines are not familiar with, or even the same words are used but with different meanings (Epstein, 2005; Klein, 2005). Team members even may be unaware of the difference in disciplinary language (Epstein, 2005).

Especially in situations of status competition, specific language is argued to be increasingly used to establish dominance of oneself or one's discipline in the team (Gohar et al. 2019). Therefore, there is a strong need to readjust definitions in the team and to create a *shared language* (Delgado & Åm, 2018). This argumentation highlighted that status competition increases the use of exclusive language that is not understood by all individuals. Status competition is therefore a hindering factor of shared language.

Team Composition

In the fields of healthcare, innovational settings, and academic research, the *composition of the team* or the diversity of disciplines in the team seems to be relevant. Individuals with complementary expertise(s), interests, ideas and/or professional goals have proven to bring the best solutions to complex problems (Gohar et al. 2019). According to O'Connor et al. (2003), team composition might influence the emergence of conflict: An inappropriate combination of disciplines is suggested to increase conflict between disciplines (O'Connor et al. 2003).

It remains a question of interpretation of what 'complementary' implies. Some said that substantial diversity brings higher effectiveness (Youngwerth & Twaddle, 2011), and others especially emphasized the importance of a balanced representation of disciplines (O'Connor et al. 2003). While the importance of an appropriate team composition is highlighted, there was not much information given on *what* the ideal composition of the interdisciplinary team could be in general. It appears to be dependent on the specific situation (McGill et al. 2017). Making a statement on any form of commonality regarding this aspect seems to be complicated. However, the researchers chose to investigate this theme further in the data collection because there is some potential relevance of it implied in the literature.

Role Clarity

The importance of *clear roles* is highlighted in all investigated fields. Interdisciplinary teams were believed to have especially high interpersonal complexities, which leads to the need for clarifying roles and contributions of each member (Gohar et al. 2019). Clear roles include having clear and allocated responsibilities (O'Connor et al. 2003; Epstein, 2005). This implies a mutual understanding of each other's roles in the team (Bronstein, 2003), and is suggested to lead to a better comprehension of expectations for each individual (Bronstein, 2003; Rumping, Boendermaker & Ruyter, 2019). High role clarity was thereby expected to lead to higher commitment within the team (Nandan, 1997).

Unclear roles lead to conflicts when responsibilities overlap (Youngwerth & Twaddle, 2013). And they become problematic when unclear roles lead to lack of recognition of value and the need to demonstrate one's value in the team (Ambrose-Miller & Ashcroft, 2016). Despite the need for some clarity in the roles, it was still argued that some degree of flexibility is required (Ambrose-Miller & Ashcroft, 2016). Ambrose-Miller & Ashcroft (2016) found that their investigated professionals agreed on the benefits of having a certain degree of fluidity in one's role to follow the emerging needs of the team. According to McGill et al. (2017) and Blackwell et al. (2009), there should be some flexibility between boundary crossing and maintaining professional boundaries.

Co-location

In all investigated fields, the importance of *co-location* of the team members was emphasized. Physical space and/or frequent team meetings were believed to be required for good collaboration (Ariss et al. 2013; O'Connor et al. 2003; Ambrose-Miller & Ashcroft, 2016; Rumping, Boendermaker & Ruyter, 2019).

Often, however, organizational structures are divided into knowledge units (Blackwell et al. 2009; Howard, 2008). The creation of new units developed for interdisciplinary collaboration may be an option (Blackwell et al. 2009). However, this would lead to the risk of creating new boundaries between one interdisciplinary unit and other units (Blackwell et al. 2009). It was suggested that the combination of formal and informal mingle opportunities creates a beneficial environment for interdisciplinary knowledge exchange (Epstein, 2005; Rumping, Boendermaker & Ruyter, 2019).

The proximity of individuals establishes a favorable communication structure (Youngwerth & Twaddle, 2011; Ambrose-Miller & Ashcroft, 2016). This can be visible in several ways: a team narrative can be created more easily (Youngwerth & Twaddle, 2011), knowledge sharing generally can occur more naturally in such setting (Ambrose-Miller & Ashcroft, 2016), and the undivided attention in a physical meeting can benefit the social dynamics of the team (Epstein, 2005). Collaborative activities generally are considered to contribute to a wider expertise of each individual (Bronstein, 2003).

Flexibility

Throughout the different aspects of interdisciplinary collaboration, flexibility was repeatedly highlighted. In the context of roles, flexibility between boundary crossing and maintaining professional boundaries was considered prominent (McGill et al. 2017; Blackwell et al. 2009). Being flexible in definitions and approaches to problem-solving (which is a part of shared work approaches) was also regarded as helpful (Blackwell et al. 2009). Moreover, the need for a shared language can be seen as standing in connection with a need for flexibility, as it was implied that some negotiation of a shared language should take place (Delgado & Åm, 2018). Thereby, flexibility appears as a necessity in connection to roles, work approaches, and use of language.

Increased Time

In innovational settings, academic research and social work, it was highlighted that interdisciplinary teams require more time than single-disciplinary teams to reach the desired results and benefits of interdisciplinary collaboration (Blackwell et al. 2009; Epstein, 2005; O'Connor et al. 2003; Ambrose-Miller & Ashcroft, 2016; Gohar et al. 2019). Insufficient time was considered the primary reason why interdisciplinary

endeavors fail (Blackwell et al. 2009). In turn, sufficient time was seen to be a critical success factor for interdisciplinary work (Blackwell et al. 2009). Blackwell et al. (2009) explained this by the necessity of building social capital across fields, which is necessary for collaboration and requires time to establish.

One of the most significant benefits of the diversity of insights provided in interdisciplinary teams seems to be that it prevents the closure of the interpretation of problems and results (O'Connor et al. 2003). Late closure of interpretations is beneficial to consider multiple solutions (O'Connor et al. 2003). This prevention of closure needs a corresponding time frame (O'Connor et al. 2003). In other words, the exchange of knowledge requires *increased time.* Moreover, creating a shared understanding of the problem that is to be solved by creating a shared work approaches requires some time that is not required in single-disciplinary constellations (O'Connor et al. 2003).

2.2.2 Overlappings: Interdisciplinary and General Teams' Needs

Shared Vision, Goals or Values

These themes, especially goals and vision, were also considered needs of teams in general (Gilley et al. 2010; Hackman, 2002). In the interdisciplinary team, a *shared understanding of vision, goals or values* was highlighted in the contexts of social work, healthcare, and innovational settings. However, the descriptions remain very vague, and the needs portrayed here seem to be relevant for all kinds of teams, and not primarily for interdisciplinary teams. A short introduction to the considerations on vision, goals, and values shall be given, nevertheless.

In interdisciplinary teams, members may have different interests and motivations (O'Connor et al. 2003). This can be seen as connected to varying levels of commitment, which leads to different expectations and eventually to mistrust among the team members (Rumping, Boendermaker & Ruyter, 2019). Concerning these different levels of commitment and expectations, creating a shared vision was found to be crucial (Rumping, Boendermaker & Ruyter, 2019).

The importance of shared goals was also repeatedly highlighted (Ambrose-Miller & Ashcroft, 2016; Youngwerth & Twaddle, 2011). Shared goals influence communication positively: They lead to better trust and less conflict (Ambrose-Miller & Ashcroft, 2016). To ensure that each member is following the established goals, the goals should be co-created (Delgado & Åm, 2018). Desired outcomes should be negotiated, and compromises are recommended (Abramson & Mizrahi, 1996).

The importance of shared values was also highlighted (Ariss et al. 2013; Blackwell et al. 2009). Clear and shared values were considered to offer direction and portray a consistent external image (Ariss et al. 2013). However, especially in innovational settings, the shared values, goals, and vision must leave room for unanticipated outcomes (Blackwell et al. 2009).

Team Evaluation

Team evaluation is a need considered for teams in general in regard to higher team effectiveness (Gilley et al. 2010; Salas, Stagl & Burke, 2004; Hackman, 2002). And also in all fields of interdisciplinary teams, a special need for evaluation of team performance or feedback was mentioned. However, the information remains very vague, and the need for team evaluation is a prominent need for teams in general.

Especially in innovational settings, the often unanticipated outcomes were considered to make evaluations of outcomes difficult (Blackwell et al., 2009). Reflection on the collaboration of the team and one's own collaborative approach appear to be crucial (Bronstein, 2003; Rumping, Boendermaker & Ruyter, 2019). Feedback sessions and team evaluation meetings can be helpful tools to evaluate performance, address conflict, collaboration, and evidence of the effectiveness of the interdisciplinary approach (Ariss et al. 2013; O'Connor et al. 2003; Bronstein, 2003; Youngwerth & Twaddle, 2013).

Leadership

In the literature on interdisciplinary teams, *leadership* was thematized in all fields. While most authors argued for the need for leading/mentoring/facilitating in some way, the suggestions of ideal leadership in interdisciplinary teams varied. No clear need for a specific form of leadership could be identified. It seems to be dependent on the field, which is why no statement on the need for a specific type of leadership in interdisciplinary teams can be made. Also, leadership was considered a relevant factor in all kinds of other teams and is therefore not specific to interdisciplinary teams (Gilley et al. 2010; Salas, Stagl & Burke, 2004; Hackman, 2002; Levi, 2007). Nevertheless, some insight into leadership in interdisciplinary teams shall be given.

Some authors argued for the utility of a leader with internal insight (Epstein, 2005; Howard, 2008). Epstein (2005) stressed the need for a facilitator who translates the languages of the different disciplines and has some internal insight. Howard (2008) also argued for the need of a leader with some familiarity with the different disciplines. Contrasting views offered some critique to having leaders with high internal insight if that insight is one-sided: There were some problems identified in having a leader with the same disciplinary background as a group in the team (Youngwerth & Twaddle, 2011). If team leaders prioritize their own

discipline, other team members' needs and views may be neglected as information flow can become one-sided (Youngwerth & Twaddle, 2011).

A few insights on singular suggestions on appropriate leadership shall be given. Blackwell et al. (2009) suggested the use of what they call *pole-star leadership*. This leadership is characterized by a leader that creates common and flexible goals and encourages a balance between focus and serendipity (Blackwell et al. 2009). Here, serendipity related to the need to leave room for unanticipated outcomes (Blackwell et al. 2009). In other words, Blackwell et al. (2009) suggested that leadership should be connected to the theme of flexibility. Some authors highlight the importance of specific tasks in leading. According to Edmondson (2003) and Ariss et al. (2013), the leader of the interdisciplinary team has to create shared meaning and direction of the situation. In other words, the leader has to create a clear vision (Howard, 2008). This can be seen as related to the argument of O'Connor et al. (2003), who suggested that leaders should establish rules, expected learning processes, clarify shared norms, roles, and responsibilities, and do team assessment. Gohar et al. (2019) argued for the need for an *integration scientis*t[2] who assesses problems and their interconnections, identifies strategies for approaching them, predict evolving issues, and provides support. Leadership was considered essential for the encouragement of team members (Abramson & Mizrahi, 2003), and it is needed to guide collaboration (Ambrose-Miller & Ashcroft, 2016). Formal and informal leadership can set a prominent example for interdisciplinary collaboration (Ambrose-Miller & Ashcroft, 2016).

When it comes to the matter of power, some authors argued for a defined leader; one that encourages democracy, shared power, and flat hierarchies (Ariss et al. 2013; Youngwerth & Twaddle, 2011). A leader should foster creativity by giving everyone the chance to actively participate (McGill et al. 2017). Moreover, strong hierarchical structures are generally considered to hinder collaboration in interdisciplinary teams (Youngwerth & Twaddle, 2011).

2.2.3 Conclusion: A Preliminary Framework

In the systematic literature review, it became clear that numerous ideas, concepts, and definitions were held in a vague manner. On one side, this vagueness seems sensible considering the diverse possible compositions and purposes of interdisciplinary teams. It, however, appears challenging to extract concrete information on how interdisciplinary teams are constructed and what elements are crucial for their collaboration. A few examples include statements saying, for instance, that interdisciplinary teams needed

[2] Concept of implementation scientist by: Bammer G. Toward a New Discipline of Integration and Implementation Sciences. In: Frodeman R, editor. The Oxford Handbook of Interdisciplinarity, 2nd Edn. (2017). Oxford, UK: Oxford University Press.

‘more time’ than single-disciplinary teams (Gohar et al. 2019), that they needed ‘complementary disciplines’ (Gohar et al. 2019) or that they needed ‘strong’ role clarity (Nandan, 1997). These statements raised questions, such as, what exactly is meant by ‘more time,’ what constitutes ‘complementarity,’ or when is a role clarity considered ‘strong’?

These unclear statements call for a thorough discussion on what the single characteristics of interdisciplinary teams mean. However, the objective of this work was not solely the discussion of concepts that are commonly held vague throughout the discourse of the subject. Instead, the focus was set on the development of a framework for management on recognizing and addressing the needs of interdisciplinary teams. And because these teams appear in many shapes and contexts, the ambiguity, in the end, allows for adaptability of the needs to different situations. By developing a general framework, some detail-orientedness is neglected, but it will enable to create an appropriate overview of needs.

Combining existing results of research on managing, Mintzberg (2009) has shown that it is possible to develop general frameworks of complex topics - that it is possible "to get it all on one sheet of paper, in the form of a single diagram" (Mintzberg, 2009, p. 47), in order to offer a comprehensive overview (Mintzberg, 2009). He did this by exploring the concept of *managing* across very different fields (Mintzberg, 2009). However, as Mintzberg (2009) acknowledged, the complexity of his topic cannot be touched fully in this compressed format. The researchers note that this is also the case with the framework developed in this work. Nevertheless, within the scopes of this work and for the sake of creating a general framework, shortcomings in detail-orientation were accepted. Even though a field-specific framework can give a more in-depth insight into the specifics of each element, the general framework offers what they do not - the aspect of interconnectedness across fields and a more likely general applicability.

The following table displays specific interdisciplinary teams’ needs in the first column, and in the second column, it shows needs that are not *especially* essential for interdisciplinary teams but for all kind of teams. Some needs show strong connections to other needs, while others do not present definite connections at all. Of course, all identified needs influence the collaboration in interdisciplinary teams in some way. However, this conclusion focuses on the explicit connections between identified special needs of interdisciplinary teams and, therefore, does not include broader elaboration on what overall effect the needs or themes may have as they have not been mentioned in the literature.

Table 3: A Preliminary Framework of Interdisciplinary Teams' Needs and Their Connections

Specific Interdisciplinary Teams' Needs	**Overlapping Themes: General and Interdisciplinary Teams' Needs**
Shared Work Approaches - *needs* flexibility	Shared vision, goals and values - *no explicit connection to other themes*
Understanding of Competencies - *encourages* knowledge exchange - *encourages* equal status	Team Evaluation - *no explicit connection to other themes*
Equal Status - *leads to* exchange of knowledge (equal participation in discourse) - *encourages* shared language - *is hindered by* lack of understanding of competencies, and lack of recognition of their competencies	Leadership - *could foster* shared language, knowledge exchange, shared work approaches, equal status
Shared Language - *is hindered by* status competition (lack of equal status)	-
Knowledge Exchange - *hindered by* status competition (needs equal status) - *encouraged* by co-location - *encouraged* by understanding of competencies	-
Role Clarity - *requires* flexibility	-
Co-location - *fosters* knowledge exchange	-
Team Composition - *no explicit connection to other themes*	-
Flexibility **integral need* - *needed for* roles - *needed for* shared work approaches - *needed for* shared language	-
Increased Time **integral need* - *needed for* exchange of knowledge - *needed for* creating shared work approach (shared understanding of problems/tasks)	-

This theoretical framework will be tested and developed further in the analysis and discussion of the empirical data. It was also translated into a template, which was used for creating an interview guide and a template for analysis of the empirical data. Once the insights from theory and data are combined, the final framework for needs of interdisciplinary teams can be created.

3 Methodology

This chapter describes the qualitative research design and the deductive-abductive research strategy. The selection of the best available knowledge is shortly described. The qualitative face-to-face interview is introduced as the data collection method, and the sampling process is discussed. The template analysis as the approach for the data analysis is presented. Finally, the authors present how they want to achieve validity and reliability and finally reflect on some limitations of the study.

3.1 Research Design

The research design was chosen according to the purpose of the study and is characterized by a qualitative approach and a deductive-abductive research strategy: the purpose of this study was to analyze the common needs that interdisciplinary teams (working with complex future problems) have, and to test the applicability of a general framework with empirical data.

3.1.1 A Qualitative Approach

According to Creswell (2003), the choice of the research approach is influenced by various factors: one being matching the research problem with the approach. Certain issues require specific approaches (Creswell, 2003). The research design served as a frame for addressing the purpose of the work (Mason, 2002). In this case, the research purpose required an exploratory approach, which allows drawing comparisons between literature and data as well as creating in-depth interpretations of possible implications (Creswell, 2003). This is why the authors identified the most applicable approach to be of qualitative nature.

Moreover, according to Creswell (2003), a qualitative approach is appropriate whenever there is a need to understand a phenomenon better because it is little researched. This is the case of interdisciplinary teams in connection with complex future problems. The qualitative approach allowed to collect emerging information and to develop themes from data (Creswell, 2003). This is specifically important as it is not certain if common needs of interdisciplinary teams exist at all. Therefore, the research process had to remain very open to the emergence of themes, also considering that common themes may not emerge at all. Qualitative research was deemed capable of detecting possible common needs as it allows to create grounded cross-contextual generalities (Mason, 2002).

Moreover, as Bryman (2012) stated, in qualitative research, the emphasis is put on the interviewees' perspectives and thoughts. It allowed the researchers to examine a phenomenon openly, considering multiple individual perspectives (Bryman, 2012). This focus on the individual perspectives and thoughts,

the researchers believed to be needed when investigating delicate themes closely connected to personal experience.

Despite the apparent applicability of qualitative research to the research subject, there are some challenges connected to the qualitative approach. The qualitative approach seems to be affected by the subjectivity of the researcher, and it is criticized due to the lack of generalizability of findings (Bell & Bryman, 2011). The researchers aimed to minimize their subjectivity in generating data with a thorough presentation of research methods and careful drawing of conclusions. When it comes to the replicability and generalization of findings, it was considered that an in-depth exploration of the identified needs is the main focus and is more important than high generalizability. In the case where it is essential to explore concepts openly, the qualitative approach was found to offer the most promising results.

3.1.2 Deductive-Abductive Research Strategy

According to Mason (2002), it is debatable whether pure forms of inductive, deductive, retroductive and abductive reasoning are ever really applied as most research strategies actually utilize a combination of different reasoning approaches. This is very prominent in this case as the approach for reasoning can be characterized as tending towards a *deductive* approach with some *abductive* elements (Mason, 2002).

A *deductive* tendency is apparent in terms of the idea that theory can be tested and to some degree verified (2002). The theory is, thereby, tested against the data (Mason, 2002) to see whether the theory matches the data (Blaikie, 2000). The deductive strategy was appropriate as it allowed to find common concepts between theory and data. The concepts introduced in the preliminary framework served as hypotheses[3]/preliminary themes that will be further tested and modified with the analysis of the data.

An *abductive* tendency, in this case, was also required because the researchers had to remain open for alternative or additional relevant concepts that may emerge later in the process. The abductive strategy addressed this need with a dialectic approach in which theory, data generation and data analysis are conducted simultaneously (Mason, 2002). In this study, it is not explicitly simultaneously but it is not strictly structured either. Thereby, the researchers remained open for surprising findings to be included in the theory (Timmerman & Tavory, 2012).

[3] The researchers highlight that the term *hypothesis* is utilized in deductive strategy, but in this work the term *preliminary concept* may be more appropriate, due to the exploratory nature of the analysis of them.

3.2 Best Available Knowledge

According to Bougie & Sekeran (2016), a thorough literature review highlights relevant themes, documents significant findings and frameworks that serve as a foundation for the discourse. Acknowledging the importance of the literature for later conclusions, a careful consideration of possible literature was applied. Relevant literature was found through conducting a keyword search including the terms "interdisciplinarity", "interdisciplinary teams", "challenges of interdisciplinary teams", "needs of interdisciplinary teams", and "managing interdisciplinary teams" on Google Scholar, and Scopus. Empirical studies and literature analyses in journals and dissertations were chosen for analysis. All research was excluded that did not clearly indicate either *challenges*, *needs*, or *influences* of/on interdisciplinary teams.

3.3 Data Collection Method

In the scopes of this work, understanding the data was prioritized over heavy quantifying of data (Mason, 2002). The semi-structured face-to-face interview was therefore chosen as a method to generate data. The needed in-depth information was believed to only be reachable in this kind of format (Mason, 2002). It allowed the interviewers to adapt questions, and to ask interviewees to clarify statements that needed more explanation (Mason, 2002). This in-depth exploration of the subject was in the interest of the researchers, but it also gave interviewees the fair possibility to share their perspectives fully (Mason, 2002).[4]

In the interviews, topic areas with questions were collected with the possibility of being adjusted during the interview (Bryman, 2012). The topic areas were derived from the preliminary template. Three open-ended questions were asked to encourage a speaking flow, and then follow-up questions were asked according to the content the interviewee talked about (see Appendix A). The interviews were conducted face-to-face or via Skype and had a duration of 20-45 minutes each.

Out of respect for the interviewee's privacy, and due to the confidential nature of the information shared, the display of the data was anonymized. Interviews have been recorded only with explicit permission. Due to having recorded the interviews, summaries could be written with indirect and direct references. The

[4] Other methods that were considered are participant observation and surveys (Lewis et al. 2009). Participant observations would have had the benefit of explaining the happenings in an interdisciplinary team in-depth (Lewis et al. 2009). But to achieve the variety of insights that was reached through interviewing, participant observation would have been very time-consuming and access to appropriate data is harder to get (Lewis et al. 2009). The second option that was considered is the survey. Surveys are connected to a much larger number of respondents (Bell & Bryman, 2011). However, questions cannot be modified in relation to the specific experiences the respondents have, and no opportunity to ask respondents to elaborate further on certain topics is given (Bell & Bryman, 2011). Therefore, this method was seen as irrelevant for this research purpose.

interviews were listened to and summarized separately by both researchers to increase the probability of including all relevant information.

3.4 Sampling

The sampling process can most appropriately be described as *theoretical sampling* (Mason, 2002). The process of theoretical sampling is concerned with finding a sample which is theoretically and empirically meaningful (Mason, 2002). Moreover, contexts were selected that allow for making crucial comparisons as well as developing and testing the argument and theory (Mason, 2002). This is a common approach for generating theory and explaining phenomena through data (Mason, 2002). The theoretical sampling that was applied does not claim generalizability of the results to the wider universe (Mason, 2002).

Firstly, the wider universe from which the sample should be drawn from had to be defined (Mason, 2002). In this case, this included all individuals who a) are or were a member and/or manager of an interdisciplinary team, and b) work or have worked in a team concerned with complex future problems, and c) work in a little researched field, which excludes the extensively researched fields of healthcare, social work, and academic research.

While healthcare, social work, and academic research were excluded from the possible sample, it was decided that *innovative fields* can be considered as a part of the relevant universe because they are closely involved with numerous fields of complex future problems; it appears very unlikely to draw a clear line between the fields. The researchers reached the decision that innovative fields should not be excluded, but explicitly *included* into the possible samples, if they stood in clear connection with the solving of future complex problems.

To identify little researched fields of complex future problems, literature on places of interdisciplinary teams was scanned for fields of possible relevance. Going back to a literature review on settings of high complexity and future relevance, the fields of *urban planning*, *IT*, *management*, and *consulting firms* were identified. A short reasoning for the choice of the sample should be given.

For urban planning and IT, the authors follow Klein's (2004) account. He argued that areas of interaction between humans and natural systems - as urban planning and technological development - are complex problems that need an interdisciplinary approach (Klein, 2004). Urban planning and technological development were therefore chosen as possible samples. Additionally, the researchers chose management and consulting as possible samples following the accounts of Brynjolfsson and McAfee (2017) and

Alvesson (2004). This is due to the consideration that managing organizations is a field that can be considered as concerned with complex future problems, for example, with integrating technological advancement (Brynjolfsson & McAfee, 2017). Then the fields of consulting - especially IT and management consulting - were identified to be generally exposed to a special kind of complexity due to their knowledge-intensive nature (Alvesson, 2004).[5]

The identified areas were researched in a LinkedIn search for people with corresponding job titles, and representatives of all the areas *urban planning*, *IT*, *management*, and *consulting firms* were contacted, and ultimately the sample includes at least two people per category (see Appendix 1 for a presentation of the sample). The interviewees were located in Sweden and Switzerland.

As statistical representation is not an issue in the *theoretical* sampling strategy, a large sample is not required (Mason, 2002). A total of 10 interviewees was considered appropriate given the time restrictions (Mason, 2002). The researchers aimed at establishing an understanding of the concepts, more than focusing on theory-saturation (Mason, 2002). A total of 13 interviews were conducted, but three of them have been excluded from the analysis. The interviews were excluded because the interviewees' experiences did not fit the definition of interdisciplinary teams that is used in this thesis.

3.5 Data Analysis: Template Analysis

In contrast to quantitative analysis, the analysis of qualitative data follows little commonly accepted guidelines (Buogie & Sekaran, 2016). The researchers could choose a method that best fitted the needs of the study: categorizing themes, displaying relations of themes, and prioritizing crucial themes. The *template analysis* was chosen as it addresses these needs: the template analysis included codes showing relations, and allowed for prioritization (King, 2004). It is also characterized by comparatively high flexibility and was, therefore, chosen over other similar and more commonly used methods such as grounded theory (King, 2004). With the template method, data generation was a continuous process in which reduction, display and conclusions influenced each other (Buogie & Sekaran, 2016).

The template analysis refers to a group of related techniques for thematic organization and analysis of data in textual form (King, 2004). The researchers followed the template method as they developed a list of codes to form a template based on the literature review (King, 2004). The template was applied to the

[5] It shall be noted that these fields were identified as possible samples for the wider universe because some proof of their complex and future-related nature of their problems could be identified in literature. However, there are numerous other possible areas that one could have chosen.

summaries of the interviews. It was modified throughout the data analysis, as new themes have emerged and others showed to be irrelevant in data (King, 2004). The researchers decided to end the coding process when all aspects considered relevant to the research had been given a code (Mason, 2002).

Following the guidelines for template analysis, not all codes have been analyzed and interpreted in-depth (King, 2004). Certain core codes were prioritized for further explanation while some were identified as minor and rejected codes that were only described shortly in the analysis. The identification of relevance was based on frequency and depth of discussion of the themes, and on the specific reference to the interdisciplinary nature of the team by the interviewee. Accounts that referred to teams in general were disregarded.[6]

Despite these considerations that led to the choice of template analysis, the nature of this method carries the risk of codes being too simple to allow depth of interpretation or too complex to explain (King, 2004). The researchers addressed this risk by having both broader and more narrow codes, and by giving generalized description as well as direct quotations from individual accounts.

3.6 Reliability and Validity

The concepts of validity, generalizability and reliability are by some authors considered irrelevant and problematic in qualitative research (Mason, 2002). This is due to the perception that the concept of evidence itself is problematic in qualitative research as it implies the data to be a "neutral body of data which speaks the objective truth" (Mason, 2002, p. 38). However, these principles can be utilized if they are not connected with the technical procedures that they are usually linked with in quantitative research (Mason, 2002). Having observed the accounts of several authors, there has no consensus been found on what information is most crucial in the considerations on reliability and validity (Mason, 2002; Bougie & Sekaran, 2016; Miles & Huberman, 1994). In this work, multiple sources were considered in order to find the most appropriate nuances of each concept in relation to this specific study.

One criterion is *category reliability*, which describes the researchers' ability to formulate sensible categories that can be used by examiners of the work to classify the data (Bougie & Sekaran, 2016). Category reliability leads to a higher *interjudge reliability*, which is defined by a consistency between coders processing the same data (Bougie & Sekaran, 2016). This can be achieved by using broad categories

[6] Moreover, many of the interviewees spoke about states in their company without adding any judgment on whether this is a desired state or whether something should be changed. Neutral statements like this have been disregarded for the analysis.

that, at the same time, do not oversimplify the information (Bougie & Sekaran, 2016). The researchers attempted to address this balancing act by creating very broad categories/themes that are likely to be identified by other researchers, combined with in-depth sub-categories and discussions to avoid oversimplification (see Appendix 3: Initial Template).

However, the researches do not have to measure reliability this way (Mason, 2002). In qualitative methods it seems more valuable to stress the careful choice and application of research methods as well as "honest and accurate" (Mason, 2002, p. 188) data generation and analysis (Mason, 2002). This form of reliability was addressed with a thorough account on *how* and *why* research methods have been chosen, and data was generated.

In the qualitative context, validity refers mostly to *internal* and *external validity*. This means that it refers to the research results representing the empirical data accurately, and that the research results can be generalized or transferred to other fields (Bougie & Sekaran, 2016).

To increase *internal validity*, contrasting evidence or *negative evidence* has been searched for actively (Miles & Huberman, 1994). Thereby, some themes from the literature review have found to be rejected by empirical data, and discussions on confirmed themes were enriched by contrasting views. This technique was expected to protect against "self-selecting biases" (Miles & Huberman, 1994, p. 169).

External validity often refers to the claim for generalization of findings (Mason, 2002). However, claims for generalizations are limited due to the small sample of the study (Bell & Bryman, 2011), and qualitative data cannot really be generalized in the conventional sense to other populations or settings (Morrow, 2005). Instead, it makes sense to refer to a parallel instrument of generalizability named *transferability* (Morrow, 2005). Transferability is reached when researchers give enough information on "research context, processes, participants and researcher-participant relationships" (Morrow, 2005, p. 252) to enable the reader to decide themselves whether findings are transferable to their context (Morrow, 2005). Therefore, there is no claim made to a generalization of findings. Instead, the researchers aimed for transferability of results through extensive considerations on the method of the study and the sampling process that was given in this chapter.

3.7 Limitations

Due to the combination of an in-depth analysis of the existing relevant literature with the semi-structured interviews, the risk arose to frame the conversations so that responses validate the theoretical findings. In

the interview format akin to an open conversation, topics flew seemingly freely. But in fact, qualitative interviews are highly guided by the interviewer (Mason, 2002). Following the argument of Mason (2002), the process of *collecting* data is actually considered a process of *generating* data. This means that qualitative data cannot neutrally be collected by the researcher, as the researcher is considered to actively construct knowledge (Mason, 2002). Thus, the interviewers had to be aware of their own advantage of information and bias towards reaching the research objectives. To address this limitation, conclusions of the analysis were always formulated with caution - so that readers know there are no objective facts stated. It should be noted that these cautious conclusions are not necessarily a limitation. The prioritization of exploring themes over generalizing or counting occurrences was an explicit goal of the research.

The chosen data collection method has possible limitations when it comes to the correlation between the identified needs and challenges with the interdisciplinary nature of a team. In this sense, it cannot be said with full certainty that challenges and needs identified for interdisciplinary needs are really related to the interdisciplinary nature of team. It is impossible to eliminate all other influences because the investigation takes place in natural situations. As a result, some identified challenges and needs could be caused by other factors related to the team's diversity such as gender, generational differences, cultural background etc. In hindsight, the risk of identifying invalid correlations could have been weakened by conducting more substantial research on other forms of teams, so that needs could have been compared and filtered. However, this would have proceeded the scopes of this thesis by large. Nevertheless, some research has been conducted on general teams, in order to identify overlapping needs between interdisciplinary and general teams, and indications have been made at the occurrences (especially in the case of the needs for team evaluation, shared goals, and leadership). Within the given possibilities of time and word count, the researchers would have done the same choices again.

This argument connects to a related limitation of the data collection that emerged during the process of interviewing. Limitations of relevance of answers may occur due to the lack of reflection on interdisciplinarity of several interviewees. Four Interviewees stated a personal wish or need to further reflect on the topic, as they had not done so in the past. This lack of reflection on the topic may have influenced the quality of answers. Interviewees had a risk of identifying problems and needs of interdisciplinary teams that could in reality just be needs of generally all teams. Or these problems and needs may have had an origin that is not the interdisciplinary nature of the team but another factor of team diversity.

The past two limitations were already addressed within the literature review, which provided the interviewers with some insight into what needs are likely to be general. These insights could then be used

when categorizing the empirical data. Another approach to moderate these two limitations was that the interviewers repeatedly stressed the sole interest in any needs and challenges directly connected to the interdisciplinary nature of the team when talking to the interviewees. Careful attention was then paid to the phrasing of interview answers: when a tendency of generalization developed, the interviewer requested clarification on whether the need or challenge arose from the interdisciplinary nature of the team or if it may have had different origins. However, it would have been beneficial to take more time to give the interviewees an overview of general teams' needs to make them aware that some of their own needs may not be connected to interdisciplinary teams and do not need to be mentioned.

Lastly, the interviewing process came with only limited insight into each interviewee's experience. When planning the interviews, it emerged that most potential interviewees were willing to participate in an interview of 20 minutes. While most interviews exceeded 20 minutes due to the interviewees' extensive answers, this limited time frame did not allow to inquire more information on all relevant aspects that the interviewees touched upon in their answers. This limitation goes with a possible loss of information that could have been extracted with more time. However, it should be noted that the interviewees had multiple opportunities to talk about the insights that they considered most relevant from their personal experiences. Even when an interview exceeded the time frame, the final question was always asked: "Do you have any other insights or comments you would like to share?". In hindsight, the researchers would have chosen to conduct longer interviews, to really obtain information on all aspects they were interested in.

4 Analysis and Discussion

A summary of the empirical data analysis will be given before commencing with an in-depth analysis of the data with simultaneous discussion on how the findings relate to the preliminary framework developed in the literature review. As the data is generated under strong influence of the preliminary framework from literature, an in-depth account focused singularly on data without reference to literature is not applicable in this case. Therefore, the focus of this chapter lies in the connection between theory and data.

4.1 Summary of Empirical Data

Before going into an in-depth discussion of the empirical data in relation to the preliminary framework from the literature analysis, a summary of the main findings is presented. To clarify the process of data reduction and analysis, it shall be referred back to the template analysis method. The initial template included all themes that were relevant for interdisciplinary themes according to the literature (see Appendix C: Initial Template). As expected, some codes/themes from the initial template have been found to a similar extent in the data and were therefore accepted fully, or were accepted with modification. Some codes/themes, however, have been rejected as there was no match between theory and data. Still, some codes/themes have been newly added because they appeared to be crucial in the data, but had not been found in literature before (see table 4). In summary, the central insight from empirical data is the confirmation, modification, and rejection of codes/themes from the initial template.

This analysis resulted in a classification of themes into core, integral, minor, and rejected themes. Themes were considered core due to a combination of frequent mentions of some themes in contrast to others, explicit reference to interdisciplinary teams, and in-depth discussion by the interviewees. The label of *integral* themes was used for two concepts, which were discussed frequently but are in such strong connection to other themes that they would appear more as an integral part of different themes rather than independent themes. Other themes were labeled as minor themes. These have been commonly discussed, but not to such frequency, depth or consensus to which they appear as especially relevant. Then again, other themes have been completely rejected due to a strong lack of discussion, or dissensus on their nature.

The following chart serves as an overview of the described distinctions. The main insight from the empirical data is that the common needs of interdisciplinary teams do exist. However, they are not all equally relevant (see the distinction between core, integral, and minor). Also, it remains important to note that three themes

team composition, leadership, and *shared goals* are overlapping themes of interdisciplinary and general teams. Another main insight is that most of the themes are also connected to some other themes. Interdisciplinary teams present themselves as a phenomenon with highly interconnected needs, which are to be taken under consideration to recognize the complexity of interdisciplinary teams fully.

Table 4. Overview of the empirical results

Core Themes	**Minor Themes**	**Integral Themes**	**Rejected Themes**
Knowledge Exchange - *Encourages* understanding of competencies - *Encouraged by* relationship-oriented culture, equal status, co-location, balance in flexibility and clarity of roles	*New: Interdisciplinarity as a learning opportunity - *Encourages* knowledge exchange	Flexibility - *Integral theme* of shared language, shared work approaches, and balance in flexibility and clarity of roles	Team Composition
Shared Language - *Needs* relationship-oriented culture, increased need for time	*New: Relationship-Oriented Culture - *Encourages* shared language, knowledge exchange, shared work approach, understanding of competencies	Increased Time - *Integral theme* of knowledge exchange, shared language, common goals, relationship-oriented culture, and equal status	Team Evaluation **also a need of general teams*
Shared Work Approach - *Needs* relationship-oriented culture, flexibility	Modified: Balance in Flexibility and Role Clarity -*Encourages* shared language, shared work approach	-	-
Understanding of Competencies - *Encourages* knowledge exchange - *Needs* increased time, co-location, leadership, relationship-oriented culture	Co-Location - *encourages* status equality and relationship-oriented culture	-	-
Equal Status	Modified: Shared Goals		

- *positively influenced by* understanding of competencies	**also a need of general teams* - multiple possible connections	-	-
-	<u>Leadership</u> **also a need of general teams* - *could encourage* knowledge exchange, equal status, shared work approach	-	-

4.2 Framework of the Needs of Interdisciplinary Teams

This section gives an in-depth description and interpretation of the empirical findings and relates it to the preliminary framework developed in the literature review. It is structured into the discussion of core, integral, minor, and rejected themes. To answer research question one "Do general/common needs of interdisciplinary teams exist? If yes, what are they?", and two "In what way are these common needs connected to each other?", a focus is set on the themes that appear to be core and integral needs, while minor and rejected themes are only discussed briefly.

4.2.1 Core Themes

Knowledge Exchange

Knowledge exchange was a core theme in the analyzed experiences. In literature, multiple authors highlighted the critical and challenging nature of knowledge exchange (Ambrose-Miller & Ashcroft, 2016; Abramson & Mizrahi, 1996; Abramson & Mizrahi, 2003; Youngwerth & Twaddle, 2011; O'Donnel, 2005). Also, the need for knowledge exchange was repeatedly highlighted in the interviews, discussed in-depth, and stated as a particular need for interdisciplinary teams. Thus, it appears to be a crucial aspect of interdisciplinary teams. For example, one interviewee argued for the relevance of knowledge exchange in the following manner:

> An organization or a project that is successful is a project that spends a lot of time of making sure that people's knowledge of each other's disciplines is continuously shared and evolved so that you

> get a broader knowledge. And together, that makes you stronger because you understand each other.[7]

There were also many accounts given on the connection of knowledge exchange with other themes. One interviewee explained that knowledge exchange positively influences the understanding of competencies and information-sharing at the same time. In turn, it was stated that the understanding of competencies encourages knowledge exchange, as it gives insight on what information one can expect the other disciplines to share, and what information disciplines need from each other. A clear understanding of competencies was argued to soften protectionist views on knowledge and to encourage active participation in knowledge exchange. Another connection is with a relationship-oriented culture, which promotes knowledge exchange. Another mentioned influence was equal status, which also increases knowledge exchange, as it fosters the relevance of all disciplines' methods and competencies and, thereby, encourages the sharing of these. Co-location is yet another beneficial influence of knowledge exchange. a shared neutral space is considered an appropriate environment for knowledge exchange. Physical meetings as a strategy for knowledge exchange were mentioned multiple times. The exchange of knowledge was, in one case encouraged by the strategy of physical meetings/co-location and by information tools. Lastly, balance in flexibility and clarity of roles was said to benefit knowledge exchange. One interviewee stated that even when roles are clear, the component of flexibility through knowledge exchange is still needed. Knowledge exchange seems to be created in the crossing of role and knowledge boundaries. Knowledge exchange appears to be a complex need of interdisciplinary teams and it is created in connection with many other needs. In this regard, the interconnection of interdisciplinary teams' needs appears to be the case.

Shared Language

In nearly all interviews, the existence of specific disciplinary language, that other individuals are not familiar with, was identified as a significant challenge. One interviewee spoke about the difference in "jargon or lingo" while another referred to concepts and abbreviations. "We don't talk the same language," an interviewee observed. Another interviewee added that the use of different languages based on one's disciplinary background is always a challenge: "you have to be much more clear in your communication, and that also takes time." The literature review supported these accounts, as multiple authors stated the emergence of discipline-specific language throughout one's education (Epstein, 2005; Klein, 2005; Brewer, 1999).

[7] In this reference and in all following references taken from interviews, there will be no indication given on which interviewee gave the statement, as they are anonymized and it is irrelevant for the argument to follow the individual accounts of any one interviewees in detail.

Several interviewees argued that specific language was thereby connected to increase with sentiments of uncertainty and insecurity. They stated that in uncertain situations, participants tend to use their familiar language to create some sense of safety. Gohar et al. (2019) stressed that especially in cases of status struggles, exclusive language is likely used to establish the dominance of one's discipline in the team. It seems that a safe climate is beneficial to create a shared language in the interdisciplinary team. In connection with other themes, where this kind of environment appears to be needed, a new code/theme emerged: the need for a relationship-oriented culture. This theme will be further discussed later in this chapter.

One interviewee states the importance of pro-active consideration of the language factor: "You have to be very sensitive to jargon or specific lingo that appears and deal with it very early on." It is to be noted that most interviewees have had several years working experiences in their interdisciplinary teams, and for some, the terminologies of the other disciplines still remained unclear. This may be an indicator of the severity of the challenge of different disciplinary languages.

But not only inherently different disciplinary languages are a challenge. Three interviewees also stated that often, same concepts, words, or topics are used, but it seems that disciplines see different meanings behind them. Concepts are used in different ways, and people from different disciplines talk "through each other." One interview stated that, for instance, the word "strategy" can have absolutely different meanings to different people. Epstein (2005) and Klein (2005) also observed that the same concepts are often used with different meanings.

Recognizing the challenging existence of different disciplinary languages, most interviewees saw a need for the negotiation of a common language. One strategy for the creation of some commonality in language was observed to be that each discipline limits itself in using discipline-specific language. Then, the meaning of concepts has to be continuously but clearly defined to minimize the risk of misunderstandings. What is more, it has been repeatedly stated that this language should be developed both collectively and consistently. This argument goes along with the need for increased flexibility (in the use and negotiation of language). This need to be flexible in language was also described by Delgado & Åm (2018). Moreover, some adaptation of the other disciplines' languages was considered to be helpful to grasp the full complexity of the problem under investigation. Finally, the aspect of language was frequently connected with the need for increased time. Several interviewees argued that negotiating a common language requires specially designated time.

Shared Work Approach

Most interviewees recognized different work approaches among the disciplines - as was also argued by Klein (2005). Interviewees suggested that different work approaches imply different ways of solving problems, prioritizing information, and different perspectives on the problem/task. These different approaches were considered to be connected to disciplinary competencies. Several interviewees used terms suggesting considerable difficulty with misaligned work approaches. They said that there is a need for "compromise" and that the existence of different work approaches comes with "difficulty" or "risk."

What appears to make different approaches challenging is that there is a strong preference for using one's methods. Literature also demonstrated the tendency to remain in one's original attitudes (Dougherty, 1992) Not only did the disciplines have different approaches, but they were hesitant to use the approach of other disciplines that they are not familiar with. It is considered that individuals naturally search for answers to problems within their field of expertise and experience. "From the school, you fill up your tool-box with different knowledge, and you want to apply this," one interviewee stated. It was argued that different disciplines want to include various kinds of information in the project and prefer different methods for information exchange, composition, and presentation of content.

Regarding this aspect, interviewees frequently tried to explain why the exchange of work approaches is challenging to master. One interviewee referred to specific frames of reference connected to each discipline, which allows each discipline to believe that their approach is the right one. Another interviewee described the own disciplinary approach as a "safe space". Stepping out of this safe space was considered to come with risk for the individual. The theme of the safe space occurs for the third time, as it was already connected to knowledge exchange and shared language. It is also argued by Dougherty (1992), that team members react to uncertain environments with remaining in their known area of expertise. The idea emerges that interdisciplinary teams may require a relationship-oriented culture to foster a sense of security.

Connecting to this challenge, most interviewees explicitly identified a need for flexibility in approaches and perspectives. Acknowledging that no single disciplinary approach is naturally best was considered crucial by one interviewee. Different approaches have to be taken into consideration, and no single method should be seen as the correct one naturally: "It might not be exactly how you want it to be, but it still is a solution [...] It was not my way, but eventually it was the right way." Approaches for disciplinary work should be agreed upon and can include aspects such as structures for knowledge exchange and discussion rules. Different ways of working have to be "fit together in a good way," another interviewee argues.

One factor identified as specifically challenging is the need to find common interpretations of problems. O'Connor et al. (2013) supported this argument as they described different interpretations of issues and tasks in interdisciplinary teams, and a connected need to find common interpretations. Interviewees observed that the problem under investigation often means something different to each discipline. Team members have certain preconceptions and find various kinds of information, more or less relevant. When disciplines engage in discussion with different interpretational basis, miscommunication occurs. Aligning the meaning of the project by establishing a conventional interpretation of the problem appears to be crucial. Moreover, this aspect was frequently connected to the factor of time.

It was also observed by two interviewees that this lack of shared work approaches could appear in the form that one discipline has to adapt to the dominant disciplines' approaches. In the organizations where these interviewees worked, the methods of business graduates were seen as the only relevant ones, and other approaches were not encouraged. This was seen as a regrettable and a missed chance for making interdisciplinary teams a learning opportunity for the people involved.

Understanding of Competencies

Nearly all interviewees elaborated on the special issue of understanding the competencies of other disciplines. They observed a direct lack to understand the competencies of the different disciplines. Competencies or knowledge of the other disciplines were described as unclear, which was suggested to make collaboration especially challenging. This impression is in line with the literature suggesting that the lack of understanding of competencies is a particular challenge in interdisciplinary teams (Abramson & Mizrahi, 1996). Interviewees and scholars suggested that some common understanding of each other's field of expertise is considered essential to identify the nature of the collaboration and to understand the roles of the different disciplines (Derry & O'Donnel, 2005). For knowledge exchange, having some insight into the competencies of the disciplines seems essential.

The understanding of competencies seems to be influenced by all the disciplines in a team. For each discipline, there is a need to explain "this is where I'm coming from, and this is my perspective on how to do things, and this is what I'm used to." But on the other side, it was considered to be crucial to show the valuation of the other discipline's competence. Showing trust in each other's competencies and skills was deemed to be fundamental. The recognition of other competencies' relevance is, thereby, believed to have a positive impact on knowledge exchange. The team members were expected to participate in the transfer of information when feeling needed and valued.

Understanding of competencies was seen to be connected to knowledge exchange by multiple interviewees. In order to share and receive knowledge, some understanding of what the discipline can and cannot do seems to be needed. When team members know that competencies and areas of work differ, they seem to be less afraid to share their knowledge. It is considered to be beneficial to have the awareness that each has a purpose and will not be replaced if they give up their capitalized insight. In other words, when competencies are very clear, there is not a problem with protectionist views on disciplinary knowledge. Understanding of competencies was seen to be positively influenced by co-location, as it gives space to get acquainted with other competencies. Another interviewee said that more important than, for example, the factor of location, was the creation of a culture that acknowledges the value of each discipline's input.

A trusting culture was also considered to be connected to issues of understanding the other disciplines range of knowledge. With a lack of identification with the discipline, it was believed to take longer to build trust among disciplines. One interviewee introduced the concept of contingent trust as he trusted the other discipline with the task within their own discipline, but not so much with tasks that went into other disciplines' areas: "trust can be contingent on the task you have. I trust you for certain tasks but not for other tasks [...]". This point introduces the idea that it is not only essential to value and acknowledge the competencies of other disciplines, but also to be aware of the limits of their competencies. Trust appears as a concept that does not need to be absolute nor unconditional - it just has to address the right aspects of work. Some sort of trusting environment is also needed according to literature (Ariss et al. 2013). This point was an influence on the creation of the new code/theme of the need for a relationship-oriented culture. As a last point, the understanding of each other's competencies (and the limits of these) may prevent professional conflicts to be misunderstood as personal issues. Misunderstandings that are in fact only professional sometimes get personal, two interviewees stated. The idea that professional disagreements are misinterpreted as personal issues is an idea Abramson & Mizrahi (1999) also introduced.

Equal Status

Status issues have been detected in both overt and covert form. When it comes to rather overt status differences, two interviewees stated that some disciplines clearly have to adapt to the methods of the dominant discipline, which is also the discipline "hosting" the project. There was a dominance detected of the discipline that is initiating/hosting the project. The initiator of the project as the dominant discipline was also recognized by Klein (2005). One interviewee describes a lack of organizational interest in utilizing more of the individual’s field-specific knowledge, meaning that the approaches and methods of the dominant discipline are favored. However, it is arguable if this is an issue in the situation of the interviewee, as the context is a consultancy which is connected to a specific discipline. Youngwerth & Twaddle, (2011)

nevertheless argued that the inclusion of all disciplines' views is a need. Multiple interviewees suggested that the way of working of the dominant discipline is not necessarily the only one that should be used.

Even more status differences could be discovered on a covert level. This corresponds to the idea of covert status difference to be of higher influence (Ambrose-Miller & Ashcroft, 2016). One interviewee noted that some individuals acted superior to others based on the disciplinary knowledge they had, which was the knowledge of the dominant discipline. Two interviewees kept their account focused on the dynamics between only two disciplines, and did not refer to two other disciplines that were also part of the interdisciplinary team. This could have had multiple reasons. It might be, for example, that there were no special challenges with the other disciplines. However, the total exclusion of these disciplines from the interviewee's account could also speak for covert status differences, as their role in the constellation might not be considered relevant. There were also contrasting experiences. Instead of status issues among the disciplines, one interviewee referred to each discipline having their hierarchy within their discipline. In this case, different disciplines were not ranked in relation to each other.

Also, there are different themes that are connected to the issue of status differences. It appears that co-location plays a role. The discipline hosting or initiating the project seems to be of implicitly higher status. In the case of one interviewee, locations were switched, so that there was no discipline that was the host of the project. The interviewee highlighted this as a factor influencing equality. He argued that without this rotation, there would likely have been an unequal authority in favor of the host. Another interviewee stated that relocating individuals into a new space also softens any already existing status relations within their known settings. Lastly, the factor of misunderstanding competencies of other disciplines was also argued to lead to a lack in respect and decreased status. This factor was also described by Abramson & Mizrahi (1999), who argued that a misunderstanding of competencies leads to decreased recognition and subsequent lower perceived status of the discipline that is misunderstood. The connection of understanding of competencies and equal status of competencies is evident.

4.2.2 Integral Themes

Flexibility

Flexibility was highlighted in connection to three themes and appeared as an integral part of these. Flexibility in interdisciplinary teams is considered needed in relation to shared language, shared work approaches, and concerning a balance in flexibility and clear roles. This insight is in line with the theoretical findings which connected flexibility to the same aspects (Delgado & Åm, 2018; Blackwell et al. 2019; McGill et al. 2017;). The precise role of flexibility is further described within the corresponding themes.

Increased Time

The need for increased time was found to be an integral theme of numerous other themes. The majority of interviewees said that some features of interdisciplinary teams required more time in comparison to single-disciplinary teams. Interviewees noted that the following themes need more time: finding shared work approaches (especially methods), understanding of competencies, negotiation of shared language (creating common definitions of the problem), negotiation of a shared goals, and establishing interpersonal relationships through a relationship-oriented culture.

Apart from this, there are no specific aspects linked to the need for time, but some authors observed the general need for more time in interdisciplinary teams (Blackwell et al. 2009; Epstein, 2005; O'Connor et al. 2003; Ambrose-Miller & Ashcroft, 2016; Gohar et al. 2019). As the different themes are often interconnected, it appears that the need for increased time cannot finally be connected to single themes while standing disconnected to others. Therefore, it is concluded that numerous themes in the analysis lead to the *general* need for increased time.

4.2.3 Minor Themes

Leadership

The majority of interviewees stated that some form of leadership is required for interdisciplinary teams. When it comes to the kind of leadership that is needed, there are diverging opinions. This aligns with the literature where the importance of some form of leadership is discussed, but no real consensus could be found (Epstein, 2005; Youngwerth & Twaddle , 2011).

The only prominent argument from the empirical data was one that the authors interpret as a form of *inclusive* leadership. This idea was derived from several interviewee's accounts arguing for the need for someone who considers not only one discipline's needs, but all of them. This is experienced to take place by highlighting the relevance of each discipline's contribution and stressing the importance of the collective work. One interviewee saw a need to hear all members and to address their significance for the team. The leader should "connect" the disciplines, and should integrate the special nature of the interdisciplinary team in the leadership style pro-actively. It was repeatedly stressed that leadership should encourage and value all contributions equally by "bringing people together." This view is supported by the argument of Edmondson (2003) and Ariss et al. (2013), as they saw a need for a leader that offers shared meaning and gives direction. The argument for equality or inclusive leading was on two occasions taken so far that the

interviewees argued it could even be best to have a leader that is not part of any discipline present in the team, in order to increase neutral treatment. This argument found only partial confirmation in literature.

Other than that, it was not possible to draw any other reliable generalizations. It appears still dependent on the specific context what exact form of leadership is needed. An example was given by interviewees who see differences in "leaders" in more traditional teams, and "project owners" in SCRUM environments. In that sense, the empirical data aligns with the literature, as the description of leadership remains very vague and seems to be dependent on the situation. The consensus was nevertheless identified between data and literature when it comes to the need for an inclusive leader, that encourages and includes all diverse views.

Relationship-Oriented Culture

When analyzing the interviews, a new theme emerged – the theme of a strong need for a *relationship-orientated culture*. It was argued that interpersonal relationships are hard to build due to a lack of identification with different disciplines. More focus on building an understanding of the individuals would be beneficial for the creation of a trusting environment. Thus, a task-oriented approach, in this case, does not leave enough room to build a basis for trust. Another interviewee argues: "There should have been more time invested in developing a common viewpoint in the team, as well as understanding each other's outlooks better." And yet again, another interviewee stressed that the primary influence on interdisciplinary collaboration is the social climate, which would have needed more time than the interviewee's teamwork allowed.

Interdisciplinarity as a Learning Opportunity

The theme of treating *interdisciplinarity as a learning opportunity* has emerged throughout the process of analyzing the interviews. Interviewees repeatedly stressed that interdisciplinary teamwork is or should be a positive experience, where people learn from each other intensively. For example, one interviewee saw the negotiation of language as an opportunity to learn some of the different disciplines' terminology. Another interviewee saw the adaption of other disciplines' methods as a perk of the team constellation. The knowledge exchange in interdisciplinary teams was frequently referred to as a unique learning experience that is challenging yet rewarding. Another interviewee argued that the interdisciplinary team is not only a mean to reach a goal, but also a process that is important to one's professional development - if treated as a learning opportunity. Therefore, this theme has been included as a minor theme.

Shared goals

The original code/theme related to this section was named *shared vision, goals, and values*. It has been modified into just shared goals because interviewees barely touched upon the need for a shared vision and values. Even shared goals appeared to be somewhat redundant, as it is a general need of all kinds of teams. However, the interviews showed that interdisciplinary teams might have an exceptionally strong demand for agreed upon goals.

One interviewee described a specific lack of shared goals, while several interviewees only highlighted a strong need for shared goals. It may be the case that especially in interdisciplinary teams, a shared and commonly negotiated goal is required to align the many differences and orientations in the team (such as different disciplinary language, work approach, etc.). One interviewee introduced the idea that the creation of goals is dependent on the duration of the project; if a project is short-term, it is not necessary to establish a goal together. If the project is long-term, the values and goals should be agreed upon by the whole team. A different interviewee stated that goals should always be co-created. No specifications on the vision and values were made. However, it is possible that interviewees mean something more akin to a vision when they talk about goals. And when it comes to vision and values, the aspects of shared work approaches and valuing of competencies might be seen as including these factors.

As visible, there can be no statements drafted on vision and values. The information given on shared goals is, moreover, quite scarce and vague, which is in line with the literature. Some authors highlighted the need for shared goals (Ambrose-Miller & Ashcroft, 2016; Youngwerth & Twaddle, 2011), that should also be commonly created (Delgado & Åm, 2018; Abramson & Mizrahi, 1996). These ideas have been addressed in empirical data, but they have not been discussed as in-depth by the interviewees as in literature.

Balance in Flexibility and Clarity of Roles

The original code/theme for this section was the need for *Role Clarity*. It has been modified because the interviews leaned towards the need for a balance in clarity flexibility and clarity of roles, which was already indicated in the literature to some magnitude (Ambrose-Miller & Ashcroft, 2016; McGill et al. 2017; Blackwell et al. 2009).

The main argument developed in this theme was a necessary balance in flexibility and clarity in roles. There were, nevertheless, some arguments for a pure clarity of roles. One interviewee, for example, claimed that each discipline has exceptional competencies. Responsibilities or roles have to be clear for everyone to be able to contribute what they can best contribute. The argument for clear roles is also heavily backed by

literature (Nandan, 1997; O'Connor et al. 2003; Bronstein, 2003; Rumping, Boendermaker & Ruyter, 2019; Ambrose-Miller & Ashcroft, 2016).

However, in the empirical data, an argument emerged towards a need for balance between flexibility and clear roles. One interviewee highlighted the importance of having clear roles because it is essential to know what has to be done and who is responsible for the delivery of what. Yet, the interviewee argued that when being too rigid, the risk emerges that people hide in their roles and disregard all other aspects of work. Having clear tasks and responsibility has to be connected to flexibility in that sense. According to another interviewee, it is vital that everyone knows in what area to contribute with, yet still, flexibility for changing focus should be allowed. This view was also supported by some literature (Ambrose-Miller & Ashcroft, 2016; McGill et al. 2017; Blackwell et al. 2009).

In conclusion, there can be no specific emphasis put on the need for roles that have balance in flexibility and role clarity. It seems problematic to conclude a dominance of any one viewpoint, as both are considered relevant. Therefore, a possible need for balanced flexibility and role clarity is displayed as a minor theme in this work.

Co-location

Half of the interviewees discussed the benefits of the physical co-location of team members. Giving the team a new environment or arena was believed to have a positive impact. This space was suggested to be designed differently from other rooms in the organization. Regular meetings in a shared neutral space are considered to create a beneficial environment for interdisciplinary teams. A space like this was especially considered to encourage status equality and a relationship-oriented approach. While literature also highlighted the benefits of a shared working space (Ariss et al. 2013; O'Connor et al. 2003; Ambrose-Miller & Ashcroft, 2016; Rumping, Boendermaker & Ruyter, 2019), the actual benefit differs from the one provided in the empirical data. Theory referred to the need for a shared space in connection to an increased possibility for knowledge exchange (Epstein, 2005; Rumping, Boendermaker & Ruyter, 2019). The empirical data stresses the connection between a shared neutral space with soothing of status issues. In this sense, there is a misalignment of theory and data regarding the specific benefit of the shared space, yet they do both illustrate the general need for it. Due to the dissensus of the reasons for having a shared space, it must remain a minor theme.

4.2.4 Rejected Themes

Team Composition

Half of the interviewees described some ideal composition of an interdisciplinary team. However, there is no consensus on what that perfect composition may be. Some argued for the need for a balanced representation of disciplines to avoid the dominance of any one discipline over the other, and to offer the possibility to discuss specialized knowledge with peers of the same discipline. It should be avoided to have a clear dominance of one discipline, as it can lead to exclusive social dynamics and status issues. Others discuss the positive benefit of high diversity and believed that more diversity gives the team the needed expertise. Some interviewees also stated that small teams are preferred over large teams, as the size of the team is believed to add an additional layer of complexity. This was not believed to be beneficial as interdisciplinary teams were already considered quite complex. One interviewee explicitly stated that the ideal composition is dependent on the context of the project.

When observing the differing answers of the interviewees, one could also come to the conclusion that the ideal team composition is dependent on the context, as the interviewees stressed different points to be relevant in team composition. Therefore, it is not possible to make a general recommendation for the ideal structure of the interdisciplinary team. These insights align with the literature review as the relevance of some appropriate team composition was highlighted (O'Connor et al. 2003; Youngwerth & Twaddle, 2011), but there was no clear consensus on what this composition could be. In the end, data and literature both spoke for the same issue - the ideal composition is dependant on the *specific* situation, and no general statement can be drawn (McGill et al. 2017). In this sense, there is a match between theory and data, but they both speak for the irrelevance of this theme as a *universal* need.

Team Evaluation

Team evaluation is the only theme that has not been touched upon by the interviewees. This does not mean that it is not relevant at all. It could imply that it was not seen as one of the most prominent needs that came into the minds of the interviewees, or that it was simply not seen as inherently connected to the interdisciplinary nature of a team. This is an interesting observation, as the literature suggested quite the opposite. In the literature review it became very clear that feedback sessions and team evaluation meetings can be a helpful tool to evaluate performance, address conflict, collaboration, and evidence of effectiveness (Ariss et al. 2013; O'Connor et al. 2003; Bronstein, 2003; Youngwerth & Twaddle, 2013). A possible reason for this mismatch between literature and data could be the general importance of evaluation or feedback for *all* kinds of teams (London, 2003). A possible awareness of the interviewees that evaluation

and reflection are always needed may be an explanation for why they did not mention it when asked about needs *specifically* connected to interdisciplinary teams.

4.3 Concluding Remarks

The aforementioned presentation of data in connection with the theoretical framework led to a clear answer to the first research question: "Do general/common needs of interdisciplinary teams exist? If yes, what are they?", as common needs of interdisciplinary needs are very likely to exist. However, not all of them seem applicable equally, and not all seem to carry the same relevance and frequency of occurrence.

Five core needs were identified for interdisciplinary teams. The discussion of them was found in both literature and data, and the deep insights are believed to offer a strong basis for further consideration of these factors in practical teamwork. The needs for knowledge exchange, equal status, shared language, understanding of competencies, and shared work approaches were found to be core necessities for the interdisciplinary team.

The two integral themes of increased time and flexibility were found to be of high relevance but connected to other needs very strongly. Increased time is seen as a need that results from the combination of many aspects that need more time, while flexibility was only related to the specific needs of shared language, shared work approaches, and balance in flexibility and clarity of roles.

Six needs were found to be of minor relevance, mainly because the discourse on them did not allow for any clear conclusions. Nevertheless, the inclusion of these themes was identified as prominent by some interviewees and literature. These themes have been included as needs as they seem of potential relevance, but they lack in either in-depth discussion by interviewees or literature, consensus on their nature, or specific reference to the interdisciplinary nature of the team. The minor themes finally are shared goals, some form of inclusive leadership, balance in flexibility and clarity in roles, seeing interdisciplinary teams as a learning opportunity, co-location, and a relationship-oriented culture. Some of them are rather difficult to specify and relate to particularly the interdisciplinary teams. Especially shared goals and an appropriate form of leadership appear to be relevant to many varieties of teams; in that sense, it is difficult to see them as fundamental specific needs of interdisciplinary teams.

Team evaluation and team composition were rejected themes that could not be supported by empirical data and, therefore, seem to be irrelevant in terms of a specific prerequisite for interdisciplinary teams. However,

it appeared to be important to explain how the rejection of them took place; also, in regard to possible future research that may return to the rejected themes.

Moreover, it was demonstrated in the discussion that research question two "In what way are common needs connected?", can be confirmed. The identified needs of interdisciplinary teams appear as strongly connected (see table 4). These needs should not and cannot be met separately, as they appear tightly interwoven. However, in the final framework, there are no single connections indicated, as it is considered that almost all aspects are in some way linked to each other.

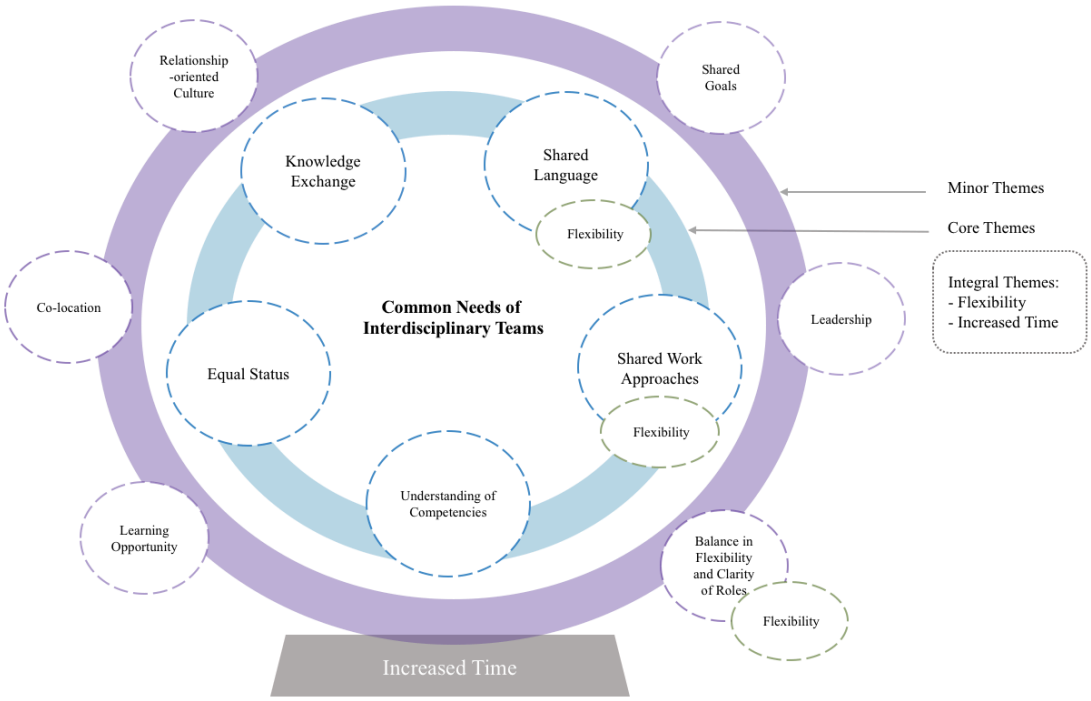

Figure 1. Final Framework of Common Needs for Interdisciplinary Teams

The final framework of common interdisciplinary teams' needs displays the described special nature of interdisciplinary teams. The framework shows the needs developed from the combination of literature and data. In *figure 1*, the researchers present *the Final Framework of Common Needs for Interdisciplinary Teams*. The framework is divided into core, minor, and integral themes as mentioned beforehand. As visible, the integral themes of flexibility and increased time have a special position in this framework: flexibility is connected to the specific themes it influences, and the need for increased time is visualized as a base for the interdisciplinary teams' needs.

The researchers have channeled their efforts to, hereby, create a framework that serves as an accessible guide for managers and members of interdisciplinary teams. Hence, the final display of the needs of interdisciplinary teams concerned with complex future problems is presented. The practical implication of this framework shall be discussed in the following chapter 5.

5 Conclusion

This concluding chapter discusses in how far research aims and objectives have been reached. The managerial implications of the findings are summarized, before the theoretical contribution is stated in connection to an outlook on what future research might entail.

5.1 Research Aims

The research aim was to develop a framework of common needs of interdisciplinary teams that work with complex future problems. This aim has been fulfilled with the creation of a framework that clearly illustrates that common needs of these teams do exist. However, not all needs were equally proven. The authors could only find strong support for some core needs and integral needs, while others appeared to be minor needs. They have also identified some themes that may be relevant to general teams, but were not backed by enough reliable information to be labeled as common needs specific for interdisciplinary teams. In this sense, a general framework was created, but it most likely does not include all relevant factors. In conclusion, it can be said that a limited framework was created, which indeed displays some needs, yet cannot hold claim to full accuracy.

5.2 Research Objectives

To answer the first research question "Do general/common needs of interdisciplinary teams exist? If yes, what are they", the authors conclude that some general needs of interdisciplinary teams exist and where also able to demonstrate what these needs are. Nevertheless, the researchers again wish to highlight that the generality of the needs is limited to some extent. As a final recapitulation, the core needs are knowledge exchange, shared language, shared work approach, understanding of competencies, and equal status. The minor needs classified are shared goals, leadership. relationship-oriented culture, co-location, interdisciplinary as a learning opportunity and balance in flexibility and role clarity. Moreover, there are some common needs that seem to be integrated into the core needs and, therefore, were further classified as integral themes. These are the need for flexibility and the need for increased time.

The second research question "In what way are common needs connected to each other" can definitely be answered positively. It has been demonstrated that various themes are strongly connected to each other. And it appears very relevant to include this interconnection in any attempts on satisfying the needs of interdisciplinary teams. One example is the theme of knowledge exchange, which is essential for the

interdisciplinary team and is heavily dependent on the factors of a negotiated common language, relationship-oriented climate and some other factors.

Moreover, there have been many factors found that are crucial in interdisciplinary teams that do not refer specifically to the interdisciplinary nature of the teams. Management of interdisciplinary teams has to include specific environments into the management approach, and cannot solely rely on the framework for interdisciplinary teams. This is due to the consideration that some needs of interdisciplinary teams, not mentioned in this work, equal the needs of teams in *general*. This framework is not to be confused with a holistic framework of all needs that interdisciplinary teams have. It only addresses needs that are *specific* to interdisciplinary teams and makes no claim whatsoever to make statements on the needs of general teams.

5.3 Practical Implications

The findings of this study carry relevant practical implications for managers of interdisciplinary teams. Research question three "What are the managerial implications of the identified needs?" connects to the discussion of the empirical results, as the managerial implications of this work directly derive from the identified needs of interdisciplinary teams.

The final framework offers an enhanced comprehension of what needs interdisciplinary teams have and gives a firm basis on which areas to focus on to exploit and utilize the potential of these kinds of teams. It appears crucial that as interdisciplinary teams are likely to have common and interconnected needs, hence managers shall not attempt to guide interdisciplinary teams as they would guide single-disciplinary teams. Instead, they should adapt their approach according to the needs identified in this discourse, and to the studies yet to be conducted on the topic, to respect the unique nature of interdisciplinary teams.

This approach of managing according to the needs of interdisciplinary teams should include the following considerations. All identified needs of interdisciplinary teams (except for rejected themes) are likely to be common, but first and foremost, attention should be shed on the core and integral themes as they appear to be of frequent occurrence and gravity. It is believed that by paying particular attention to the core needs, many challenges of interdisciplinary teams can be prevented or solved. The arguments of the minor themes might be of use to include in a management approach as well, but ought to be adapted to the specific situation. The researchers believe that, still, a selection of the most crucial needs can be made for each interdisciplinary team to, without a doubt, focus on the aspects in the framework that address the situation of each unique team constellation best. The framework, thereby, appears as a dynamic structure that shows

what aspects managers might want to consider, but it is expected to be adapted in a way that is specific to each team.

Furthermore, the study contributed to the insight that needs of interdisciplinary teams are highly interconnected and should not be addressed separately. Even if some needs might be more relevant than others in the situation of different teams, the interconnection to other themes should always be checked, and connected themes should be approached together so that the ideal satisfaction of the needs can take place. It is essential to know what the influences on each need are, to find an intervention that approaches the needs in a way that provides the most advantage.

All in all, it has been suggested that it is worth it to spend the necessary time to address the special needs of interdisciplinary teams. Managers should respond to the challenges and corresponding needs of the interdisciplinary team; unravel the true potential of the interdisciplinary team in the organization and go beyond that: managers should recognize the interdisciplinary nature of the team, integrate it in their managerial approach, and make it an asset for the team instead of a concern.

5.4 Theoretical Contribution and Suggestion for Further Research

After having explored the common needs of interdisciplinary teams, the question of what contribution this study has offered to the research landscape, and how further research on the topic should be conducted was answered. To discuss suggestions for further research, it is plausible to parallelly portray the theoretical contribution this study has offered.

Firstly, the study has provided insights into interdisciplinary teams concerned with complex future problems. It has given unique insights into the needs that interdisciplinary teams commonly face and, thereby, developed the very field-specific research landscape into a guide that can be used by numerous practitioners from diverse areas of work. It has offered an understandable overview, which was lacking in the available discourse on interdisciplinary teams.

The qualitative approach and, especially, the sampling strategy in this research have limited the insights in terms of their generalizability (Mason, 2002). While the insights can claim to be of some theoretical relevance to the broader universe, the small sample, however, does not allow for much generalizability of results. The explored needs were rather displayed in an explorative manner. The authors, however, are still convinced that this type of sampling, in combination with the qualitative semi-structured interview offers the most valuable insights into the individuals' experiences with interdisciplinary teams. Therefore, it is

suggested that future research might address similar sampling and data collection methods; but addresses a larger sampling group, and more time to interview subjects to enhance the depth of information and the multitude of perspectives.

This could lead to a confirmation and further development of the themes identified by the researchers in this discourse. Once the general relevance of the needs has been more broadly confirmed, research that offers an in-depth investigation on what constitutes each specific need should be conducted. Thereby, it could be of worth to investigate their complexity more closely, for example, what exactly defines themes such as disciplinary language, and what concrete method can be used to align the different disciplinary languages.

Due to the strong connection between theory and empirical data, the insights are influenced by information drawn from various context and national settings. The empirical data was, however, only drawn from Swedish professionals and one Swiss professional. Therefore, it would be of interest to replicate the study with an empirical research sample that represents the national variety that the literature includes. With that having said, the authors believe that the most fruitful adaption of the sampling and data collection strategy is the widening of the sample size and extending interviews to at least 60 minutes.

This study has highlighted the relevance of managerial implications of the findings, but it goes beyond the scopes of the study to develop a concrete managerial tool or strategy to satisfy these needs. Further research should aim to develop a form of tool or management format that can be further applied in practice. This research has demonstrated evidence that a specific managerial handling is needed while, at the same time, giving suggestions on what aspects to focus on.

In the end, both aspects are of high relevance: a more in-depth understanding of the identified needs and the development of a practical approach to address these needs. The interdisciplinary nature of a team can be compared to other factors that make teams diverse, such as cultural or generational backgrounds. With these aspects of team diversity, it has also shown to be of prominence to reach an understanding as thorough as possible to develop a grounded managerial approach. The authors of this study strongly believe that this is the case with interdisciplinary teams as well. To be well managed, the phenomenon has to be well-understood by all involved individuals. For this, the phenomenon of interdisciplinary teams shall be illuminated theoretically as well as practically in future endeavors. Furthermore, in managing interdisciplinary teams, an understanding should be created on both the level of team members and managers.

Lastly, this study has contributed to the expansion and the relevance of interdisciplinary teams for the field of complex future problems. As became visible in extensive literature review and the accounts of the interviewees, the interdisciplinary team is an innovative mode of sharing and generating knowledge in various organizations. And the investigation of this special constellation transpires as essential for many principal problems of the modern world. The researchers expect to have raised awareness on this actuality and hope to inspire other researchers to further pursue and widen this valuable topic.

Appendix A: Interview Guide

Short summary of who we are and what the thesis is about.

Question 1: Can you tell us about your experiences with working in a team with people from different academic or professional backgrounds?

Question 2: What issues/challenges have you encountered that you would connect with interdisciplinarity?

Open Discussion:

Non-fixed themes that were explored when the occasion was given:

- Need for knowledge exchange
- Difference in work approaches / need for shared work approaches
- Lack of understanding of competencies / need to create understanding
- Status differences and difficulties / need to have equal status
- Disciplinary Language / need for common language
- Relevance of a certain team composition
- Importance of shared vision, goals and values
- Need for team evaluation
- Need for knowledge exchange
- Need for clear roles
- Need for shared responsibility and decision making
- Increased need for time
- Need for flexibility

Question 3: Do you have any other insights or comments you would like to share?

Appendix B: Anonymized List of Interviewees

Interviewee	Relevant Experience	Disciplinary Background	Disciplinary Background of Collaborators
1	Project Coordinator in urban development	Psychology	Police officers, social workers and various academic researchers
2	IT Consultant	Engineering	Engineering, law and business
3	IT Consultant	IT/Business	Controllers, medical technicians
4	Business Consultant	Business	Law, business, economics, anthropology
5	Business Consultant	Economics	Law, business, economics, anthropology
6	Business Consultant	Law	Law, business, economics, anthropology
7	Innovational Business Consultant	Economics	Marketing, accounting, IT
8	Innovational Business Consultant	Economics, communication, sustainable water systems, engineering	Economics, biochemistry, law, economics, chemistry,
9	IT Consultant	Engineering	Accounting, law, mathematics, psychology, economics
10	Communications Consultant in urban development	Communication (behavioral science)	Mathematics, communication, engineering

Appendix C: Initial Template

1) Disciplinary Language
    1) Existence of interdisciplinary language differences
    2) Unawareness of disciplinary language differences
    3) Use of same words with different meanings
    4) Stronger occurence of specific language in relation to status competition
    5) Need for commonly negotiated language

2) Team Composition
    1) Need for certain composition
        1) Balanced representation of disciplines
        2) The more diversity the better
    2) Needed composition dependant on context
    3) Connection of team composition with conflict

3) Shared vision, goals and values
    1) Lack of shared vision, goals or values
    2) Need for shared vision, goals or values
    3) Need for co-creation of the aspects
    4) Need for flexibility and reevaluation
    5) Importance of balance of clarity and flexibility of the factors

4) Shared Work Approach
    1) Difference of work approaches
    2) Preference of using own approaches
    3) Need for common approaches
        1) Need for common interpretations of problems

5) Understanding of Competencies
    1) Lack for understanding of competencies
    2) Need for understanding of competencies
    3) Need for understanding value of common work
    4) Need for equal value of competencies
    5) Connection of understanding competencies with knowledge sharing
    6) Connection of understanding competencies with culture of trust
    7) Misunderstanding diverging competencies as interpersonal issues

6) Team Evaluation
    1) Need for evaluation, feedback or reflection

7) Equal Status
    1) Challenge of overt status differences
    2) Challenge of covert status differences
        1) Higher perceived relevance of the task of some disciplines
        2) Dominance of discourse of some disciplines
        3) Discipline that initiated the project is of higher status
        4) Status of one discipline not acknowledged due to illegitimate power
    3) Connection of status issues with exchange of information
    4) Connection of lack of understanding of competencies with status issues

8) Knowledge Exchange
    1) Need for strategy of knowledge exchange
    2) Need for valuation and trust in the knowledge of each discipline
    3) Lack of sharing due to wish to keep knowledge exclusive
    4) Connection of knowledge exchange with status competition
    5) Connection of knowledge exchange with co-location
    6) Other Solutions (e.g. informal and formal exchange, coordinated activities)

9) Role Clarity
    1) Need for clear roles
        1) Need for clear responsibilities
        2) Need for mutual understanding of roles
        3) Connection of unclear roles with conflict
    2) Need for flexibility of roles
        1) Need for balance of clarity and flexibility

10) Leadership
    1) Need for leadership
        1) Kind of leadership required
        1) Leader with other disciplinary background
        2) Leader with insights on one or more disciplines
    2) Factors connected to leadership

12) Increased Time
    1) Need for more time
    2) Specific aspects that require more time

13) Co-location
    1) Need for co-location
    2) Influences of co-location

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