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Exploring context-dependent antecedents and consequences of trust in a project team setting

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Doctoral thesis

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Thesis for the Degree of
Philosophiae Doctor
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Department of Industrial Economics and
Technology Management

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Abstract

The working relationships between members of a project team can have critical influences on project outcomes, and trust has been recognized as a key factor contributing to project success. The overall aim of this thesis is to examine the significance of trust in the context of project teams by exploring context-dependent antecedents and consequences of trust in a project team setting in the construction industry. The inherent need for collaboration and cross-functional integration, and the high interdependency project teams face, makes trust pivotal for team functioning and for project success. This thesis addresses some of the shortcomings of previous research by focusing on how the temporal nature of projects affects trust development in project teams. Further, it responds to the mixed and inconsistent findings on the relationship between trust and performance and trust and knowledge sharing that exist in the literature and examines the nature of these relationships. The research questions are mainly answered through the three empirical papers included in the thesis, employing both qualitative and quantitative methods. The context of the research, the construction industry, is a traditional project-based industry characterized by nonroutine production processes, complex working relationships, uncertain conditions, and interdisciplinary knowledge.

The objective of paper I was to explore the temporal aspect of trust development in a project team setting by addressing the question of how prior ties and familiarity between team members may influence the development of trust in teams. A single case study in the construction industry was conducted in order to study how prior ties can be a determinant for levels of trust in project teams. A total of 12 in-depth interviews with key project team members were undertaken. The results suggest that positive prior ties seem to stimulate early trust formation and team integration through central team process, such as early formation of integrative work practices, development of a common philosophy, open communication, and

early and clear role expectations, all of which contribute to the development of a shared climate of trust in an early phase.

In paper II, the purpose was to shed more light on the complex relationship between trust and performance in the context of cross-functional project teams. This was done by examining a moderated mediation model that investigated the impact of team trust on team performance, mediated by project commitment and moderated by climate strength (the consensus among team members on the level of trust). To test the proposed model, data was collected from 171 project team members in 31 Norwegian construction project teams. The results indicated that the effects of the formative indicators of trust are indirect and mediated by project commitment, while the expected moderation effect of climate strength was not found.

The objective of paper III was to enhance our understanding of the relationship between trust, commitment, and knowledge sharing in a project team context by examining how trust directly and indirectly (through commitment) affects knowledge sharing. Two foci of commitment were included—team commitment and project commitment. A mediation analysis was conducted on data from 179 project team members in 31 Norwegian construction project teams. Results showed that project commitment fully mediates the relationship between propensity to trust and knowledge sharing, while trustworthiness was partially mediated by project commitment. Contrary to our expectations, mediation of team commitment on the same relationships was not confirmed. In conclusion, the present thesis offers new and empirical insights into the complex nature of temporal project work and underscores the significance of prior relationships and shared work history in facilitating trust development and cross-functional team integration. Further, the findings show that in a project setting, the impact of trust seems to be indirect rather that direct, and that commitment to the project is an important factor conveying the impact of trust on project team outcomes.

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List of papers

Paper I

Buvik, M. P., & Rolfsen, M. (2015). Prior ties and trust development in project teams: A case study from the construction industry. *International Journal of Project Management, 33*, 1484–1494.

Paper II

Buvik, M. P., & Tvedt, S. D. (2016). The impact of commitment and climate strength on the relationship between trust and performance in cross-functional project teams: A moderated mediation analysis. *Team Performance Management*, *22*, 114–138.

Paper III

Buvik, M. P., & Tvedt, S. D. (2017). The influence of project commitment and team commitment on the relationship between trust and knowledge sharing in project teams. *Project Management Journal, 48*, 5–21.

Introduction

This thesis examines the significance of trust in the context of project teams. The working relationships between members of a project team can have critical influences on project outcomes and trust has been recognized as a key factor contributing to project success (Wong, Cheung, Yiu, & Pang, 2008). Trust among members in the project team is important for several reasons: (1) project teams are often heterogeneous and cross-functional, creating high interdependency between team members; (2) the nature of work in projects often introduces high levels of uncertainty, time pressure, and risk; and (3) continuous coordination, integration, and collaboration within the team is essential to produce project outcomes. These characteristics emphasize the need for trustful working relationships between project team members.

Trust in organizations has received considerable attention over the past few decades and is recognized as a critical construct in organizational research and practice (McEvily, Perrone, & Zaheer, 2003; Rousseau, Sitkin, Burt & Camerer, 1998). The scholarly attention to issues of trust in organizations is due to at least two important reasons. One is that work tasks are becoming increasingly more knowledge-intensive, complex, and cooperative in nature (Hauser, Perkmann, Puntscher, Walde, & Tappeiner, 2015), thus amplifying the role of trust in promoting cooperative behaviors (Jones & George, 1998). Another reason is the growing awareness of social factors as a source of competitive advantage in organizations (Putnam, 2000). Changes in organizational life, such as mergers, collaborations, and project-organizations, have emphasized this. Moreover, the move towards more team-based structures and collaborative working practices has led to growing interest in studying trust at the team level (Costa & Anderson, 2011; Kozlowski & Bell, 2003). However, although trust has been a

topic of interest for organizational and team researchers, studies of intrateam trust are relatively scarce (Braun, Peus, Weisweiler, & Frey, 2013; Lau & Liden, 2008), and there is still a need to know more about the significance of trust in the context of project teams—an increasingly important and frequent type of team in organizational life (Picazo, Gamero, Zornoza, & Peiró, 2014). During the last decades we have seen a rise of both projects and teams (Chiocchio, Kelloway, & Hobbs, 2015; Kozlowski & Chao, 2018), and a fair portion of the emergence of teams can be attributed to the rise of projects, and thus of project teams (Chiocchio & Hausdoft, 2014). Projects are becoming increasingly widespread (Bakker, 2010) and this "projectification" of activities is not limited to traditional project-based industries but is evident in all sectors (Bredin & Söderlund, 2011).

Although the management of teams has been subject to increased focus in the project management literature (Gemuenden, 2014), there remains a need to investigate what makes project teams effective (Kozlowski & Ilgen, 2006). Hobbs, Chiocchio and Kelloway (2015) noted important shortcomings in the literature, as project management studies have primarily focused on the project (or the project manager) as the unit of analysis and neglected more recent developments in team research, while organizational psychology researchers have often neglected the specific context of projects. Many scholars have recognized that identifying the context in which teams function is paramount to a better understanding of team effectiveness (Chiocchio & Essiembre, 2009), yet context remains understudied (Sundstrom, McIntyre, Halfhill, & Richards, 2000), and its influence "is often unrecognized or underappreciated" (Johns, 2006, p. 389). Thus, there is a need to focus on project teams as the unit of analysis and to consider the influence of the context in this endeavor. Although much research has demonstrated a positive impact of trust in teams in general and in projects, there is a gap regarding specific research on trust at the project team level.

This thesis responds to De Jong and Elfring's (2010) request for more context-specific research on trust in teams suggesting that the way trust operates in temporary project teams may be different compared to in permanent operational teams. For instance, the temporary nature of project teams may influence the way trust develops. The traditional view of trust implies that interpersonal trust typically needs time to develop. However, sufficient time may not be available in project teams, and therefore initial trust levels within the team may be important in shaping the project. Relationship duration and the degree of familiarity between team members can be a determinant of the level of trust at the start of the project, and this initial level of trust can send the project team into a spiral of increasing or decreasing trust (Zand, 1972). More specifically, the behaviors triggered by initial levels of trust may reinforce or undermine trust as the project progresses. Consequently, there is a need to know more about how to promote high levels of initial trust in order to get project off on the right track from the start. This is in line with Pinto, Slevin and English's (2009) acknowledgement of a gap in research on antecedent conditions that can affect trust development in a project setting.

The way trust impacts important project team outcomes may also be specific for teams operating in a project setting. A review of the existing literature on trust shows that trust has been repeatedly identified as an important component in teamwork (Costa, 2003; Webber, 2008), and has been associated with several positive outcomes that are highly significant for project teams, including team performance (Costa, 2003; De Jong & Dirks, 2012; Webber, 2008), knowledge sharing (Andrews & Delahaye, 2000; Lee, Gillespie, Mann & Wearing, 2010; Park & Lee, 2014) and commitment (Costa & Anderson, 2011; Ferres, Connell, & Travaglione, 2004). However, there are mixed and inconsistent findings on the relationship between team trust and performance (De Jong & Dirks, 2012; De Jong and Elfring, 2010; Dirks and Ferrin, 2001), as well as between trust and knowledge sharing (e.g., Bakker,

Leenders, Gabbay, Kratzer, & van Engelen, 2006; Ozlati, 2015); this leads to the question of whether these relationships are direct or mediated. Consequently, more research is needed to demonstrate how trust impacts project team functioning, and to examine the potential mechanisms through which trust may influence outcomes in a project team setting (Chowdhury, 2005; DeOrtentiis, Summers, Ammeter, Douglas, & Ferris, 2013; Mayer & Gavin, 2005; Renzl, 2008; Wang & Noe, 2010).

While we now see project work expanding to all sectors, this thesis will focus on a traditional project-based industry: the construction industry. Construction is a key example of a project-based industry, with nonroutine production processes, complex working relationships, and interdisciplinary knowledge (Bresnen, Goussevskaia & Swan, 2004; Liu, van Nederveen, & Hertogh, 2017). While the project team's ability to manage the technical components of the project has been extensively studied (Chinowsky, Diekmann, & Galotti, 2008), there is a need to investigate the significance of trust in the context of the project team. The characteristics of construction projects, such as high uncertainty and interdependence, underline the importance of trust in such an organizational setting.

In sum, this thesis sets out to answer the call for more research on three main shortcomings identified in the existing body of research on trust in teams:

1. A lack of studies focusing on trust at the team level in general, and in the context of project teams specifically.
2. A lack of research on antecedent conditions for trust development in a project team context.
3. Mixed and inconsistent findings on the impact of trust on team outcomes, resulting in a need for more research on the nature of these relationships.

Research objective and research questions

The main objective of this thesis is to investigate the significance of trust in a temporary project team environment to enhance our understanding of the development and impact of trust in this context. The study will address the shortcomings outlined above and provide researchers and practitioners with insight into factors pertaining to trust that are particularly central for project teams. More specifically, this study sets out to answer the following research questions:

1. *How does the temporal nature of projects affect trust development in project teams?*
2. *What is the nature of the relationship between team trust and central project team outcomes?*

The thesis, including the three papers within it, will answer these questions. To do so, there is a need to know more about trust in organizations in general, and trust in work teams specifically. We also need to know more about how a shared climate of trust in teams can evolve, and how trust can be measured at the team level. Next, we must obtain an overview of characteristics of projects and project teams in general, and in the construction industry more specifically. These aspects will be covered by the first part of the thesis and serve as a backdrop for answering the research questions.

To answer research question one, we need to know more about the specific factors that can affect the development of trust in the context of project teams. Previous studies and literature on trust development in general are briefly presented before a more thorough inquiry into how the temporal nature of work and the degree of familiarity can affect trust development. The review of such literature makes it clear that there is a need to know more about conditions that affect trust development in the specific context of project teams. Paper I therefore sets out to

answer the question, *How do prior ties between team members influence the development of trust in a project team setting?* to identify aspects of team functioning that can be affected by a history of interaction and familiarity between members of the project team.

Research question two, which deals with the nature of the relationship between trust and project team outcomes, is mainly answered by papers II and III. The thesis briefly presents literature on the effects of trust on project team outcomes, with an emphasis on the relationship between trust and project performance and knowledge sharing - two critical outcomes of project teams. The literature has indicated mixed and inconsistent findings, leading to the question of whether these relationships are direct or mediated. Accordingly, paper II and paper III set out to examine the nature of the relationship between trust, and project performance and knowledge sharing, respectively. More specifically, the research questions of paper II and III are:

Paper II: What is the relationship between trust climate and perceived project performance in project teams? Is the relationship direct, or mediated by commitment? And does the consensus of team members on the level of trust moderate the relationship?

Paper III: What is the relationship between trust climate and knowledge sharing in project teams? Is the relationship direct, or mediated by commitment? Which foci of commitment, team or project commitment, is favored in this relationship?

The research questions asked in the three papers are answered via the use of both qualitative and quantitative methods. To answer the research question in paper I, qualitative interviews in a single case study were conducted, while quantitative survey data was utilized to answer the research questions in both papers II and III. This triangulation of methods allows for a widening of perspective and for a pluralistic approach to studying the significance of trust in project teams. In sum, the papers investigate important antecedents and consequences of trust

in project teams. The temporary nature of projects, with its effect on relationship duration and familiarity between team members, is assumed to impact the development of trust in such a setting. Trust is also expected to affect outcomes such as performance and knowledge sharing in project teams; therefore, the nature of these relationships is also examined.

Structure of the thesis

The structure of the thesis is as follows. First, the theoretical foundations and a review of the relevant literature are presented. This begins with an overview of trust and trust definitions in general, followed by an outline of trust in teams, trust climate, and the measurement of trust. Next, the characteristics of projects and the project context are presented, including a closer look at the construction industry. An overview of definitions and models of teams in general, and project teams in particular, are then presented, followed by a discussion of trust development in project teams in light of issues of temporality, relationship duration, and familiarity. Next, a short overview of literature on the effects of trust on project team outcomes are presented, primarily focusing on the effect of trust on project performance, knowledge sharing, and commitment.

The method section of the thesis then follows, with an elaboration on the methodological approach, presentation of the research context, overview of the sample, procedure and data collection, measures, levels of analysis, and data analysis. Next, a summary of the results from the three empirical articles is offered, followed by a discussion in which these findings are integrated, and inferences made. The contribution of the thesis and implications for theory and practice are then discussed, followed by limitations and proposals for future research. Finally, conclusions are presented. The research papers are provided as appendices at the end of the thesis.

Theoretical framework and literature review

Trust in organizations

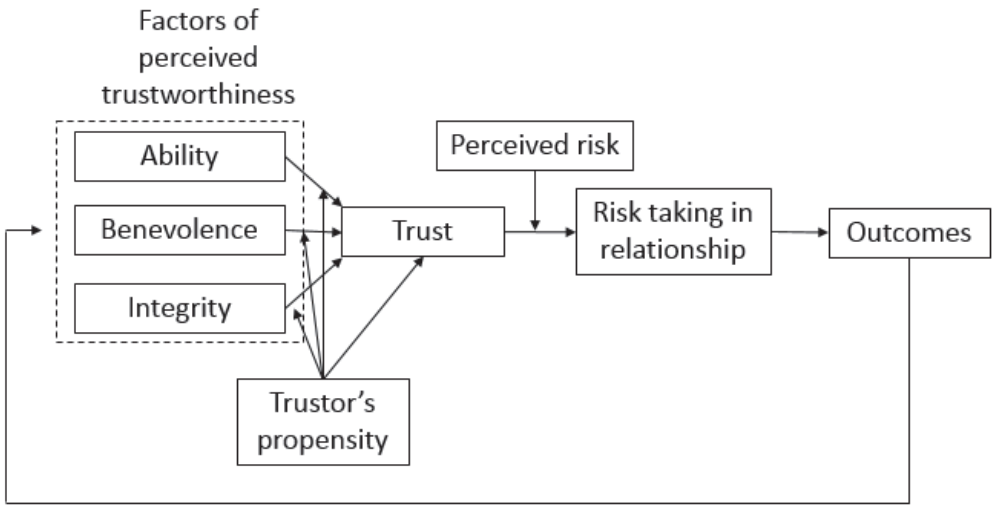
Trust is considered a critical construct in organizational research and practice (McEvily et al., 2003; Rousseau et al., 1998), and has increasingly been studied across a variety of disciplines, including management, sociology, psychology, and economics. This multidisciplinary perspective has provided a breadth of research that has strengthened the trust literature (Bigley & Pearce, 1998; Rousseau et al., 1998), but it has also created confusion about the definition and conceptualization of the trust construct (Colquitt, Scott, & LePine, 2007). While divergent definitions of trust exist, there seems to be agreement among scholars that trust involves "positive" or "confident" expectations about another party, and a "willingness to accept vulnerability" in the relationship, under conditions of interdependence and risk (e.g., Bigley & Pearce, 1998; Kramer, 1999; Lewicki, Tomlinson, & Gillespie, 2006; Mayer, Davis, & Schoorman, 1995; Rousseau et al., 1998). Two seminal articles published in the 1990s contributed to a clarification of what trust is (Mayer et al., 1995; Rousseau et al., 1998). The most quoted definition of trust is that of Mayer et al. (1995), who stated that trust is "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party" (p. 712). Rousseau et al. (1998) defined trust as "a psychological state comprising the intention to accept vulnerability based upon positive expectations of the intentions of behavior of another" (p. 395).

The trust model outlined by Mayer et al. (1995) is likely to be the best known, and most studied, model of trust in the literature (Wildman et al., 2012). While trust is relevant in all types of relationships, Mayer et al.'s (1995) model is designed to focus on trust in an organizational setting, suggesting that the nature and bases of trust in this context may be

different from that in other settings. In Mayer et al.'s model they separate trust (a person's willingness to be vulnerable based on positive expectation of another party's actions) from trustworthiness and trust propensity (a dispositional willingness to rely on others) (Rotter, 1980). The concept of trustworthiness is central to understanding and predicting trust levels (Colquitt et al., 2007), and Mayer et al. (1995) proposed that trustworthiness involves three factors: ability, benevolence, and integrity. *Ability* captures the knowledge and skills needed to do a specific job, along with the interpersonal skills and general wisdom required to succeed in an organization (Gabarro, 1978). Ability is critical to trust because people need to be assured that the other party is capable of performing the task he or she is being trusted to do (Robert, Dennis, & Hung, 2009). *Benevolence* is the extent to which a person is believed to want to do good for others, aside from an egocentric profit motive, with synonyms including loyalty and caring (Mayer et al., 1995). *Integrity* is a person's perception that the other will adhere to sound moral and ethical principles (Colquitt et al., 2007). The benevolence and integrity components of trustworthiness are compiled in Gabarro's (1978) "character" base of trust. While ability captures the "can-do" component of trustworthiness by describing whether the trustee has the skills and the abilities needed to act in an appropriate manner, the character variables capture the "will-do" component by describing whether the trustee will choose to use those skills and abilities to act in the best interest of the trustor (Colquitt et al., 2007). These trustworthiness dimensions also reflect both affect-based and cognition-based sources of trust (McAllister, 1995). For affect-based trust, emotional ties linking individuals provide the basis for trust, while the basis for cognition-based trust is cognitive reasoning. In this sense, benevolence has much in common with affect-based trust, whereas ability and integrity have much in common with cognition-based trust (Colquitt et al., 2007). Mayer et al.'s (1995) conception of interpersonal trust holds that a person will be willing to rely on someone else

based on this person's propensity to trust people in general and his or her perception that the other person is trustworthy. Figure 1 shows Mayer et al.'s (1995) model in more detail.

Figure 1 Model of trust (Mayer et al., 1995).



Research has supported the importance of ability, benevolence, and integrity perceptions for the development of trust (e.g., Colquitt et al., 2007). Colquitt et al. (2007) further recognized that trust often requires more than the expectations that ability, benevolence, and integrity can inspire, and that trust propensity may drive that leap.

As can be seen from Figure 1, the model also includes the perception of risk. Mayer et al. (1995) clarified the definition of trust by distinguishing between willingness to take a risk and actually taking a risk: "Trust is not taking risk per se, but rather it is a willingness to take risk" (p. 712). Making oneself vulnerable implies that there is something of importance to be lost. There is no risk taken in the willingness to be vulnerable; one does not need to risk anything in order to trust (Mayer et al., 1995); however, Mayer et al. asserted that risk is inherent in the behavioral manifestations of trust; one must take a risk in order to engage in trusting action. Accordingly, they proposed that the level of trust is comparable to the level of perceived risk

in a situation, and that people engage in trusting behaviors based on this evaluation in the specific situation. Gillespie (2003) also related trust to risk and argued that risk actually creates an opportunity for trust. Similarly, Luhmann (1988) advocated that the need for trust usually emerges in situations where it is necessary to take some kind of risk. However, the mere presence of risk alone is not enough for trust; there needs to be a mutual relationship characterized by interdependence before risk behaviors can be characterized as trusting (Rousseau et al., 1998).

Trust, in a broad sense, is confidence in and favorable expectations of others' behaviors. By trusting someone, people discard many of that person's possible, yet unfavorable, behaviors and thus reduce the complexity of understanding others (Gefen, 2000). Without trust, people would be confronted with the unconceivable complexity of considering every possible consequence of every person around before determining what to do (Gefen, 2000). Trust is thus a complexity-reduction method that makes it possible for people to interact despite the impossibility to control the actions of others or fully understand their motives.

The trust model proposed by Mayer et al. (1995) and outlined above focuses on trust at the dyadic level, comprising both an individual and a relational component of trust. In the organizational literature, trust has been studied across different levels, including interpersonal work relationships, leader/subordinate relationship, teams, organizations, and governance structures (Costa, 2003). The move toward team-based organizational structures and the rise of projects—and thus project teams—has, as noted above, led to increased interest in studying trust at the team level (Costa & Anderson, 2011). We should note that in addition to research on intraorganizational trust (i.e., trust within organizations), which comprises within-team trust, there exist two other strands of research on trust; one that deals with interorganizational trust (i.e., trust between organizations) and one that deals with trust between organizations

and their customers (i.e., marketing concerns) (Dietz & Den Hartog, 2006). The focus of this thesis is on within-team trust, which is an intraorganizational phenomenon. This will be discussed next.

Trust in teams

While many aspects of trust in organizations have been studied extensively (e.g., Blomqvist, 1997; Kramer, 1999; Rousseau et al., 1998), empirical studies on the antecedents and consequences of trust in teams are less comprehensive (Braun et al., 2013; Kiffin-Petersen, 2004; Lau & Liden, 2008), and research in this area is underdeveloped (Kozlowski & Ilgen, 2006). Nevertheless, there has been growing interest in the area, and trust has been recognized as a key component of teamwork (Jones & George, 1998; Salas, Goodwin, & Burke, 2009; Webber, 2008). Within-team trust is imperative for several reasons. First, the popularity of work teams and the interdependent nature of work tasks require people to collaborate and coordinate with each other in order to accomplish organizational goals (Groysberg & Abrahams, 2006). Trust has been recognized as an important precursor for collaboration (Ferrin, Bligh, & Kohles, 2007) and a major component of effective decision making and proactive behaviors at work, both of which are necessary for effective performance of interdependent work (Lau & Liden, 2008). Further, interpersonal trust facilitates social exchange relationships (Blau, 1964), such that when team members trust each other, they are more willing to help each other because they know that their peers are likely to reciprocate their help in the future (Gouldner, 1960; Lau & Liden, 2008).

Trust at the team level is grounded in interpersonal trust, since teams are composed of interacting individuals. Accordingly, Mayer et al.'s (1995) definition is to some extent applicable to trust in teams. However, in a team setting trust is not a mere function of a one-to-one relationship between individual team members but is also dependent on the reciprocal

interactions of members of the team. As such, team trust is both an individual and a collective phenomenon (Costa & Anderson, 2011). When one team member realizes that his or her team mate is taking a considerable risk by trusting, this may lead others to reciprocate the trust and behave in a trustworthy manner (Costa & Anderson, 2011; Das & Teng, 1998). However, team members' judgments about their team mates' trustworthiness are also partly anchored in their own dispositions and their prior experiences of others' behavior. Moreover, trust only becomes an issue when there is some degree of dependency—i.e., when a team member is dependent on, and vulnerable to, the actions of other team members (Kramer, 1999; Searle, Weibel, & Den Hartog, 2011). The combination of positive expectations and vulnerability within a dependent relationship is pivotal for trust (Luhmann, 1988). The higher the interdependency, the more trust is required to achieve efficiency (Wicks, Berman & Jones, 1999). Risk and vulnerability vary between contexts and situations; thus, trust may not be a salient consideration in every situation. Similarity, if there is little to lose if the trusted team member does not behave as desired, the risk may be small, and trust is less relevant (Searle et al., 2011). In a team setting, team members often depend upon each other to achieve task-related outcomes (Ferguson & Peterson, 2015; Guzzo & Dickson, 1996; Kozlowski & Bell, 2003). These relationships often present some risks for individual team members in that their success may be tied to the success of the team (Wageman, 1995). Therefore, a certain level of trust is necessary for teams in order to cooperate and achieve important team outcomes together (Ferguson & Peterson, 2015).

Consistent with several scholars of trust (Cummings & Bromiley, 1996; Kramer, 1999; Langfred, 2004), Costa (2000) showed that trust can be conceptualized as multifaceted, with distinct but related indicators. This conceptualization of trust as a latent construct with indicators is consistent with Mayer et al.'s (1995) definition, which views trust as a highly complex phenomenon that includes both the factors that determine the psychological state

(formative indicators) and the behavioral consequences of that state (reflective indicators). Following this conceptualization, Costa and Anderson (2011) defined trust between team members as a latent construct based on the individuals' own propensity to trust others and on the perceived trustworthiness of the other team members, which then leads to behaviors of cooperation and monitoring between team members. In this conceptualization of trust, propensity to trust and trustworthiness constitute formative indicators of the latent trust construct since they reflect dispositions and perceptions underlying the construct (MacKenzie, Podsakoff, & Jarvis, 2005). The behaviors of trust, defined by Costa and Anderson (2011) as cooperation and monitoring, are viewed as reflective indicators, and are a result of the action to trust or not.

Although propensity to trust has been commonly viewed as a relatively stable dispositional trait and referred to as a general willingness to trust others (Rotter, 1980), it is also likely to be affected by team members and environmental factors. In teams, propensity to trust is thus likely to influence, and be influenced by, perceptions of trustworthiness and actions of other team members (Costa & Anderson, 2011). Trustworthiness, which is defined as the extent to which individuals expect others to uphold and behave according to their claims (Costa & Anderson, 2011) develops, as we have seen, from perceptions and information regarding ability, benevolence, and integrity (Mayer et al., 1995). In a team setting, trust is very much related to knowledge of the other team members' abilities and skills, since trust is usually related to a task we expect others to be able to perform. Cooperative behaviors are reflective indicators of trust and relate to several positive actions that reflect a willingness to be vulnerable to others whose actions one does not control (Costa & Anderson, 2011; Zand, 1972). Team monitoring can be viewed as "a cognitive operation in which team members observe actions of their teammates and watch for errors or performance discrepancies" (Marks, Mathieu, & Zaccaro, 2001, p. 367). Ouchi (1979) suggested that group members must

either trust or monitor each other in order to work together. However, more recent studies suggest that there might be some nuance to this. While Costa and colleagues have repeatedly demonstrated a negative relationship between trust and monitoring (Costa, 2003; Costa & Anderson, 2011; Costa, Roe & Taillieu, 2001), other studies have yielded mixed findings on the trust-monitoring relationship (Bijlsma-Frankema, De Jong, & Van de Bunt, 2008; De Jong & Elfring, 2010; Langfred, 2004). In this sense, the concept of monitoring can be conceived as a two-sided phenomenon that can be viewed as both negative and positive behavior depending on the type of team and type of trust under consideration (McAllister, 1995). Negative control-based monitoring is associated with distrust (Zand, 1972), wherein suspicious team mates check their colleagues to make sure that they are performing properly. Although this negative interpretation of monitoring is the dominant view, a positive need-based monitoring has also been proposed (McAllister, 1995). This form of monitoring is driven by affective trust, where team members are sensitive to each other's needs and provide assistance when needed. The differences between the positive and negative interpretation of monitoring are further discussed in paper II.

Trust behaviors are the behavioral manifestations of trust. While Mayer et al. (1995) proposed a sequential model of behaviors with the components of trust, and others have argued that trust behaviors must be kept separate, both conceptually and empirically (Kiffin-Petersen, 2004; Wildman et al., 2012), Costa et al. (2001), Costa (2003), and Costa and Anderson (2011) viewed trust behaviors (cooperation and monitoring) as components of trust and not as an effect of trust itself. Costa (2003) argued that these behaviors are components of trust because they enable individuals to act on their own judgments (Lewis & Weigert, 1985). It has also been claimed that it is through observation and interpretation of the behaviors of others that individuals are able to make inferences of trustworthiness (Zand, 1972). Others

have argued that trust behaviors are mediating variables between trust and outcomes of trust (Wildman et al., 2012).

Trust climate and climate strength

Behaviors resulting from the decision to trust or not are important aspects of trust, since they are the basis for reciprocity between individuals (Nooteboom, 2002). Reciprocity is key for establishing and maintaining trust in teams (Costa & Anderson, 2011). Costa and Anderson (2011) argued that team trust reflects a climate that is shared among team members and is likely to influence and be influenced by individual propensities and perceptions of trustworthiness, and lead to behavior patterns that reflect that climate. By interacting within their work team, team members are likely to develop shared perceptions, expectations, patterns of understanding, and norms of behavior with their team colleagues (Costa & Anderson, 2011). These shared perceptions and the collective sense-making in teams (Rentsch, 1990) can create the opportunity for a shared climate to evolve (Anderson & West, 1998; Kozlowski & Klein, 2000; West & Anderson, 1996). Hence, although trust within teams can derive from an individual set of beliefs regarding their team, it is likely that through ongoing interactions and interdependent task demands individuals will develop consensual or shared notions of trust (Costa & Anderson, 2011; Rentsch, 1990; West, 2001).

The notion of climate as an interpretation of the group situation can be traced back to early work by Lewin, Lippitt, and White (1939). In contemporary theory and research on climate, the concept of *climate strength* is beginning to catch the attention of scholars (González-Roma, Fortes-Ferreira, & Peiro, 2009). González-Roma et al. (2009) defined climate strength as the degree of within-unit agreement of employees' climate perceptions. In research on climate strength, it can be seen that individual-level constructs (e.g., trust) combine through social interaction processes to emerge as team-level phenomena (trust climate). The greater

the degree of shared perceptions among team members on the level of trust within the team, the stronger the trust climate. However, a high degree of shared perceptions of trust does not necessarily indicate a high level of trust within the group. Brown, Kozlowski, and Hattrup (1996, in Kozlowski & Ilgen, 2006) suggested that sharing, consensus, or agreement on climate perceptions should be a substantive phenomenon of interest in itself, rather than a mere statistical justification for aggregating individual climate perceptions to represent collective climates.

Chan (1998) proposed a five-level typology of composition models: (1) additive, (2) direct consensus, (3) referent shift, (4) dispersion, and (5) process. Composition models are strategies for operationalizing climate at aggregated levels of analysis. In direct consensus models, higher-level constructs represent the consensus among lower-level units (Dickson, Resick, & Hanges, 2006). These models have traditionally been used in climate research because a climate is said to exist in a group only if there is a certain degree of agreement on the climate measure (James, Demaree, & Wolf, 1984). James et al. (1984) developed the r_{wg} index, which is still recognized by many as the superior measure of climate consensus (Lindell & Brandt, 2000). According to this consensus model, within-group agreement, or the r_{wg} score, should be 0.70 or higher for a shared climate to exist, legitimating aggregation to the team level. Thus, a team-level climate, such as a team trust climate, is conceived as present only if there is an acceptable level of consensus among team members. On the contrary, the absence of shared perception, or high within-group variability, implies that a group-level construct does not exist (Klein, Conn, Smith & Sorra, 2001). In contrast to the direct consensus model, dispersion models treat within-group variability, or the degree of shared perception, as a focal construct (Chan, 1998). Dispersion models explicitly test the idea that variability can be an important predictor of outcomes. In the last 10–15 years, examples of research using the dispersion model have demonstrated that the level of

heterogeneity (or strength of the climate) can vary between groups, and that this variability can be meaningful (e.g., González-Roma et al., 2009; González-Roma Piero & Tordera, 2002; Luria, 2008; Schneider, Salvaggio, & Subirats, 2002).The concept of climate strength is often associated with Mischel's (1973) concept of situational strength. Strong situations (strong climates) are said to foster uniform and consistent behavior, whereas weak situations (low agreement or consensus) induce more variability and thus make the predictability less reliable.

Regarding team trust research, most studies have tended to exclude the variation of trust between team members and have merely focused on mean levels of team trust. A recent exception is De Jong and Dirks' (2012) study of trust in teams, where asymmetry (dispersion) was found to moderate the relationship between trust and team performance, providing evidence for why dispersion or variance in team members' trust should be taken into account. When team members agree on the level of trust within the team, they can also show more consistent behaviors. Conversely, if team members vary much in how they perceive the trust climate of their team, the variability of associated responses can be larger, and the predictability weakened.

Measurement of trust

In their review of trust measures in organizational research, McEvily and Tortoriello (2011) concluded that the state of the art of trust measures is undeveloped and fragmented. They explained some of this fragmentation with reference to the context-specific nature of trust; researchers are often confronted with the need to adapt existing instruments to meet the distinctive purposes of their study and adjust them to the specific features of that context. While recognizing that context may differ and influence the measurement of trust, McEvily and Tortoriello (2011) asserted that it is the type of organizational relationship in the study that is critical. Instruments designed to measure trust in one specific type of relationship may

be less applicable to other relationships. According to Searle et al. (2011), the lack of coherent trust scales may be to blame for some of the inconsistent results on the outcomes of trust.

As noted above, the research on trust has predominantly been conducted on the interpersonal or the organizational level, with fewer empirical studies at the team level of analysis (e.g., Braun et al., 2013; Serva, Fuller, & Mayer, 2005). However, during the last decade there has been an increased emphasis on team trust, and thus more studies conducted at the team level (Costa & Anderson, 2011; Serva et al., 2005; Webber, 2008). Gully (2000) argued that "to conduct research on work teams in the organizational context, the team has to be treated as the primary level of analysis" (p. 27); nevertheless, a widely accepted and used instrument to measure team trust has been lacking in the literature. Of the measures that do exist, one relatively recent example is Costa and Anderson's (2011) multifaceted measure of trust in the context of work teams. Their measure consists of four dimensions—two distinct formative indicators (i.e., propensity to trust and perceived trustworthiness) and two distinct reflective indicators (i.e., cooperative and monitoring behaviors). These dimensions can be compared with those proposed by Mayer et al. (1995) and Smith and Barclay (1997). The initial validation provides support for this multidimensional construct of trust and the usability of their measure (Costa & Anderson, 2011).

When assessing trust at the team level, it is essential to consider the referent of the measurement (Korsgaard, Brower & Lester, 2015). Serva et al. (2005) discussed three options regarding how to study trust at the team level. The first is to make groups come to a collaborative answer by responding to the questions together; however, this method could be biased due to social influences. A second method that is frequently used is to direct the questions to individual team members, with the item referent also directed toward the individual, and subsequently aggregate to the team level. Serva et al. (2005) also pointed out

weaknesses with this technique, since a mean response may not be a valid indicator of the team's collective perception. Instead, they recommended a third alternative, proposed by Kozlowski and Klein (2000), to measure shared team properties, where the *team* is used as the referent in the question, rather than the individual. Each respondent thus becomes a data source and reports not only his or her beliefs, but also what he or she perceives the team to believe (Serva et al., 2005). Within-group agreement is tested, and individual data are aggregated to the team level of analysis to represent the shared team construct. Bliese, Chan and Polyhart (2007) further explained the difference between individual and collective constructs. When the referent is the individual (e.g., "I trust my team mates"), the average rating represents a direct consensus construct that is isomorphic or similar to the individual-level construct (Bliese et al., 2007). In contrast, when the referent is the collective ("We can rely on each other"), the consensus construct is a "referent shift," meaning that it is fully unique from individual-level trust (Bliese et al., 2007). In the latter case, rather than asking team members about their individual perceptions, the referent shifts to incorporate the group as a whole. Nevertheless, both forms assume group members to share a common perception, and high interrater agreement is necessary for the aggregation of individual data to team-level data. As noted above, the within-group variance can also represent something meaningful and may interact with the teams' average scores. González-Roma et al. (2002) suggested, therefore, that research interested in the social environments of groups should examine the level of consensus among team members, as well as the average team score.

Projects and project teams

The previous section outlined the literature and theories on organizational trust, and trust in teams specifically. In this section, the specific characteristics of projects and project teams will be elaborated. As noted earlier, teams and projects both seem to be playing a growing

role in modern organizations (Chiocchio et al., 2015). In their influential reviews on work team effectiveness, Cohen and Bailey (1997) and Kozlowski and Ilgen (2006) both emphasize the increasing prevalence and importance of teams in organizations. Correspondingly, the practice of organizing work into projects is becoming increasingly widespread (Bakker, 2010) and scholars have referred to a "projectification" of work, where projects are spreading across industries and beyond traditional fields of project organizations (Bredin & Söderlund, 2011; Chiocchio et al., 2015; Maylor, Brady, Cooke-Davies, & Hodgson, 2006). These coinciding trends are seen as means to promote organizational adaptability (Hollenbeck, Beersma, & Schouten, 2012), address change, and adapt to context-specific problems (Johnson, 2013). As projects are usually carried out by project teams, these teams must be seen as being of "strategic importance for any organization to survive and thrive" (Chiocchio et al., 2015, p. 480). Projects are by definition temporary, and temporary forms of organization differ from permanent settings in various ways.

The characteristics of projects will be outlined next, followed by an overview of characteristics of teams and project teams.

Characteristics of projects and the project context

Project management is an interdisciplinary field based on the idea that managing projects is different from managing non-project activities (Hobbs et al., 2015). It is an applied field in which professional practitioners and associations play a significant role. Within the project management literature, definitions of projects have often referred to the project task, and there is consensus on its defining characteristics (Hobbs et al., 2015). The Project Management Institute has defined the project task as "a temporary endeavor undertaken to create a unique product, service, or result" (Project Management Institute, 2013, p. 1). Hinging on this

definition, Hobbs et al. (2015, p. 8) discussed three characteristics that differentiate project from non-project tasks:

1. Projects are temporary, meaning that they have a beginning and an end. While most tasks eventually come to an end, projects are temporary by design and are often contrasted with continuous operational processes.
2. Projects must entail a unique product, service, or result. The opposite of unique is repetitive; however, there is no clear-cut rule as to how unique a product must be to qualify as a project.
3. Projects must involve progressive elaboration, meaning "the iterative process of increasing the level of detail in a project management plan as greater amounts of information and more accurate estimates become available" (Project Management Institute, 2013, p. 552). The project task becomes progressively better defined as the project unfolds.

Many tasks that are not projects have one or two of these features, but for a task to be considered a project it must have all three defining characteristics (Hobbs et al., 2015). Turner and Müller (2003) further defined a project as "a temporary organization to which resources are assigned to undertake a unique, novel and transient endeavor managing the inherent uncertainty and need for integration in order to deliver beneficial objectives of change" (p. 7). They thus highlighted "unique, novel and transient" as defining features of a project. Furthermore, their definition builds on Turner's (1999) identification of three pressures often associated with projects: (1) uncertainty, (2) the need for integration, and (3) urgency. Uncertainty arises as it is virtually impossible to be certain that plans will deliver the required project outcomes or desired beneficial change. Turner (1999) suggested that the three pressures are distinctive of projects and project management, and not just the management of

time, cost, and quality, which are characteristics shared with routine management. Hanisch and Wald (2011) listed the following as main characteristics of projects: temporariness, uniqueness, heterogeneity, short-term orientation, and lacking organizational routines. Most temporary organizations are inherently complex due to these characteristics (Geraldi, Maylor, & Williams, 2011).

While it has often been stated that the project task is nonroutine or nonrepetitive, there are examples of repeatability in projects as well. Kadefors (1995) and Pipan and Porsander (2000) for example, have shown that even radically unique projects can consist of several nonunique technical components, as well as highly standardized administrative procedures. While accomplishing the overall task of a project requires progressive elaboration, subtasks within the project might be routine work. Moreover, Engwall (2003) argued that no temporary organizational system is an island and stated that the interior processes of projects are influenced by its historical and organizational context. Recent work has increasingly emphasized a contextual perspective on projects (Bakker, 2010), and considered them as inextricably embedded within an organizational and social context with structures, procedures, and personal networks spanning successive projects (Engwall, 2003).

At the heart of project management is the goal of project success (Müller & Jugdev, 2012). Project success has traditionally been measured by factors such as time, cost, and quality (Brown & Adams, 2000; Turner, 1999), often referred to as the “iron triangle” or the “triple constraint” (Pollack, Helm & Adler, 2018). However, researchers have criticized the notion of the iron triangle as an oversimplification of project practice and considered project success to be a more complex concept than presented (Mir & Pinnington, 2014; Müller & Jugdev 2012). Müller and Jugdey (2012) showed how the understanding of project success has evolved to be regarded as a multidimensional construct encompassing several factors. They asserted that

perceptions of success differ by "individual personality, nationality, project type, and contract type" (p. 768), and concluded that a clear definition of project success does not exist; "project success is predominantly in the eyes of the beholder" (p. 768). According to Söderlund (2015), project tasks are commonly heterogeneous, infrequent, and ambiguous, and he pointed to knowledge integration as key determinant of successful projects. The impact of the project manager and his or her leadership style on project success has also been examined (Müller & Turner, 2007), suggesting that the leadership competencies are correlated with project success and that different leadership competencies are appropriate for different types of projects. The quality and effectiveness of teamwork has also been considered as a critical factor for project success (Bryde, 2008; Hoegl & Gemuenden, 2001; Pinto & Pinto, 1991).

As previously explained, the distinction between project and nonproject tasks is based on the temporary nature of projects, the unique nature of the project deliverables or results, and the progressive elaboration of the deliverables (Hobbs et al., 2015). We are now seeing project work expanding beyond "traditional" fields such as architecture, construction, information technologies, military, and new product development (Chiocchio et al., 2015). Work is organized into projects in both private and public organizations and has become a "standard operating procedure" (Söderlund, 2015, p. 78). Organizations can be entirely structured around projects and project teams, or projects can represent secondary assignments and obligations. Project-based organizations (PBO) are those in which the majority of products or services are produced through projects for either internal or external customers (Pemsel & Wiewiora, 2013, p. 31). The construction industry is a prime example of an industry comprised of PBOs, since mainstream activities are entirely or mostly project based. In construction, new product development involves not only nonroutine production processes, but also complex working relationships and interrelations (Bresnen et al., 2004). The industry has commonly been criticized for its variable performance and project delivery (Baiden,

Price, & Dainty, 2006), and is frequently characterized by time and cost overruns due to extensive rectification. This has partly been attributed to the inability of project participants to work together effectively and to form effective teams (Baiden et al., 2006). More details on the characteristics of the construction industry context will be discussed in the method section and in paper I, but the specific features of construction projects underline the importance of trust in such an organizational setting (Karlsen, Graee & Massoud, 2008). The role of trust in construction engineering and management has received increased research attention in the last decades (e.g., Girmscheid & Brockman, 2010; Kadefors, 2004; Lau & Rowlinson, 2009; Wong et al., 2008). In a construction setting, trust has been found to be one of eight key indicators of team integration, and again is considered essential for successful project delivery (Ibrahim, Costello, & Wilkinson, 2011). For the most part, however, previous studies of trust in construction have focused on interorganizational trust (Laan, Voordijk, Nooderhaven, & Dewulf, 2012; Lau & Rowlinson, 2009), trust in partnering projects and contracts (Wong et al., 2008), and trust in the project–stakeholder relationship (Black, Akintoye & Fitzgerald, 2000; Kadefors, 2004; Karlsen et al., 2008; Pinto et al., 2009). In general, trust has been found to play an important role in construction projects (Karlsen et al., 2008), and successful trust building within project teams could improve project outcomes (Wong et al., 2008).

Teams and project teams

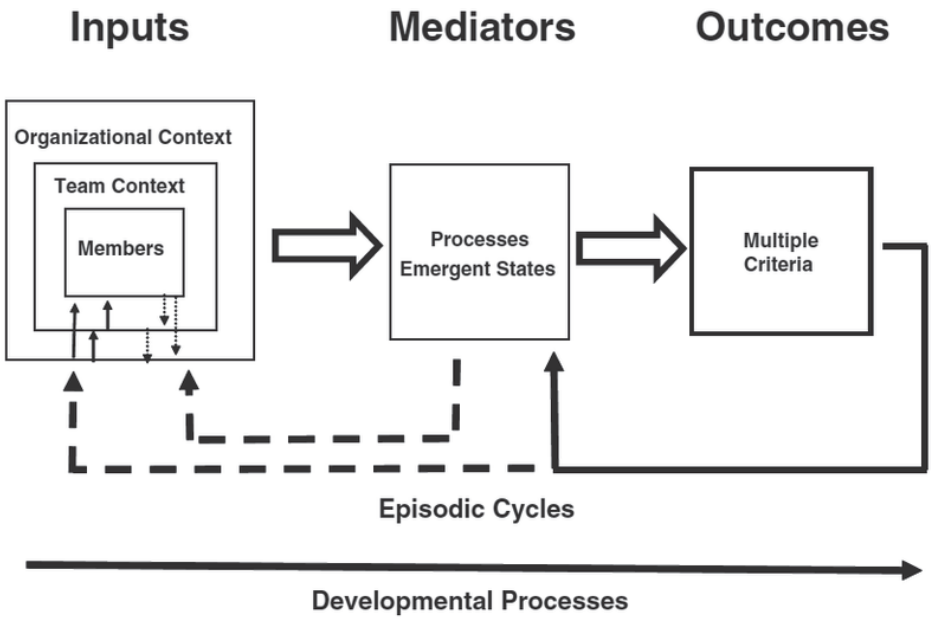
Teams have been an important part of organizational life for decades (Tannenbaum, Mathieu, Salas, & Cohen, 2012), and researchers in social and organizational psychology have been studying team effectiveness and its underpinnings for over 60 years (Kozlowski, 2015, Kozlowski & Chao, 2018). Teams provide diversity in knowledge, attitudes, skills, and experience, and have the potential to offer greater adaptability, productivity, and creativity than any one individual can provide (Gladstein, 1984; Hackman, 1990; Salas, Sims, & Burke,

2005). This is the result of what has been called *the wisdom of collectives*, which is the increased capacity for achieving various types of performance made possible by the interaction of team members (Salas, Rosen, Burke & Goodwin, 2008). A much-cited definition of teams was proposed by Cohen and Bailey (1997), who stated that a team is "a collection of individuals who are interdependent in their tasks, who share responsibility for outcomes, who see themselves and who are seen by others as an intact social entity embedded in one or more larger social systems and who manage their relationships across organizational boundaries" (p. 241).

A frequent question in research on teams has been to identify factors that constitute effective teamwork and how good teamwork manifests in actual behavior (Kozlowski & Ilgen, 2006). McGrath's (1964) input–process–output (IPO) model of team effectiveness has long characterized the psychological approach to studying teams and has served as a framework for organizational studies for many years (Mathieu, D'Innocenzo, & Kukenberger, 2015). The fundamental premise of the IPO model is that various inputs (including work design, task interdependence, and team composition) combine to influence team processes that, in turn, influence team outcomes (Guzzo & Shea, 1992). Although the IPO model has been important, it has been criticized for not adequately capturing the dynamic, emergent, and adaptive nature of teams (Mathieu, Maynard, Rapp & Gilson, 2008). The more recent input–mediator–outcome–input model (IMOI) proposed by Ilgen Hollenbeck, Johnson, and Jundt (2005) includes additional interactions between inputs; more feedback loops between inputs, processes, and outcomes; and greater consideration of time scales. By concluding the model with input, it calls attention to the idea of cyclical causal feedback. Team outputs, such as team performance, can act as inputs to future team processes and emergent states. Moreover, the process portion of the model has been expanded to include both team processes and emergent states under the collective label "mediators" (Marks et al., 2001; Mathieu et al.,

2008). Emergent states tap qualities of a team that represent member attitudes, values, cognitions, and motivations (Marks et al., 2001), and are team-level phenomena indicative of team members' individual states that develop over the life of the team (Ilgen et al., 2005; Kozlowski & Klein, 2000). Advocating a multilevel approach to the study of teams, Kozlowski and Klein (2000) recognized teams as multilevel systems (individual, team, and organizational levels). Individuals are nested in teams, which in turn are nested in organizations, which exist in environments (Mathieu et al., 2008). The model puts more emphasis on the temporal dynamics of teamwork by adding developmental processes and episodic cycles. Developmental processes illustrate how teams qualitatively change and are differentially influenced by various factors as they mature over time (Kozlowski, Gully, Nason, & Smith, 1999). Marks et al. (2001) proposed an episodic approach to team processes and argued that teams must execute different processes at different times, depending on task demands that recur in a cyclic fashion. They differentiated between action and transition phases, where action phases are periods of time during which team members are engaged in acts that contribute directly to goal accomplishment (i.e., taskwork) (p. 360). In contrast, transition phases are periods of time during which teams focus primarily on evaluation and/or planning activities to guide their accomplishment of a team goal or objective (Marks et al., 2001, p. 360). Figure 2 shows an extended IMOI model inspired by Ilgen and colleagues (2005).

Figure 2 IMOI model inspired by Ilgen et al. (2005).



Source: Mathieu et al. (2008).

Macro trends in society at large have also changed the nature and structure of teams in modern organizations, with more people collaborating across nationalities, cultures, and languages, as well as across space and time (Wageman, Gardner, & Mortenson, 2012). We have seen a rise of virtual, global, dispersed, or distributed teams, where technologically mediated collaborations are common. As noted above, we have also seen a rise in project teams as project work has grown beyond traditional boundaries (Bredin & Söderlund, 2011). Many project teams operate in a larger system composed of multiple teams working on the same project (Mathieu et al., 2015). Contemporary teams also tend to be less bounded and stable, with team members working simultaneously in more than one team (O'Leary, Mortensen, & Wolley, 2011).

While team membership is more dynamic in modern organizations overall, we can still differentiate teams according to their duration. Permanent or ongoing teams are long term and

often have repeated tasks to accomplish their many and recurring goals that are established at inception or that evolve over time (Saunders & Ahuja, 2006). Temporary teams, on the other hand, only exist to accomplish a time-bound goal. These teams are typically dissolved after the goal has been accomplished. Project teams are by definition temporary, as they set out to accomplish time-limited project goals. While project teams share some characteristics with permanent teams, they also differ from other teams. In his recent review, Chiocchio (2015) pointed out several problems with the traditional definitions of project teams and claimed that many suffer from the "flying fish problem," which arises when "a particular feature of a team is brought to the foreground and overemphasized, while leaving out other potentially important features" (Chiocchio, 2015, p. 43). To mitigate the flying fish problem and other critical elements of earlier definitions, Chiocchio (2015) proposed a general definition of project teams that is hierarchically integrated with a general definition of a team and different kinds of project teams. As a generic definition of project team, he proposed the following:

"A project team unites people with varied knowledge, expertise, and experience who, within the life span of the project but over long work cycles, must acquire and pool large amounts of information in order to define or clarify their purpose, adapt or create the means to progressively elaborate an incrementally or radically new concept, service, product, activity, or more generally, to generate change." (Chiocchio, 2015, p. 54)

According to Chiocchio (2015), this definition is meant to fit under the general definition of a team to avoid repeating similarities between the two. For example, interdependency and striving toward a common work-related goal are part of a generic definition of teams and thus not repeated in the definition of project teams. To address the flying fish problem, this definition highlights that team members have "varied knowledge, expertise, and experience," instead of restricting it to cross-functionality, which is commonly used in project team

definitions (Chiocchio, 2015). Hence, project teams can be cross-functional, but they are not necessarily so; expertise and experience can be achieved within a function as well. The important element to note is that project teams "must acquire and pool vast amounts of information" across the boundaries (Chiocchio, 2015, p. 56). Chiocchio (2015) further recognized that there is more than one kind of project team and suggested three typical configurations of project teams: core project teams, component project teams, and integrated project teams. A *core project team* is responsible for overall integration of the project and for the planning, control, and closing of the project (Chiocchio, 2015). This team manages the project and exists for the full duration of it. A *component project team* is composed of people who contribute to the project, but only for the specialized tasks within the project that the core team cannot do (Chiocchio, 2015). There can be one or more component project teams at once or throughout the project. The *integrated project team* is the "do-it-all" team (Chiocchio, 2015). It manages the project and executes the work required by it, and thus excludes the existence of the other two.

Decentralized project team working is often the norm in large-scale projects (Bresnen & Marshall, 2000), and project workers spend most of their time working on projects. Project team members have a long-term affiliation to a line department in the basis organization, but in large projects they are often co-located with their project team and assigned to the project on a full-time basis during the course of their project assignment (Bredin & Söderlund, 2011). Project teams are by nature embedded within a system that exerts influence from levels above (e.g., the organization) and levels below (e.g., project members) (Mathieu et al., 2015).

This outline of the characteristics of projects and project teams, as well as the review of trust in teams provided in the previous section, both serve as a backdrop for our understanding of contextual conditions for trust development and outcomes of trust in the context of project

teams. Next, we discuss trust development in project teams focusing on temporality, relationship duration, and familiarity—factors that are highly relevant for working relations in temporary project teams.

Trust development in project teams

Trust researchers have long recognized the dynamics of trust, and have attempted to explain the processes of formation, growth, and decline of trust over time (Costa, Bijlsma-Frankema & De Jong, 2009; Kramer, 1999; Lewicki et al., 2006; Nooteboom, 2002). Early work described trust as a phenomenon that develops gradually over time (e.g., Zand, 1972), and stage models of trust building suggested that trust can change and take on a different character as the relationship evolves (e.g., Lewicki & Bunker, 1996). The assumption in these stage models is that trust levels starts low and gradually increase as relationships develop (Costa et al., 2009). It has been debated, however, as to whether initial trust in interpersonal relationships necessarily is low, or if it can be moderate or even high. According to McKnight, Cummings, and Chervany (1998), high initial trust can be explained by "hidden factors," such as the general propensity to trust others, role-based behavior (or swift trust, which will be discussed in more detail later), and institution-based structures. In project teams, relationship duration and the degree of familiarity among team members from past work experiences can also be a determinant of the levels of trust at the start of the project (Costa et al., 2009).

Temporality and its effect on trust development

According to Poppo, Zhou, and Ruy (2008), trust is founded on positive experiences from past interactions and favorable expectations of future interactions. Prior relations and interactions have been depicted by Poppo et al. (2008) as a "shadow of the past," which

promotes trust as developed over time via a history of mutual interactions and experiences. The other perspective advances that the expectation of continued interaction, depicted as a "shadow of the future," is necessary to promote cooperation and trust (Poppo et al., 2008). In a project setting, the extent of the shadows of the future and the past may vary from team to team. Team members often go from one project to another and may be involved in multiple projects at the same time. Some team members may have a shared history together, while others are complete strangers who have never worked together before. Some teams may even change members during the course of the project. There may also be different prospects of working together in the future. For team members that have a shared history, it is likely that the experiences from earlier collaborations, both positive and negative, can carry over onto the current project (De Wit, 2015).

Previous studies have found that the shadow of the past, or prior ties and knowledge of each other, have a positive effect on trust (Costa et al., 2009; Laan et al., 2012; Maurer, 2010; Webber, 2008). Costa and colleges (2009) found that teams with high prior social capital systematically reported higher levels of trust and performed better compared to teams lacking prior relationships. Maurer (2010) found that team members in interorganizational projects who knew each other from prior collaborations had greater opportunities to interact and develop expectations of each other's behaviors, thereby facilitating mutual trust. Further, Webber (2008) showed that early trust in project teams is developed through prior familiarity, and that this trusting foundation is an important contributor to future trust. In a quantitative study of project partnering in the construction industry, Laan et al. (2012) found that both prior experiences and prospects of future exchanges influenced trust between partners. This is in line with Poppo et al. (2008), who studied the interplay between the shadow of the past and shadow of the future in an interorganizational exchange context. Poppo et al. (2008) suggested that the past and the future are intertwined as origins of trust and proposed that

when expectations of continuity and prior history work collectively, their joint effect on trust is stronger compared to merely a shadow of the past.

However, a shared history of interactions with other team members may not always lead to higher levels of trust and yield positive outcomes. Negative experiences, such as relationship conflicts between team members, may also carry over to other projects (De Witt, 2015), and relationship conflicts are negatively associated with trust (Simons & Peterson, 2000).

Trust in familiar and unfamiliar others

As we have seen, the extent of familiarity or unfamiliarity between team members is highly relevant to the understanding of trust in a team setting. In general, team familiarity can have a great impact on team interactions, and ultimately on team performance outcomes (Espinosa, Slaughter, Kraut & Herbsleb, 2007; Faraj & Sproull, 2000; Rockett & Okhuysen, 2002; Tannenbaum et al., 2012). For example, familiarity has been found to smooth coordination and encourage positive, team-building behaviors (Gruenfeld, Mannix Williams, & Neale, 1996; Rockett & Okhuysen, 2002). In a group setting, team members acquire and use information about other team members to guide their interactions. The familiarity between team members, as the degree of interpersonal knowledge that team members have regarding one another (Okhuysen, 2001), can influence the pattern of participation, as well as the dynamics of the group, both among team members who know each other and even among those who are not familiar with one another (Rockett & Okhuysen, 2002). According to Gefen (2000), familiarity and trust differ, as familiarity deals with an understanding of the team members' current behaviors, while trust deals with beliefs about the future actions of other people. However, Luhmann (1979) emphasized that familiarity is highly related to trust as familiarity can both create trust, when the prior experience is favorable, or ruin trust, when the prior experience is unfavorable.

A team member's intention to trust is based on positive expectations of the actions of his or her fellow team members (Colquitt et al., 2007). These positive expectations are typically based on prior interactions that shed light on the trustworthiness of others. If a team member knows and likes another teammate, he or she will be more likely to trust him or her, ask for help, or provide help. However, members of project teams may also lack a shared history and thus be unable to infer trustworthiness from prior interactions. In such unfamiliar contexts, the dispositional aspects of trust (e.g., trust propensity) are likely to be the most relevant antecedents of trust (Bigley & Pearce, 1998; Rotter, 1980). Others have argued for a unique form of trust occurring in temporary teams, namely swift trust (Meyerson, Weick, & Kramer, 1996), which will be discussed next.

Swift trust

As we have seen, the underlying assumption of the trust model proposed by Mayer and colleagues (1995) is that involved parties have sufficient time to determine this deep-level information about the party to be trusted. However, the process of trust development in temporary groups may differ from conventional forms of trust development (Meyerson et al., 1996). In temporary teams, team members sometimes do not have enough time to accurately perceive and judge such deep-level characteristics about other team members when the team is first formed. Initial levels of trust in the team may thus be based on more surface-level characteristics that can be quickly perceived (Wildman et al., 2012). Meyerson et al. (1996) introduced the concept of swift trust to characterize the unique form of trust found in temporary systems. In swift trust, individuals rely on defined roles rather than personalized sources to inform their decision to trust, and the trust is a specific form that occurs between individuals brought together to accomplish specific tasks, often under time constraints. It enables members to take action and deal with the uncertainty, ambiguity, and vulnerability

that arise while working on complex interdependent tasks with strangers (Saunders & Ahuja, 2006) Because there is often insufficient time for expectations of trustworthiness to be built from scratch in this setting, team members are more inclined to import expectations from previous experiences, as well as stereotyping and categorization, than to develop trust via personal interactions (Meyerson et al., 1996). This almost instant formation of trust is based on presumptive knowledge about the competence of other team members and their compliance to their professional roles. Hence, a certain level of trust may already exist at the start of a relationship (McKnight, Cummings, & Chervany, 1998) based on an assumption that they are able to perform their tasks. Importing expectations and relying on defined roles may be useful for dealing with uncertainty and risk and enables team members to engage in interdependent collaboration at the very outset of the project. However, swift trust is very fragile and often short lived (Jarvenpaa & Leidner, 1999; McKnight et al., 1998), and development of trust based on interaction and experience is still necessary in the long run. Moreover, enduring personal networks exist in projects (Engwall, 2003) with team members that have a shared history of working together (Poppo et al., 2008). Trust development may hence be a continuation of prior ties between team members (Bechky, 2006).

On the basis of this outline of factors relevant for trust development in the context of project teams, and the recognition that the level of trust may be influenced by relationship duration and the degree of familiarity among team members from past work experiences, we have identified a need to know more about *how* prior ties can be a determinant of the levels of trust in project teams. Which team processes and factors are affected by continuing relationships, and how does this influence trust development? This is the basis for paper I, and findings from this research will be presented in the results section and discussed in a later section of the thesis.

In the following section, a brief outline of research on the effects of trust on project team outcomes is presented. While paper II and paper III give a more in-depth review of literature concerning the relationship between trust in project teams and performance and knowledge sharing, respectively, the following section will present some overarching issues of these complex relationships and identify gaps addressed in the papers.

The effects of trust on project team outcomes

Searle et al. (2011) contended that despite the breadth and richness of research on trust, there is a lack of coherence in the pattern of findings, particularly when it comes to the outcomes of trust. They argued that this lack is partly due to limited attention being paid to the strength of context as an influence on the salience of trust, as well as a lack of coherent trust scales.

Correspondingly, De Jong, Dirks and Gillespie (2016), in their recent meta-analysis on intrateam trust and performance, also pointed to a fragmentation regarding the effects of trust. They argued that this lack of coherence is due to two reasons: (1) many studies have used trust as one among many predictors of team performance, and not as a core variable of interest, and (2) studies have yielded mixed and contradictory results in research where trust is the focal predictor of team performance (De Jong & Dirks, 2012; De Jong et al., 2016; Dirks & Ferrin, 2001).

Despite the mixed findings, the prevailing notion is that trust has a positive effect on team performance (Braun et al., 2013; De Jong et al., 2016). Team performance is expected to be positively affected by within-team trust because trust allows team members to interact with each other as though any uncertainty and vulnerability were favorably resolved (De Jong & Elfring, 2010). Trust thus enables team members to work together more effectively and efficiently, and to allocate their energy and exchange resources in ways that contribute to

team performance (Dirks, 1999). By contrast, a lack of trust may lead team members to lose sight of project goals and the interests of the team and focus on their personal interests instead (De Jong et al., 2016; Joshi, Lazarova, & Liao, 2009), thus reducing team performance. While the positive effect of trust on team performance is widely recognized, the nature of this relationship is still undetermined in a project team setting. Commitment has commonly been associated with successful project outcomes (Chan, Ho, & Tam, 2001; Leung, Chong, Ng, & Cheung, 2004) and may be a highly relevant factor conveying the effects of trust in this setting. Accordingly, paper II further examines the nature of the relationship between trust and performance.

Knowledge sharing is also an imperative outcome of project teams and is especially important for construction teams because it acts as the basis for integrating multidisciplinary expertise (Javernick-Will, 2011) and is vital for the coordination of dependencies (Wen & Qiang, 2016). Without adequate knowledge sharing, knowledge leakage may lead to repeated mistakes, duplicated work, lack of innovation, and ultimately organization inefficiency (Wen & Qiang, 2016).

The relationship between trust and knowledge sharing has drawn researchers' attention in recent years (Koskinen, Pihlanto, & Vanharanta, 2003; Ding, Ng & Li, 2014). However, this research has produced mixed results on the nature of the relationship between trust and knowledge sharing (Bakker et al., 2006; Ozlati, 2015), leading to the question of whether this relationship is direct or mediated. However, research on potential mediators between trust and knowledge sharing has been rather scarce (Ding et al., 2014); for this reason, paper III sets out to further explore this relationship. Additionally, acknowledging the existence of multiple foci of commitment inherent in project teams, Tremblay, Lee, Chiocchio, and Meyer (2015) called for research that investigates which focus of commitment is favored in the project team

context, and particularly the relative importance of commitment to project goals (project commitment) in comparison to commitment to the team as a social entity (team commitment). This is also further examined in paper III, where the mediating effect of the two different foci of commitment is tested.

Methods

This research is what Flyvbjerg (2006) called "problem driven," as opposed to "methodology driven," meaning that methods are selected based on which are best positioned to answer the research questions at hand. As a result, a combination of qualitative and quantitative methods is used to answer the overall research question. This combination of approaches has been variously called multimethod (Brannen, 1992), multi-strategy (Bryman, 2004), and mixed method (Creswell, 2003). Mixed-methods research can be defined as "the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or languages into a single study" (Johnson & Onwuegbuzie, 2004, p. 17). While the justification and reasons for employing mixed methods may vary, the main argument for using both qualitative and quantitative methods for this study is expansion, since we are seeking to extend the breath and range of enquiry by using different methods for different research questions (Bryman, 2006).

The utilization of triangulation with the combined qualitative and quantitative methods used in this research can be viewed as a pragmatic approach in order to synthesize the findings from the research data. By using mixed methods, the strengths of both quantitative and qualitative methods can be harvested. One of the main strengths of the qualitative approach is that it allows us to explore the meanings people give to their experiences and behavior. This yields more insightful information and quality data on how people think about their work situation and their lived-world experiences. The research questions in the three papers constituting this thesis imply that different methodological approaches are suitable to best answer these questions. The research question in paper I is explorative and is a *"how"* question, and thus qualitative interviews in a single case study were considered the most suitable approach, while the research questions in papers II and III were concerned with

"what" questions, and a quantitative survey method was thus utilized to answer the research questions therein.

The method chapter of the thesis is structured as follows. First, the research context of the construction industry will be presented. Next, the methodological approach of the research will be discussed with a distinction between the case study approach utilized in paper I and the quantitative survey conducted for papers II and III. Details about the sample, procedure, data collection, measures, and data analysis will be given for the two approaches separately.

Research context—the construction industry

The construction industry encompasses the construction of houses, other buildings, and infrastructure, and is a major industry in Norway in terms of employment and adding value. The industry employs over 244,000 persons and consisted of over 57,000 enterprises in Norway in 2017 (Statistics Norway, 2017). While the industry as a whole includes a vast range of activities (from large-scale engineering projects to smaller-scale repetitive building work) and thus varying organizational forms, project-based organizational forms are exceedingly common (Bresnen et al., 2004).

Construction projects are often complex in terms of design and engineering, which requires a range of expertise from multiple parties, both internally and externally. Project teams within the industry are thus often heterogeneous, consisting of members from different professional and functional backgrounds (Bresnen et al., 2004), and often different organizations. The multiorganizational nature of project teams in the construction industry is mainly due to the magnitude and complexity of construction projects and the need for a range of expertise and professionals to complete each project. When a construction project commences, available subcontractors with the required skills are assigned. Construction commonly entails a

complex interaction between different disciplinary approaches, such as architectural design, mechanical engineering, finance, and legal aspects, all of which need to be effectively coordinated and managed (Walker & Christenson, 2005). This complexity, in terms of both specialized knowledge and magnitude, creates high interdependency within the construction project team. The architect is typically responsible for the building's aesthetics and functions, the engineer for its structure, and the project manager for ensuring that it is built on time and within budget. Team members do not necessarily have the skills to perform the work of their fellow teammates and have to rely on the functional expertise of their colleagues. This mutual interdependency requires them to collaborate in order to carry out their respective tasks.

The nature of the work in construction also introduces high levels of uncertainty and unpredictability. For example, changes are frequently made during the construction phase as drawings and specifications may have errors or omissions that need to be corrected (Kadefors, 2004). Likewise, market demands and user needs may change, and thus modify preferences. Further, weather and soil conditions may also alter priorities and lead to changes in the methods used and resources needed (Kadefors, 2004). In such a setting there are also often high levels of risk involved. The potential for damaged reputation and failed investments is high.

The industry has been criticized for its variable performance and project delivery (Baiden et al., 2006; Fulford & Standing, 2014). While many projects perform well in terms of time and cost, there are also frequent examples of time and cost overruns due to the need for extensive rectification. This has partially been attributed to the inability of project participants to work together effectively, and their failure to form effective teams (Baiden et al., 2006). Team members are seldom trained for the specific project, and their individual contributions often come together as a whole-team effort in an *ad hoc* manner as the project processes (Cornick

& Mather, 1999). Project teams in construction are often composed according to the technical skills and the expertise team members hold and are not based on the members' ability to work together. Moreover, team members may have some experience of working with members of their team or be completely strangers with no prior knowledge of each other or experience of working together. Further, construction projects often have large turnover of personnel, with some leaving and some joining the project during different phases. Team members can also hold multiple team memberships, as they may be members of more than one project team at a time. The fragmented and temporary nature of construction teams may lead to an environment in which team members do not have a vested interest in the overall success of the project as a whole (Dainty, Moore, & Murray, 2007).

In addition, the extensive subcontracting and multiple organizations involved can contribute to fragmentation and conflicts in the industry (Fong & Lung, 2007). Moreover, the construction industry has historically used procurement methods and contractual arrangements that have encouraged adversarial relationships and mistrust, especially between clients and contractors (Baiden et al., 2006; Bresnen & Marshall, 2000). More cooperative relationships, such as partnering; a commitment by organizations to cooperate to achieve common business objectives (Bennett & Jayes, 1995, in Bresnen & Marshall, 2000); and "joint ventures" are now increasingly advocated (Bresnen & Marshall, 2000; Laan, Noorderhaven, Voordijk, & Dewulf, 2011).

Methodological approach—paper I

Case study

To answer the research question in paper I ("*How do prior ties between team members influence the development of trust in a project team setting?"*), a single case study approach was applied. A case study approach aims to study the case in its natural setting and strives for in-depth understanding of the phenomenon under investigation (Yin, 2003). Case studies may be descriptive, explanatory, or exploratory for a single case, or multiple cases. One of the defining features of a single case study is its focus on a single "case"—i.e., an entity with a boundary. For this research, one team responsible for leading a project in a Norwegian construction company was chosen the case, or unit of analysis. According to Yin (2003), a case study design should be considered when (1) the focus of the study is to answer "how" and "why" questions; (2) the behavior of those involved in the study cannot be manipulated; (3) the aim is to cover contextual conditions based on a belief that they are relevant to the phenomenon under study; or (4) the boundaries are not clear between the phenomenon and the context. A single case study is especially valuable when the aim is to provide rich description and to get as close as possible to the phenomenon described (Walsham, 1995). While the use of multiple cases allows for cross-case comparison and may thus give more robustness to the results of the study, multiple cases may also provide "thin" descriptions, rather than revealing the deeper social dynamics that can be achieved by single case studies.

Case selection and procedure

The case project team in this study is situated within a large construction company in Norway. As noted, the construction industry is a prime example of a PBO, as mainstream activities are mostly project oriented (Bresnen et al., 2004), and its specific features underline the

importance of trust (Karlsen et al., 2008). This makes the construction industry especially suitable for studying trust in project teams. Entry to the construction company and access to the case project team was gained through a prior professional contact in the company. The specific case project was suggested by the company contact who had record of and information about all the ongoing construction projects and knew that the composition of the project team was in accordance with the research issue. As Flyvbjerg (2006) noted, a representative or random sample may not be the most appropriate strategy when the objective is to achieve the greatest possible amount of information on a given problem or phenomenon. The case in this research, the project team, was selected on the basis of expectations about its information content and can thus be described as an "information-oriented" selection strategy (Flyvbjerg, 2006, p. 230). Eisenhardt (1989) recommended selecting cases in which the phenomenon of interest is "transparently observable" (p. 537). Availability was also an important practical selection criterion, since the case was selected from the construction company's current portfolio of projects.

The company contact worked as a gatekeeper internally and conveyed the request to the project manager of the case project. The project manager agreed to participate in the study and initial contact was then established. Several telephone meetings and e-mails were used to exchange information about the research project and the case project team. Dates for site visits and interviews with the project team members were set. Key project team members were selected for interviews, with the aim of obtaining a rich and comprehensive understanding of the influence of relationship duration and prior ties on trust development in the case project. An overview of the data collection process is given in the next section, as well as in paper I.

Case description

The case project involved the construction of a new school building for secondary education in a semi-urban area in Norway. Constructing buildings is primarily a labor-intensive process that involves a series of sequenced activities to produce a "one-off" product that is in line with requirements of the client or the builder (Cooke, 2013). This work induces a complex interaction between different disciplinary approaches, such as architectural design, mechanical engineering, finance, and legal aspects, all of which need to be effectively coordinated and managed (Walker & Christenson, 2005). The project was "turnkey," meaning that the construction company takes responsibility for the whole process from design to building. The client/builder puts forward its functional requirements, while the contractor can choose the solutions and suppliers to meet these requirements. The contractor coordinates the work and hires different subcontractors for the specific part of the construction. The building phase lasted for about two years and the total project value was approximately 45 million euros. The project team had been cooperating for about four months prior to the first phase of interviews and was at the starting point of the building phase when the interviews took place. When the follow-up interviews were conducted, the project was in the completion phase. The work was at this point concentrated on the technical installation and the fixtures. The project team consisted of nine members with core functions: project manager, assistant project manager, engineering manager, construction manager, two operations managers, two procurement engineers, and one project controller. This team was what Chiocchio (2015) referred to as a core project team; that is, a team responsible for the management of the project, the overall integration of the project, and the planning, control, and closing of the project. In this project key team members, such as the project manager, construction manager, project controller, and one operations manager, had worked together on a prior project and knew each other well. They described the earlier project as tough and challenging, with many

complications, and they believed that this experience had strengthened their mutual relationship. The current project was complex, with high interdependency and complex tasks, strong time pressure, and multiple stakeholders. The project team had to coordinate and ensure productive collaboration, both internally with its engineering department and externally with the builder/client and the subcontractors. Even though the projects have company-specific systems and procedures, they are decentralized, with great autonomy regarding how work is conducted, and roles and functions defined. Thus, team members did not simply execute predefined roles, but rather negotiated the content of the roles and the functions.

Data collection

While case study research typically uses multiple data sources, including both qualitative and quantitative methods, this study was mainly based on semi-structured, qualitative interviews. Interviews are often the primary data source in interpretative case study research where the goal is to arrive at an understanding of a particular phenomenon from the perspective of those experiencing it (Kvale & Brinkman, 2009). In semi-structured interviews, a set of predefined questions is asked, as well as optional probing questions for the stimulation of rich descriptions (Neuman, 2003). An interview guide was used to help cover all relevant areas and to keep the interview within the aim of the study. This method thus yields uniform information, which assures comparability of data while maintaining an open-ended nature and permitting rich and unanticipated responses. The interviews were conducted face to face in a meeting room at the construction site. The face-to-face nature of the interviews allowed the respondents to feel more comfortable in answering questions relating to trust. Before the initiation of the interview, permission was sought from the interviewee for tape recording.

The interviews lasted from 35–75 minutes and were all recorded and transcribed verbatim to facilitate detailed and systematic analysis.

A longitudinal approach to data collection was adopted in which project team members were interviewed at two different phases of the project. Project team members were interviewed at the start-up phase (phase 1), at a point about four months into the project; follow-up interviews were then conducted with key members approximately one year after the first interviews (phase 2). A total of 12 interviews were completed, eight in phase 1 and four in phase 2 (see Table 1 in paper I for details). The selection of project members for follow-up interviews in phase 2 was mainly based on the centrality of their role.

Ethical considerations

Prior to the interviews, participants were provided with a covering letter describing the nature and context of the research project and its objectives, the data collection process, and the extent of involvement required from the participants. The covering letter also included information concerning data storage, confidentiality, anonymity, and voluntariness. Participants were assured that they had the opportunity to decide whether to participate, often referred to as informed consent (Miles & Huberman, 1994), and that they could withdraw from the study at any time without a specified reason. Participants were also given information about how the data would be handled and stored. They were informed that tape recordings would be retained for five years and then destroyed, and that access to data was restricted to the researcher and the researcher's supervisor. The covering letter was also handed to the participants at the beginning of the interviews, along with a request for tape recording the interviews to facilitate the collection of information and later transcription and analysis.

Data analysis

The process of data analysis that was undertaken in the study resembles the phases for thematic analysis identified by Braun and Clarke (2006, p. 87). Table 1 provides an outline and description of the analysis phases. The software QSR NVivo 9 was utilized to aid in organizing and examining the data.

Table 1 Phases of the thematic analysis approach.

Analysis phase	Description of the process
1. Familiarizing with data	Transcribing data, reading and rereading the data, noting down initial ideas
2. Generating initial codes	Coding interesting features of the data systematically across the entire data set, collating data relevant to each code
3. Searching for themes	Collating codes into potential themes, gathering all data relevant to each potential theme
4. Reviewing themes	Checking if the themes work in relation to the coded extracts and the entire data set, generating a thematic map
5. Defining and naming themes	Ongoing analysis for refining the specifics of each theme and the overall story that the analysis tells, generating clear definitions and names for each theme
6. Producing the report	The final opportunity for analysis. Selection of vivid, compelling extract examples, final analysis of selected extracts, relating back of the analysis to the research question and literature, producing a report of the analysis

According to Sandelowski and Barroso (2003), research findings can be placed on a continuum indicating the degree of transformation of data during the data analysis process from description to interpretation. Thematic analysis is a commonly used approach in data analysis of qualitative interviews that require a relatively low level of interpretation, in contrast to grounded theory or hermeneutical phenomenology, in which a higher level of interpretive complexity is required (Vaismoradi, Turunen, & Bondas, 2013). Thematic analysis as an independent qualitative descriptive approach has been described as "a method for identifying, analyzing and reporting patterns (themes) within data" (Braun & Clarke, 2006, p. 79). It involves the search for and identification of common treads that extend across an entire interview or set of interviews (DeSantis & Noel Ugarriza, 2000). Themes capture important points in relation to the overall research question (Braun & Clarke, 2006).

Evaluation of quality

Scientific rigor and trustworthiness are the aim for qualitative research, as well as for quantitative methods (Golafshani, 2003; Morse, Barrett, Mayan, Olson, & Spiers, 2002). While the terms reliability and validity are essential criterion for quality in quantitative paradigms, Lincoln and Guba (1985) have suggested that the terms credibility, confirmability, dependability, and transferability are the critical criteria for assessing the trustworthiness of qualitative research. Instead of reliability, one can strive for what Lincoln and Guba (1985, p. 288) denoted as "dependability" or "consistency;" they suggested that the real question for qualitative research is not whether the results of one study can be reproduced in another, but whether the results of a study are consistent with the data collected. In this study, the process of respondent validation or member checking was used to address the trustworthiness of the study results. Member checking involves the direct testing of data, findings, and interpretations with the informants (Lincoln & Guba, 1985). This was done during and after

the interviews, as the participants were asked for clarification and the initial interpretations were tested; as well as after the analyses was done, when the paper draft was sent to one of the key participants. While the process of member checking did not produce any substantial feedback or input to the findings, it can to some extent be regarded as consensus regarding the findings and interpretations.

A common concern arising from case studies, and especially single case studies, is that they provide little basis for generalization (Yin, 2003). Yin (2003) answer to this is:

"case studies (...) are generalizable to theoretical propositions and not to populations or universes. In this sense, the case study (...) does not represent a 'sample', and in doing a case study, your goal will be to generalize theories (analytical generalization) and not to enumerate frequencies (statistical generalization)." (p. 10)

The goal of the qualitative research in this study is thus not to generalize, but rather to provide a rich, contextualized understanding of the issue at hand through the study of a single case. According to Kvale and Brinkman (2009), the postmodern approach to the issue of generalizability replaces the positivist quest for universal knowledge, as well as the humanistic view of individual uniqueness, by emphasizing the heterogeneity and contextuality of knowledge. Adopting a contextual constructionist position implies that knowledge is local, temporary, and situation-dependent (Madill, Jordan, & Shirley, 2000), and that the meaning of a situation or phenomenon is constructed subjectively by participants (Berger & Luckmann, 1966). Inspired by generalization in legal and clinical practice, Kennedy (1979) suggested that the validity of a generalization of single case studies hinges of an analysis of the similarities and differences between the original and the present case, and on the extent to which the attributes compared are relevant. This presupposes that the researcher gives a "thick description"—i.e., one that is rich, dense, and detailed (Kvale & Brinkman, 2009, p. 263).

Kennedy (1979) further asserted that the range of generalization cannot be known by the researcher that produced the information; instead, it is the receiver of the information who determines whether the findings apply to their situation. Relatedly, Greenwood and Levin (2005) suggested reframing generalization as a process involving reflective action by users of research, and making researchers decide for themselves whether previous findings make sense in a new context. This is what Lincoln and Guba (1985) referred to as transferability, and what others have denoted as reader or user generalizability (Merriam, 1995).

Methodological approach—papers II and III

Papers II and III examine the nature of the relationship between trust, and project performance and knowledge sharing, respectively. A quantitative research design with a deductive approach was undertaken to investigate the research questions in these papers. The adopted research design is cross-sectional with the use of survey method.

Procedure and data collection

The study was conducted in four large construction companies in Norway. The companies were contacted by the author and asked to participate in the study. The contact persons in the companies were either from the human resources department, or managers. Projects that could be considered for the study were selected from the construction companies' current portfolio. The criterion was that the projects were large building ventures, thus excluding infrastructure projects. The argument for this limitation is that there are somewhat different contextual factors pertaining to the construction of buildings versus infrastructure. Since the qualitative case study considered a building project, the foci for the survey study were also restricted to projects of this kind. The project team was defined as the key members who worked on the

project within the construction company and did not include subcontractors who had worked on the project for a while.

All project team members' e-mail addresses were provided, and the questionnaires were distributed, and data collected electronically via the online survey platform Questback. Prior to dispatching the questionnaire, the respondents received an e-mail with an invitation to participate in the survey, including information about the study, data protection, data storage, confidentiality, and anonymity. The study was also reported to and approved by the Norwegian Social Science Data Services (no. 34118). The data collection took place between September 2013 and March 2014.

Sample

The sample consisted of responses from 184 project team members from 34 project teams, providing an overall response rate of 77%. Three project teams were excluded from the analysis because they consisted of two or fewer participants. The remaining teams (31) ranged from 3 to 10 members, with an average of 5.7 individuals per team. Of the 179 team members, 154 (86%) were male. Age was evenly distributed, with 95% of the sample aged 20–60: 19.6% were 20–29, 27.4% were 30–39, 20.7% were 40–49, 26.8% were 50–59, and 5.6% were 60 or over.

Measures

The survey questionnaire comprised of several validated measures from well-documented studies. As the 7-point Likert scale has been shown to maximize reliability (Nunnally, 1978) all measures were given on a 7-point scaling ranging from 1 = "completely disagree" to 7 = "completely agree." The survey measures consisted of multiple items measuring the same dimension to ensure good reliability (De Vaus, 2002). Some of the measures comprised

negatively worded items to help mitigate response bias. These items were reversed scored during the data analysis phase.

All measures were translated into Norwegian and back-translated to guarantee the accuracy of the translation (Brislin, 1970). This process is considered more rigorous compared to a simple process of direct translation from one language to another. In this study, the back-translation process started with an initial translation of all measures from English to Norwegian. Next, a bilingual colleague translated this material back into English. This translator was not familiar with, and did not have access to, the original source version before conducting the back-translation. The back-translated version and the source version were then compared to check for equivalence of meaning. Adjustments were made until no mistakes in meaning were found. In addition to the thorough translation process, the survey items were sent to the contact person in two of the participating companies, as well as to a professor in project management, to test the appropriateness of language and items in a project and construction industry context. Small language adjustments were made to some of the items based on feedback from the contact persons in the construction companies.

Team trust was measured using four trust scales developed by Costa and Anderson (2011). They included propensity to trust, trustworthiness, cooperative behaviors, and monitoring behaviors. *Propensity to trust* refers to a general willingness to trust others and is commonly viewed as a dispositional trait (Costa & Anderson, 2011). This was measured by six items; one example item is “In this team most people stand behind their convictions.” *Perceived trustworthiness* refers to the extent to which individuals expect others to be and behave according to their claims (Costa & Anderson, 2011) and was measured by six items; an example item is “In this team people can rely on each other.” *Cooperative behaviors* correspond to a number of positive actions that reflect a willingness to be vulnerable to others

(Costa & Anderson, 2011), and was measured by six items; an example is, “In this team we work in a climate of cooperation.” *Monitoring behaviors* refers to the extent to which team members feel it necessary to exert control over other members’ work through monitoring and checking behaviors (Costa & Anderson, 2011). It was measured using three items; an example is, “In this team people check whether others keep their promises.”

Project commitment was measured using a five-item scale adapted from Hoegl, Weinkauf and Gemuenden (2004). The measure addresses how positively team members relate to the overall project and its objective. An example item is, “Our team feels fully responsible for achieving the common project goals.”

Team commitment was measured using five items from Allen and Meyer’s (1990) affective commitment scale adapted to the team level, as done by Van der Vegt and Bunderson (2005). Affective commitment concerns “identification with, involvement in, and emotional attachment to…” (Allen & Meyer, 1996, p. 253). An example item is, “I feel a strong sense of belonging to the project team.”

Knowledge sharing used items derived from two existing measures. The first four items measure *knowledge sharing behavior* and were adopted from Zhang and Ng (2012) and adjusted to the team level. These items measured the team’s knowledge sharing behavior with reference to Ma, Qi, and Wang’s (2008) description of knowledge involved in construction project teams. An example item from this index is, “In this team we share project knowledge with each other.” The second measure of knowledge sharing focuses on more tacit types of knowledge, such as ideas and expertise, and is named *knowledge sharing climate*. It captures the team’s perception of the shared norms and practices of knowledge sharing within the team. The measure consists of five items and was derived from Connelly and Kelloway’s (2003) scale. An example item is, “People in this team share their ideas openly.”

Project team performance was assessed using a four-item scale adapted from Hoegl et al. (2004). An example item is, "The team is satisfied with its performance to this point."

The internal consistency reliability for the different measures was determined using the Cronbach's alpha coefficient (Cronbach, 1951). Generally, a minimum Cronbach's alpha value of .70 is regarded adequate, and an alpha value of .80 or more is considered good (Nunnally, 1978). The assessment results showed that all measures had good reliability and validity for this research. The Cronbach's alpha values are found in Table 1 in paper II (p. 122) and on page 10 in paper III.

Level of analysis and aggregation

All hypotheses in the present study pertain to the team level and require aggregation of data to the team level. Thus, within-unit agreement was assessed for all measures prior to aggregation by the within-group agreement index (James et al., 1984). When multiple team members rate a single target on a single variable using an interval scale of measurement, within-group agreement may be assessed using the r_{wg} index, which defines agreement in terms of the proportional reduction in error variance. This index can be further extended to the multi-item $r_{wg(j)}$ index (LeBreton & Senter, 2008). A common rule of thumb is that values should be equal to or greater than .70 to justify aggregation (Lance, Butts, & Michels, 2006; LeBreton, Burgess, Kaiser, Atchley, & James, 2003). With the exception of monitoring, all study measures had acceptable mean values. The $r_{wg(j)}$ values, means, and standard deviations for the variables are found in Table 2 (p. 122) in paper II and on page 11 in paper III.

All the variables, with the exception of team commitment, assumed a referent-shift consensus model (Chan, 1998). As explained earlier, in a referent-shift the item referent is directed toward the team as a whole. The definitions of these constructs are collective in nature even

though they are being assessed at the individual level. Rather than asking team members about their own individual perceptions, referent shift incorporates the group as a whole. In contrast, the team commitment variable assumed a direct consensus model (Chan, 1998) with the item referent directed toward the individual. This is because this construct resides in the individual's owns perceptions and feelings and the individual team member forms their own perception of how committed they are to the team. Both forms of models assume that group members share a common perception and that interrater agreement is necessary to justify aggregation to the team level.

Data analysis

The descriptive statistics were computed with IBM SPSS 21.0 for paper II and 23.0.for paper III. For paper II the hypotheses were tested in two steps; a simple mediation model was used first, followed by a moderated mediation model. A simple moderation model was used for testing the hypotheses in paper III. Mediation refers to a sequence of causal relations by which X exerts its effects on Y by influencing intervening variables, while moderation describes a situation in which X's effect on Y varies as a function of some third variable, the moderator variable (Hayes, 2009, p. 415). Moderated mediation models refer to models in which the effects of the independent variable X on the outcome variable Y via the mediator variable differ depending on levels of a moderation variable. Both the simple mediation hypotheses in papers II and III and the moderated mediation hypothesis were tested with the process macros developed by Hayes (2012) through IBM SPSS 21.0 and 23.0, respectively. The macros are based on standard Ordinary Leas Square (OLS) regression, and prior to analysis all variables were mean centered to prevent multicollinearity (Cohen, Cohen, West, & Aiken, 2003; Hayes & Matthes, 2009). As demonstrated by Preacher and Hayes (2004), this macro produces a test that is more rigorous than that of Baron and Kenny (1986), and at

the same time avoids the bias of the Sobel (1982) approach. Preacher and Hayes (2004) achieved this by employing a bootstrapping procedure. Bootstrapping works by basing inferential procedures on a concrete sampling distribution from the sample at hand, rather than the traditional sampling distribution created by a hypothetical infinite number of samples from the population of interest (Efron, 1982). The concrete sampling distribution thus reflects the distribution of the sample, rendering the assumption of normality superfluous, and allows for the testing of mediators on small samples ($N > 25$) (Preacher & Hayes, 2008). A bootstrap sample of 10,000 was drawn (with replacement) and used for analysis of the mediation model, as well as the moderated mediation model.

Results

In this section, summaries of the results from the three independent papers are presented.

Paper I

Buvik, M. P., & Rolfsen, M. (2015). Prior ties and trust development in project teams: A case study from the construction industry. *International Journal of Project Management, 33*, 1484–1494.

The aim of this study was to explore the temporal aspect of trust development in a project team setting by addressing the question of how prior ties and relationships between team members may influence the development of trust. Which team processes and factors are affected by continuing relationships, and how does this influence trust development? The inherent need for collaboration and cross-functional integration, and the high interdependency facing project teams makes trust pivotal for team functioning and for project success, but the context and environment facing these teams may also pose challenges for trust development. We contend that the level of trust in the project team may be influenced by relationship duration and the degree of familiarity among team members from past work experiences.

Our findings show that positive prior ties can have a substantial effect on the development of trust at the beginning of the project. More specifically, our findings suggest that positive prior ties between team members seem to stimulate early trust formation and integration within the team through their effect on central team processes. We identified these team processes as the early establishment of integrative work practices, development of a common philosophy, open communication, clear role expectations, and a shared climate of trust within the team. The prior ties made it easier to be vulnerable and to communicate freely, and thus to establish common norms and good team practices. In addition, prior ties were positively associated

with explicit role expectations, which improved the working practice and increased the level of trust. Hence, this study underlines the effect of positive prior ties in creating favorable conditions for early integration of the team, the development of trust, and obtaining a good start to the project. Project staffing that pays attention to prior relationships can create some stability and a long-term basis for team member interaction, and thereby create good conditions for early trust development.

Taken together, our findings indicate that positive prior ties stimulate a high level of trust and thus create conditions for a favorable start to the project.

Paper II

Buvik, M. P., & Tvedt, S. D. (2016). The impact of commitment and climate strength on the relationship between trust and performance in cross-functional project teams: A moderated mediation analysis. *Team Performance Management*, *22*, 114–138.

The purpose of this study was to shed more light on the complex relationship between trust and performance in the context of cross-functional project teams. Previous research has yielded inconsistent and contradictory results regarding the relationship between trust and performance, and we suggest that this may be due to (1) the context-specific nature of performance, (2) the limited focus on how trust affects performance through potential mediating variables, and (3) the fact that studies have mainly relied on the mean-level approach of studying trust at the team level. We conducted a moderated mediation model that investigated the impact of team trust on team performance, mediated by project commitment and moderated by climate strength (the consensus among team members on the level of trust). Results indicated that project commitment fully mediates the relationship between propensity, and trustworthiness and team performance, while it partially mediates the relationship

between cooperation and team performance. For monitoring, the results showed no mediation. The results yielded no support for the moderation effects of climate strength, suggesting that the mean-level approach to studying trust at the team level is still important. Overall, our results suggest that trust has an impact on project commitment, and both directly and indirectly on team performance. While trust is important, the mediating effect of project commitment suggests that we also need to go beyond trust building and seek to develop a strong commitment to the project as well.

Paper III

Buvik, M. P., & Tvedt, S. D. (2017). The influence of project commitment and team commitment on the relationship between trust and knowledge sharing in project teams. *Project Management Journal, 48*, 5–21.

The purpose of the study was to enhance our understanding of the relationship between trust, commitment, and knowledge sharing in a project team context. We examined how trust directly and indirectly (through commitment) affects knowledge sharing. This study addresses the mixed findings on the relationship between trust and knowledge sharing by identifying and investigating the potential mechanisms through which trust may influence knowledge sharing in the specific context of project teams. Two foci of commitment are included: team commitment and project commitment. Results confirm that project commitment fully mediates the relationship between propensity to trust and knowledge sharing, while trustworthiness is partially mediated by project commitment. Contrary to our expectations, mediation of team commitment on the same relationships was not confirmed. While our results suggest that one of the trust dimensions affects knowledge sharing directly, the indirect relationship through project commitment is stronger. Our results also show different effects of the two foci of commitment, indicating that, in a project team context, project commitment is

more important for knowledge sharing compared to team commitment. In sum, our findings suggest that the impact of trust on knowledge sharing is more complex than previous literature has indicated and can explain why some equivocal results exist.

General discussion

In this section, the main findings and inferences of the thesis are summarized, integrated, and discussed. In addition, theoretical contributions and practical implications are presented. The main methodical issues and limitations are then discussed, and finally suggestions for future research and a conclusion are outlined.

The overriding objective of this thesis is to investigate the significance of trust in a project team environment to enhance our understanding of the development and impact of trust in this context. More specifically, the thesis sets out to answer the following two research questions:

1. *How does the temporal nature of projects affect trust development in project teams?*
2. *What is the nature of the relationship between team trust and central project team outcomes?*

The three papers constituting this thesis try to give some answers to these questions by focusing on both the antecedents and consequences of trust in the context of project teams in the construction industry. A brief summary of the main results of the three studies follows, before the findings are discussed more broadly:

Paper I) Positive prior ties between project team members stimulate early trust formation through their effect on central team processes such as early establishment of integrative work practices, development of common philosophy, open communication, and clear role expectations, all of which lead to a shared climate of trust early on in the project life.

Paper II) Project commitment fully mediates the relationship between propensity, and trustworthiness and team performance, while it partially mediates the relationship between cooperation and team performance. For monitoring, the

results showed no mediation. The results yield no support for the moderation effects of climate strength.

Paper III) The relationship between trust and knowledge sharing is mainly indirect and mediated by project commitment. The results show no mediation effect of team commitment.

In the next section, the first research question will be elaborated on in light of the findings and the literature background presented earlier.

How does the temporal nature of projects affect trust development in project teams?

Projects are by definition temporary, and are often characterized by urgency, uncertainty, and high flow of personnel. These characteristics may hinder team members from gaining mutual experience and developing predictability regarding each other's actions. In other words, the temporal character of projects can complicate the development of trust, since trust in the traditional view needs time to develop and is built incrementally through prior experiences (Lewicki & Bunker, 1996; Zand, 1972). Team members' decision to trust their fellow team members is based on positive expectations of the actions of their colleagues (Colquitt et al., 2007), and these positive expectations are typically grounded on prior interactions. In a project team setting, the degree of previous knowledge and familiarity between team members may vary from team to team. Some teams may consist of team members who have a shared history together, while other teams consist of complete strangers who lack prior knowledge of each other. Because there might be insufficient time for expectations to be built from scratch, the prior experiences team members have of each other may form a basis for trust (McAllister, 1995). Following this, the findings in paper I indicate that relationship duration

and the degree of familiarity between team members can be determinant of the level of trust within the team at the start of the project, showing that trust development in a project setting may be a continuation of prior ties, as depicted by Bechky (2006). This is in line with other studies, which have shown that prior ties and shared work experience can have positive effects on trust (Costa et al., 2009; Laan et al., 2012; Maurer, 2010; Webber, 2008). The findings from paper I extend these previous studies, however, by giving in-depth knowledge about how the prior ties between team members affect trust development in the project team by impacting and facilitating several important antecedents of trust, such as frequent interaction, open communication, team cohesion and identity, and clear role expectations. Trust is a decision-making process, and is thus highly dependent on the information people have available on other team members. Because several team members in the case project team had worked together on previous occasions, their mutual experiences led to a better understanding and knowledge of each other's motives, preferences, and routines. Ongoing interactions and experiences allow team members to learn and assess one another's behaviors (Gabarro, 1978). The previous interactions yielded considerable information about their teammates across different situations and made it easier to assess their abilities, integrity, and benevolence—i.e., their trustworthiness. Assessments of ability and competence are especially important for trust in working relationships. The familiarity of team members at the start of the project influenced the pattern of interaction and the dynamics of the group among both team members who knew each other and those who did not, thus creating a shared trust climate. A positive prior collaboration between project team members makes it easier to create good collaborative routines at the start of the project. This is critically important in a project context because limited time and complex interdependent tasks necessitate effective collaboration from the beginning. Continued relationships give team members the opportunity to develop trust and effective ways of working together, thus saving time and resources in the

process. However, prior experience and familiarity between team members may not necessarily breed trust; depending on the specific experiences and the nature of the past relationship, prior collaboration can yield either high or low levels of trust. The nature of past relationships can thus allow the impact of trust to accumulate and persist over time, resulting in positive team dynamics when trust is high and more dysfunctional dynamics when trust is low (Ferrin, Bligh, & Kohles, 2007). This is in line with Zand's (1972) spiral reinforcement model, which indicates that the initial level of trust can send project teams into spirals of increasing or decreasing trust. In other words, behaviors triggered by the initial levels of trust may reinforce or undermine trust as the project progresses.

Trust can also develop swiftly in temporary systems, independent of prior collaboration and familiarity (Meyerson et al., 1996). Swift trust is based on expectations rather than real experience and is thus granted presumptively or "*ex ante*" (p. 170). Team members can import expectations of one another based on their background and professional roles, and a certain level of trust may already exist at the start of the relationship. Importing expectations is a pragmatic strategy for dealing with uncertainty and risk in temporary systems, which makes it possible to perform complex tasks effectively. However, swift trust is fragile and can be easily destroyed, and once it has developed, it is tested and proven through actions. This suggests that swift trust can only exist during the very early stages of a project, until team members accumulate enough experiences together to provide bases for more traditional forms of trust. In addition, the existence of swift trust necessitates that team members apply to specific and defined roles. Role clarity and role compliance are not always the case in many project settings, however, as was the case for the project team in paper I. This research suggests that swift trust may be more adaptive in routine interactions where team members comply with their predefined roles to a greater extent.

What is the nature of the relationship between team trust and central project team outcomes?

Trust is often viewed as a critical factor for effective teamwork (Costa, 2003; Webber, 2008), and is particularly important for interdependent work (Salas et al., 2005). While several studies have shown that trust is associated with many positive team outcomes, including team performance (Costa, 2003; De Jong & Dirks, 2012; De Jong et al., 2016) and knowledge sharing (Andrews & Delahaye, 2000; Ding et al., 2014; Park & Lee, 2014), mixed and inconsistent findings on these relationships also exist (De Jong & Elfring, 2010; Dirks & Ferrin, 2001). As pointed out by De Jong et al. (2016), a cumulative body of evidence on the performance implications of team trust is lacking, and this fragmentation and mixed evidence have led to a search for mediators and moderators of the trust–performance relationship. However, in their recent meta-study of team trust, De Jong et al. (2016) found evidence for the direct effect of trust on team performance. The results in papers II and III bring some new evidence to the trust–performance and trust–knowledge sharing relationship in a project team setting.

Paper II demonstrates the mediating role of project commitment between trust and team performance. The formative indicators of trust, propensity to trust, and perceived trustworthiness are fully mediated, while the reflective behavioral component, cooperation, is partially mediated through project commitment. Monitoring, the other reflective indicator, did not show any effect, either indirect or direct, on performance. The results indicate that the effects of the formative factors of trust on performance are indirect and conveyed through project commitment. High trust levels are associated with high levels of commitment, which again is associated with higher team performance. Perceiving their team members as capable and competent (trustworthy) seems to strengthen team members' belief in the team's ability to

successfully attain its goals and motivate them to engage in the project, thus promoting commitment to the project and in turn facilitating team performance. These results are in line with Barczak and McDonough (2003), who found that trust was related to new product market performance only through project commitment.

The results in paper III also indicate that the relationship between trust and the output variable, knowledge sharing, is mainly indirect. This finding suggests that trust is an important condition, but not necessarily a sufficient motivator for knowledge sharing in a project team setting. This is in line with Bakker et al.'s (2006) findings, which suggested that trust is a condition, but not a main driver, of knowledge sharing. Others have argued for a more direct relationship between trust and knowledge sharing (e.g., Cramton, 2001), but the present results suggest that the links are not that straightforward in a project team setting. The results in paper III also indicate the primacy of project commitment over team commitment in relation to knowledge sharing. Project commitment is related to the task at hand, while team commitment pertains to the project team as a social entity. As discussed in the paper, the different influences of the two foci of commitment might be found in the strong task orientation found in project teams, thus resulting in higher task cohesion than social cohesion (Chiocchio & Essiembre, 2009).

Taken together, the findings from papers II and III show that in a project setting the impact of trust seems to be indirect rather that direct, and that commitment to the project is an important factor conveying the impact of trust on project team outcomes. Having confidence in the abilities and benevolence of their fellow team members increases team members' commitment to the project. Further, being committed to the project makes team members willing to do whatever is needed to accomplish the project successfully, and thus promoting knowledge sharing and team performance. By contrast, if team members are not confident in

their teammate's competence or benevolence, they are less likely to exert the effort, involvement, or energy necessary to effectively complete the project (Barczak & McDonough, 2003).

Results from paper I also provide some evidence that commitment to the project is needed for trust to have a positive impact. In the case project team, early project commitment was established because central team members knew each other, and a shared trust climate developed. This made team members confident that the project could be successful, and thus made them more willing to exert the effort needed.

The significance of trust in a project team setting

The findings of this thesis underline the importance of including the context of the team in understanding the significance of trust. As previously noted, two conditions are necessary for trust to exist: risk and interdependence (Rousseau et al., 1998). To trust essentially means to take risk and leave oneself vulnerable to the actions of others, while interdependence implies that two parties are dependent on each other to achieve the desired outcome. Teamwork in a project setting is often both a risky and an interdependent activity (Barczak & McDonough, 2003), with risk arising from numerous uncertainty factors and decisions to be made and interdependence occurring as a result of the necessity for various expertise and functional groups to work together to make the project successful. This combination of risk and interdependency in project teams suggests that trust can be a significant component of project success.

As we have seen, the temporal nature of projects makes trust building particularly important yet challenging. The construction industry has often been criticized for a lack of trust and cooperation (Cheung, Ng, Wong, & Suen, 2003; Kadefors, 2004). The temporal nature of

projects may affect trust development differently depending on the duration of the project and the composition of team members in relation to shared experience and familiarity. The nature of such past relationships again influences the trust level of the new project team and can bring about a spiral of trust or distrust. Initial trust levels within the team are thus important in shaping the project, and the way project teams are composed may therefore play an important role for trust development.

The results of this thesis show that trust plays a vital role in prompting commitment to the project, which again is pivotal for project success. In projects the work pace can be rather intense, especially near milestones (Chiocchio, 2007), requiring team members to complete a great amount of work within a short time period. Such stressful time constraints (Chiocchio et al., 2010; Tremblay et al., 2015) emphasize the importance of developing project commitment early on and keeping it until the end, as commitment increases and sustains motivation throughout the project (Tremblay et al., 2015). This thesis shows that trust positively affects commitment, and that positive prior ties between project team members can create good conditions for early trust development, which again can contribute to early commitment to the project. If team members have high expectations that other team members are both able to and will do their jobs well and work toward common goals, they are more likely to have a positive attitude and strong involvement in the project (Barczak & McDonough, 2003).

Contributions and implications

This thesis is expected to be significant for both researchers and practitioners in teamwork in general, and in the field of project work specifically. The findings provide both theoretical contributions and practical implications. First, the research extends studies on teams, which have commonly been conducted on ongoing, permanent teams, to a context-specific project team environment. Accordingly, this research adds to the body of knowledge in team research

by empirically testing out theories in a project context—an increasingly common organizational form. This is in line with the appeal of several researchers' (e.g., Searle et al., 2011) that the strength of the context may influence the salience of trust. A primary theoretical contribution of the thesis is the demonstration that in the context of project teams in the construction industry, trust mostly operates through project commitment to influence project outcomes, such as performance and knowledge sharing. The mediating role of project commitment also confirms the positive relationship between trust and commitment in a real-life project team context.

This thesis also contributes to the literature by providing support for a multidimensional trust construct with distinct but related dimensions. The dimensions can have various impacts on outcomes and mediating variables, as shown in this research. Another contribution of this thesis pertains to the findings regarding the different foci of commitment. By simultaneously studying team commitment and project commitment as mediators, this thesis contributes by expanding the understanding of how different foci of commitment relate to the relationship between trust and knowledge sharing. The findings show a clear precedence of project commitment over team commitment, which resembles those of previous studies showing task cohesion to be more strongly linked to team performance compared to social cohesion (Carless & De Paola, 2000; Mullen & Copper, 1994). Finally, this thesis offers new and empirical insights into the complex nature of temporal project work and underscores the significance of prior relationships and shared work history in facilitating trust development and cross-functional team integration.

The results of this research provide several important insights for practitioners as well. Overall, the findings stress the importance of building trust and commitment in project teams. Teams with a high level of trust are more likely to be more committed to the project, and thus

be more willing to share knowledge and perform better than low-trusting teams. A high-trusting project team is not only beneficial for the current team's functioning but can also serve future project teams if positive relationships formed in one project are continued into the next. Considering the positive outcomes of trust in project teams, managers and leaders of temporary organizations should prioritize activities and structures that provide opportunities for team members to get to know each other on an interpersonal level and form deeper relationships with each other, thereby enhancing trust development. Further, this research highlights that even though trust in itself can be important for project team functioning, we need to consider the mechanisms through which trust operates. The results show that team members' commitment to a project is critical, and that we need to go beyond trust building and look for ways to grow a strong sense of commitment to the project among members of the project team. This can be done by providing project teams with a common purpose and goals and creating teams with necessary functional and interpersonal skills (Katzenbach & Smith, 1993; McDonough, 2000), and through giving team members more responsibility and decision-making authority. However, this does not imply that trust should be ignored or discouraged. Trust is important in itself; without it, commitment to the project is unlikely to occur. If team members trust their fellow team members and have confidence in their abilities, they may be more willing to commit themselves and exert the effort necessary to make the project successful. Therefore, trust needs to be developed and cultivated within a project team setting. This can be done by engaging team members in collaborative processes and providing opportunities for team members to demonstrate their individual competency.

In addition, this thesis shows that positive prior ties can have a considerable effect on trust development, and that this should be considered when staffing projects. Staffing project teams with people who have established positive ties due to a history of working together on past projects is one way to foster trust and commitment early on. Project staffing that pays

attention to prior relationships can thus create some stability for team member interaction and create good conditions for successful teamwork in projects. However, achieving temporal stability and continued relationships may be challenging in a project setting. Managers and project staffers should be aware that project teams may be less efficient when membership is constantly changing, or teams are unnecessarily broken up and reformed with new members and should consider the advantages of repeated ties. Having worked together in the past and having the prospect of working together again in the future gives a powerful boost to the level of trust in a construction project. However, managers should also recognize the intended and unintended consequences of staffing projects with team members that know each other, considering the potential for subgroups and diverse social identities to develop. Managers should therefore encourage the team to identify shared goals and interests as a whole group. A shared social identity between project team members, as a whole, creates a stronger level of commitment to the project, which can reduce conflict (Petter & Carter, 2017) and is beneficial for knowledge sharing and project performance, as shown in this study.

Methodological considerations and future research

One major strength of the thesis is that all data were collected in field settings, involving natural project teams operating in real project contexts. This not only enhances the external validity of the findings, but also corresponds to the recommendations of Kiffin-Petersen (2004), among others, who emphasized the need for more studies of trust in real work teams. Another strength is the use of both qualitative and quantitative methods. This triangulation of methods allows for a widening of perspective and for a pluralistic and powerful approach to studying the significance of trust in project teams.

Despite its strengths and promising theoretical and practical contributions, there are also some methodological limitations in this study, as with all empirical studies, that should be taken

into consideration. The most noteworthy limitation is the use of cross-sectional data in mediation analysis. Mediation presumes to explain the causal link between variables; in order to appropriately measure causality, the cause should precede the mediator, which in turn should be measured before the outcome. In cross-sectional designs, all variables are measured simultaneously and hence do not directly support definite causal inference (Maxwell and Cole, 2007; Maxwell, Cole & Mitchell, 2011). The absence of time precedence implies that the basis for causal inference in cross-sectional data is assumption and a convincing rationale of directionality from theory and previous findings. Hence, the findings related to mediation in this study cannot be taken as conclusive evidence, and the mediating effect should be interpreted with caution. Future research should therefore test the models in longitudinal and multilevel studies, to shed more light on the causal nature and possible reciprocal relationships across time and levels. However, it is important to note that temporal priority in itself is not a sufficient condition for causation (Wunsch, Russo, & Mouchart, 2010) and that simply ordering variables according to time does not guarantee causation in nonexperimental studies (Shrout & Bolger, 2002). A second potential limitation is the use of self-reported measures in this study, and the fact that some of the effects might have been influenced by common method variance (Podsakoff, MacKenzie, & Podsakoff, 2012). To address this issue, we undertook procedural remedies and conducted the widely used Harman's single-factor test, which suggested that common method bias is not a major concern in this study (Podsakoff et al., 2012). A word of caution must also be put forward as the empirical data for paper I is restricted to a single project from a single organization and is thus influenced by the context of this organization and the particular local conditions. Although formal generalization is not the aim of this study, there are some limitations arising from the use of a single case study.

Future research should address some of the weaknesses discussed above, and also seek to expand this study. For example, negative prior ties can have a negative impact on the climate of trust in a project team, and this should be included in future qualitative research on the impact of prior ties on trust development in such a setting. In addition, the combination of prior ties based on past experiences and the favorable expectations of future interactions should be considered for future studies. Further, future research should focus on the potential of subgroups developing within teams where some, but not all, team members have a shared work history. While this was not a specific topic of interest, nor was it evident, in the present study, subgroup development may occur in larger project teams where team members tend to categorize themselves into a smaller collective or group (Hogg & Terry, 2000; Tajfel & Turner, 1979). Team members who have shared positive work experiences or project outcomes are more likely to view themselves as a subgroup within the project team, creating a collective social identity as a subgroup (Petter & Carter, 2017). The presence of subgroups can both be beneficial and a potential hindrance for effective team functioning and could therefore be considered in relation to team members with prior ties.

In addition, future studies should test the nature of the relationship between project and team commitment and its influence on knowledge sharing and other project outcomes. Further, task duration and shared work history among team members may impact the development of both foci of commitment and should be considered in future studies as well.

Conclusions

The aim this thesis was to examine the significance of trust in the context of project teams by exploring context-dependent antecedents and consequences of trust in a project team setting. This thesis has addressed some of the shortcomings of previous research by focusing on how the temporal nature of projects affect trust development in project teams. Further, it has added some new insights to the mixed and inconsistent findings on the relationship between trust and performance and trust and knowledge sharing by examining the nature of these relationships.

In conclusion, the present thesis offers new and empirical insights into the complex nature of temporal project work and underscores the significance of prior relationships and shared work history in facilitating trust development and cross-functional team integration. Further, the findings show that in a project setting, the impact of trust seems to be indirect rather that direct, and that commitment to the project is an important factor conveying the impact of trust on project team outcomes. Trust positively affects commitment, and positive prior ties between project team members can create good conditions for early trust development, which again can contribute to early commitment to the project, all of which contributes to a good starting point for successful project outcomes.

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Paper I

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Prior ties and trust development in project teams – A case study from the construction industry

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Abstract

The limited duration and the high time constraints facing projects may pose challenges to the development of working relationships in project teams. Relationships can be influenced by the history of interactions and prior ties between team members. Development of trust is crucial but challenging in the context of cross-functional project teams and prior ties can have imperative influence on the team's ability to create trust. Through a case study in the construction industry, we explore *how* prior ties between team members influence the development of trust. We identify four important aspects; early formation of integrative work practices, development of a common philosophy, open communication, early and clear role expectations, all contributing to development of trust in an early phase. Our findings offer new, empirical insights into the complex nature of temporary project work and underscore the significance of prior ties in facilitating early trust and integration within project teams.

Keywords: Project teams; Trust; Temporary organizing; Teamwork; Prior ties; Shadow of the past; Construction industry

1. Introduction

Temporary forms of cooperation and working constellations, such as projects, are becoming increasingly widespread (Bakker, 2010). Projects are by definition characterized by finite time spans and this transient feature may influence working in such temporary systems. Teams in a project setting face different challenges when it comes to the development of working relationships, compared to ongoing work teams. Relationships and interactions between team members are temporal phenomena that can be influenced by the history of interactions and prior experiences between participants (Poppo et al., 2008).

Project teams are a group of people responsible for complex tasks over a limited period and are typically cross-functional, consisting of members who have complementary skills and come from different disciplines and functional areas in the organization. The advantage of cross-functional project teams lies in their capacity to do multiple activities simultaneously, rather than sequentially, which saves time (Brown and Eisenhardt, 1995). The inherent functional diversity should facilitate a team's ability to interact across team boundaries to its members' "home" departments, thereby enhancing performance. However, to utilize the potential benefits of functional diversity, cross-functional teams must engage in collaborative interaction (Daspit et al., 2013). Thus, the ability of a cross-functional project team to execute a project successfully relies on its ability to integrate the relevant knowledge and skills that are distributed among its members. This integration of the capabilities in the team depends on the way they work together and their interpersonal relationships, such as the degree of trust. Trust may thus be particularly important in these teams, because many sub-tasks are interdependent, with team members relying on the functional expertise of their colleagues. In this setting, the temporal aspects of relationships may affect the work and consequently influence the success of the project. Relationship duration is of particular

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importance for trust development in a project team setting (Levin et al., 2006). The inherent need for collaboration and the high interdependency facing this form of work require trust between project team members. This is because trust has been identified as an important component of teamwork (Webber, 2008) and researchers have acknowledged its critical role in the development of effective work processes and the successful performance of traditional operational teams (Dirks, 1999; Kirkman et al., 2006). While trust has been proven to create various benefits for the team and the overall project, researchers also point to the difficulties of establishing trust in such a setting (Maurer, 2010). Trust rests on expectations and predictions of other people's behavior based on an evaluation of their trustworthiness (Mayer et al., 1995), but in a project team setting, members may lack prior collaboration and experience on which they could base their expectations and predictions (Gulati, 1995). The high time pressure often facing project teams (Nordqvist et al., 2004) makes it difficult to develop familiarity and to prove each other's trustworthiness. Hence, the formation of trust is a pivotal but simultaneously challenging task that has received only limited attention within the field of project management so far (Maurer, 2010). Even though the interest of trust in construction projects has grown in recent years (Chow et al., 2012), the focus has mainly been on inter-organizational trust (Lau and Rowlinson, 2010, trust among project stakeholders (Black et al., 2000; Laan et al., 2012; Pinto et al., 2009), and contracting in construction (Wong et al., 2008). Empirical research on team trust in general is underdeveloped (Kozlowski and Ilgen, 2006), and we argue that exploration of the role of trust development in project teams operating in complex project environments is warranted.

Team members may work with colleagues with whom they share a history of collaboration or they may work with new and unfamiliar team members. This may have a significant effect on trust development and is especially important in the early phases of a project. Prior experience between project members and knowledge of each other can create social relationships between members. These relationships are called prior ties in our study. Recent studies have shown that prior ties have a positive effect on trust in inter-organizational projects (Maurer, 2010), in teams (Webber, 2008), in project partnering (Laan et al., 2012), and on project performance (Huckman et al., 2009; Reagans et al., 2005). Still, there is a shortcoming in the literature regarding identifying in greater depth *how* prior ties influence trust development in a project setting. Recently, Pinto et al. (2009) have also called for more research on the various antecedent conditions or actions that can affect trust in a project setting, and Maurer (2010) recognizes that more in-depth qualitative approaches are needed to explore the complexity of trust.

Our study is set up to meet these shortcomings through developing a deeper understanding of the temporal aspect of relationships in project teams by exploring the following research question: "How do prior ties between team members influence trust development in cross-functional project teams?" Our focus is on trust development *within* the project team. Although trust can exist at different levels, we focus on trust development at the team level of analysis. The majority of trust research has focused on interpersonal trust and organizational trust and there is a lack of research examining trust at the team level (Webber, 2008). We take an explorative approach to answering the research question with the use of a qualitative case study of a project team in the construction industry. The construction sector is a prime example of a project-based industry, in which new product development involves not only non-routine production processes, but also complex working relationships and interrelations (Bresnen et al., 2004). Our findings offer new, empirical insights into the complex nature of temporary project work and underscore the significance of prior relationships and shared experience in facilitating trust and cross-functional integration in the project team.

2. The temporal aspect of trust development in project teams

Trust has received research attention across multiple disciplines with different definitions and approaches. Nevertheless, there has been some convergence on the central elements of trust. Trust is viewed as both multidimensional and dynamic (Kramer, 1999; Rousseau et al., 1998), and scholars seem to agree that it includes "positive" or "confident" expectations about another party and a "willingness to accept vulnerability" in the relationship, under conditions of interdependence and risk (Kramer, 1999; Lewicki et al., 2006; Mayer et al., 1995; Rousseau et al., 1998). Trust within the project team has been associated with several outcomes that are expected to contribute positively to the success of the project. Examples of outcomes are knowledge sharing (Andrews and Delahaye, 2000; Ding et al., 2014; Lee et al., 2010; Park and Lee, 2014), commitment (Costa and Anderson, 2011), team satisfaction (Costa et al., 2001), formation of social networks (Shazi et al., 2015), and team performance (Costa, 2003; De Jong and Dirks, 2012; Webber, 2008). As noted, trust is a complex phenomenon and may have a variety of meanings and impacts, depending on the type of team and the context (Chiocchio and Essiembre, 2009). In construction, Kadefors (2004) has argued that the specific characteristics where contractual relationships dominate can counteract mutual trust development. It is recognized that successful trust building within project teams could improve project outcomes (Wong et al., 2008) and mutual trust has been found to be an important success factor in maintaining a partnering relationship (Black et al., 2000). Pinto et al.'s (2009) research on the role of trust among project stakeholders in construction projects showed that trust had different meanings for contractors and owners, thus demonstrating its context-specific nature (Ding and Ng, 2010).

Bakker (2010) recognizes that trust and social relations are areas that will most likely be affected by the duration of temporary organizational forms. Poppo et al. (2008) depict two perspectives on the origins of trust: the shadow of the future and the shadow of the past. The first perspective advances the notion that the shadow of the future – that is, the expectation of continued interaction – is necessary to promote cooperation and trust. The other position is that the shadow of the past – that is, prior relations – promotes trust as it is developed over time by a history of mutual interactions and experiences. Poppo et al. (2008) studied the interplay between these two origins of trust

in an inter-organizational exchange context and they propose that when expectations of continuity and prior history work collectively, their joint effect has a stronger influence on trust.

In recent studies, prior ties have been found to have a positive effect on trust in inter-organizational projects (Maurer, 2010), on trust in teams (Webber, 2008), on trust in project partnering (Laan et al., 2012), and on project performance (Huckman et al., 2009; Reagans et al., 2005). Maurer (2010) found that team members in inter-organizational projects who knew each other from prior collaboration had greater opportunities to interact and develop expectations of each other's behaviors, facilitating mutual trust. Further, Webber (2008) showed that early trust in project teams was developed through prior familiarity and that this trusting foundation was an important contributor to future trust. In a quantitative study of project partnering in the construction industry, Laan et al. (2012) found that both prior experiences and prospects of future exchange influenced trust between partners. Moreover, Reagans et al. (2005) found that team members' prior experience in working together helped them to allocate tasks effectively and coordinate across specialized roles.

When people have worked together on previous occasions, their mutual experiences will most likely result in a better understanding and knowledge of each other's motives, preferences, and routines. Prior ties can thus provide opportunities to obtain trust in the early phases of the project, and research has also shown that early trust formation has a positive impact on trust development later in the team's life (McKnight et al., 1998; Webber, 2008).

Although most previous research suggests that prior ties will have a positive influence on trust development, there are also studies suggesting that temporary organizations using prior ties may perform worse. This research argues that members tend to hold biased assessments in favor of their prior partners, and therefore tend to overestimate the actual quality and trustworthiness of their friends (Sorensen and Waguespack, 2006). It is also possible that a team member could be familiar with another team member from a previous collaboration that was problematic. In other words, prior collaboration with someone could represent knowledge of a negative experience, which would hinder the development of trust. Thus, the nature of the prior ties is important to consider when assessing how prior ties can affect trust development.

Following the shadow of the past perspective (Poppo et al., 2008), the traditional view of trust is that it needs time to develop and is built incrementally through prior experiences (Lewicki and Bunker, 1996). However, in a project setting, project team members often lack prior collaboration experience on which they could ground their expectations and predictions (Gulati, 1995). At the same time, they regularly suffer from time pressure throughout the time span of the project (Nordqvist et al., 2004). Project team members need to learn about each other's trustworthiness in order to develop expectations of how they will behave in future situations (Lewicki et al., 2006). According to Mayer et al. (1995), the assessment of fellow team members' trustworthiness can be evaluated along three dimensions: competence, benevolence, and integrity. Competence refers to the abilities, skills, and capabilities that a person has in a particular domain, while integrity refers to expectations of whether the team member is loyal, has a strong sense of justice, and performs consistently. Benevolence implies an attachment between team members and an expectation that each party wants to do good for the other (Mayer et al., 1995). Lewicki and Bunker (1995, 1996) link trust development to the stages of relationship development and distinguish between three "bases" of trust: calculus-based trust, knowledge-based trust, and identification-based trust. Calculus-based trust is founded on consistency of behavior, the confidence that people will do what they say. Knowledge-based trust is generated through interactions over time as the parties learn about each other's actions and intentions through reciprocated behavior. The final step is identity-based trust, which occurs when the parties start to identify with one another, and expect the other party to be caring. The suggestion is that judgments of competence and integrity are formed in the earlier stages of a relationship and can be linked to calculus- and knowledge-based trust, while benevolence is more linked to identification-based trust, as the judgments would require more information and thus take more time to develop. In this sense, trust building is a slow and time-consuming process that moves from calculative to personal and emotional (Lewicki et al., 2006).

Trust can be viewed both as an outcome of effective teamwork (Cohen and Bailey, 1997) and as an input factor (Holland et al., 2000). This is an example of the reinforcing character of trust or "self-fueling spirals" (Hackman, 1990), where trust and teamwork mutually reinforce each other. Zand (1972) suggests that mutual trust or mistrust among team members is likely to be reinforced unless there is clear or continuous disconfirming behavior. The starting conditions, in the form of trust or distrust, may thus trigger both vicious and virtuous cycles of behavior and expectations. In the context of projects, the final outcome may be influenced by the initial intentions and expectations of the parties involved (Munns, 1995).

Historically, trust has been viewed as a dynamic phenomenon that develops and strengthens over time. However, research has also identified trust among individuals and groups early in relationships (McKnight et al., 1998). Meyerson et al. (1996) suggest that trust may be based on presumptive foundations beyond evidence of direct contact between individuals, and proposed the concept of *swift trust*. In swift trust individuals rely on defined roles rather than personalized sources to inform their decision to trust, and it is a unique form of trust that occurs between groups or individuals brought together to accomplish specific tasks. While swift trust is based on a feeling of confidence without having prior mutual experience (Meyerson et al., 1996), temporary organizations like projects may also be characterized by the shadow of the past (Poppo et al., 2008) and trust development may hence be a continuation of prior ties (Bechky, 2006).

3. Method

To study how prior ties influence trust development in project teams, we conducted a single case study in the construction industry in Norway. The project, named Project School, was selected because the project team had a substantial "shadow of the past" through prior experience in working together. Given the

exploratory nature of this study, the case-study approach was found to be appropriate, as it provides a deeper description and understanding of the social phenomenon of trust development (Eisenhardt, 1989). Following Yin (2003), we argue that the case-study approach is suitable, as it allows us to study "a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2003, p. 2). A single-case approach is especially valuable when the aim is to provide a rich description and to get as close as possible to the phenomenon described. Multiple case studies, on the other hand, may provide rather "thin" descriptions, rather than the deeper social dynamics that can be achieved by single-case studies. The most often-cited limitation of the case-study method is the difficulty of generalizing findings to different settings (Yin, 2003). However, the aim of this research is not to obtain generalizable findings, but to explore an underdeveloped phenomenon. The extent to which the findings can be applied to other situations is determined by the people in those situations. As stated by Merriam (1995, p. 58), "by providing thick description on the phenomenon under study, readers themselves are able to determine how closely their situations match the research situation and hence, whether findings can be transferred." In the qualitative paradigm, reliability and validity are commonly conceptualized as trustworthiness, rigor, quality, and dependability (Searle, 1999). In this study the process of respondent validation or member checking was used to address the validity (trustworthiness/rigor/quality) of the study (Lincoln and Guba, 1985). This allowed the participants the chance to correct errors of facts or of interpretation.

A longitudinal approach to data collection was adopted when we interviewed the project team at two different phases of the project. We interviewed the project team members in the start-up phase (phase 1), about four months into the project, and then conducted follow-up interviews with key members approximately one year after the first interviews were conducted (phase 2). A total of 12 interviews were completed, 8 in phase 1 and 4 in phase 2 (see Table 1 for details). Key project team members were selected for interviews, with the aim of obtaining a rich and comprehensive understanding of the influence of relationship duration and prior ties on trust development in our case project. The selection of project members for follow-up interviews in phase 2 was mainly based on the centrality of the role.

We used semi-structured interview guides with the main questions for every interview, completed with optional probing questions for stimulating rich descriptions. The interviews lasted from 35–75 minutes and were all recorded and transcribed verbatim to facilitate detailed and systematic analysis. The software QSR NVivo 9 was utilized to aid in organizing and examining the data. Thematic analysis was adopted to analyze the qualitative data. This is a research technique of encoding qualitative data into themes to help construct, understand, and make valid inferences from a body of texts (Braun and Clarke, 2006).

4. Case description

The case project is within a large construction company, involving the construction of a new school building for secondary education in a semi-urban area in Norway. Constructing buildings is primarily a labor-intensive process that involves a series of sequenced activities to produce a "one-off" product that is in line with the requirements of the client or the builder (Cooke, 2013). This work induces a complex interaction between different disciplinary approaches, such as architectural design, mechanical engineering, finance, and legal aspects, all of which need to be effectively coordinated and managed (Walker and Christenson, 2005). The project was a "turnkey" project, meaning that the construction company takes responsibility for the whole process from design to building. The client/builder puts forward its functional requirements, while the contractor can choose the solutions and suppliers to meet these requirements. The contractor coordinates the work and hires different subcontractors for the specific part of the construction. The building phase lasted for about two years and the total project value was approximately 45 million euros.

The project team had been cooperating for about four months prior to the first phase of interviews and it was at the starting point of the building phase. When the follow-up interviews were conducted, the project was in the completion phase. The work was at this point concentrated on the technical installation and the fixtures. The project team consisted of nine members with core functions: project manager, assistant project manager, engineering manager, construction manager, two operations managers, two procurement engineers, and one project controller. In this project key team members, such as the

Table 1
Overview of interviews and phases of data collection.

Interviewee	Function	Age	Gender	Phase 1 (June 2013)	Phase 2 (August 2014)
1	Project manager	33	Male	x	
2	Assistant project manager	63	Male	x	x
3	Engineering manager	43	Male	x	
4	Construction manager	55	Male	x	x
5	Operations manager	48	Male	x	x
6	Operations manager	31	Male	x	
7	Procurement engineer	30	Male	x	
8	Project controller	29	Female	x	x
Total interviews				8	4 = 12

project manager, construction manager, project controller, and one operations manager, had worked together on a prior project and knew each other well. They described the earlier project as tough and challenging with many complications, and they believed that this experience had strengthened their mutual relationship.

The current project was complex, with high interdependency and complex tasks, strong time pressure, and multiple stakeholders. The project team had to coordinate and ensure productive collaboration, both internally with its engineering department and externally with the builder/client and the subcontractors. Even though the projects have company-specific systems and procedures, they are decentralized, with great autonomy regarding how work is conducted and roles and functions defined. Thus, team members did not simply execute predefined roles, but rather negotiated the content of the roles and the functions. The construction sector is a prime example of a project-based industry, in which new product development involves non-routine production processes as well as complex working relationships and interrelations (Bresnen et al., 2004). However, the industry has been widely criticized for its variable performance and project delivery (Baiden et al., 2006). While many projects perform well on time and on cost, there are also several examples of time and cost overruns due to extensive rectification. This has partially been attributed to the inability of project participants to work together effectively and their failure to form effective teams (Baiden et al., 2006). Construction projects often have complex design and engineering, which requires a range of expertise from multiple parties, both internally and externally. The nature of the work introduces high levels of uncertainty and unpredictability. Every building project represents a unique process and different expertise is brought together, with distinctive constraints and goals. In addition, different stakeholders represent different individual and organizational interests, needs, expectations, risks, and constraints (Lau and Rowlingson, 2010). Construction projects usually build on extensive subcontracting and incomplete contracts, and restrictive terms can produce conflicts (Li et al., 2001). In addition, the team members are seldom trained for the specific project and their individual contributions often come together as a whole-team effort in an *ad hoc* manner as the project processes (Cornick and Mather, 1999).

5. Results

The case analysis indicates that prior ties affect trust development within the project team through their impact on central team processes. These processes are particularly imperative for the early phases of construction projects. More specifically, we found that prior ties led to the *early establishment of integrative work practices* that could respond to challenges that they had experienced previously. The familiarity also made it easier to create a *common philosophy* that depicted which attitudes and norms of behavior were desirable. Further, knowledge of each other influenced the communication climate by facilitating *open communication* in the early phases. Additionally, prior knowledge and experience enabled *clear role expectations*, as the key persons were familiar with each other's preferences and way of working. Finally, we found that prior ties contributed to the early development of a *shared climate of trust*. We will now provide more details qualifying these findings.

5.1. Early establishment of integrative work practices

Based on their prior experiences, the team members established work practices that could prevent some of the previous difficulties. Team members described the prior project as turbulent, and this shared experience stimulated them to prevent such a situation happening again. Weekly meetings were established involving the whole team, where they allocated time for each function to go through the current situation and make assessments about workload and resources. This became an arena for identifying "where the shoe pinches" and offering support when needed. All the project members talked positively about these meetings and some even called them sacred, in the sense that they were of great importance for the team to function. They felt that they could talk freely and prevent misunderstandings. One team member described the impact in the following way:

> "So it's things like this [the internal meeting] I think, that make everyone a little bit safer at what we do, and we always get to say something if there are things we encounter."

Another team member elaborated on the function of this meeting and its benefits:

> "When we are all here together and talking together it is much easier … Yes, then we can ventilate if we have any problem – if there is something that is incorrect or if we see that there can be a problem, or we see that we must speed up, or if we need to make some changes somewhere, so we address it there and then [in the internal meeting]. So all possess the same information and that's what's really important, that everyone doesn't hold on to THEIR information, and so no one knows what the other is doing or if there are any problems."

The last quote sheds light on the integrative function that this meeting had for the project team. By being together and talking freely about all aspects of the project, they were able to unify their different experiences and perspectives and create a mutual understanding. The sharing of important project information with all members simultaneously contributed to a collective orientation and a feeling of shared responsibility for obtaining the project goals.

The follow-up interviews indicated that this practice persisted throughout the project and was still considered important.

5.2. Common philosophy

Based on the shared experiences of working together, key team members knew each other's thoughts and attitudes, views and perspectives on important aspects of the project work. They described their views as a common philosophy of humanity and they agreed on a mutual standard for how to treat people. One team member explained:

"It's easier to think the thoughts and do something with it if you have some of the same people who also have shared the experience."

Their shared experience also included knowledge of each other's thinking processes, the tacit, implicit knowledge that is difficult to articulate but is revealed in people's actions. The mutual knowledge made it easier to set ideas into practice, as the quote indicates. Another team member explained the common philosophy in this way:

"We have somehow our own policy here … I can't really explain it so well, but I feel that we – we think the same thought, mostly. Mostly – we are different people of course. But for the most part we see things the same way. We have the same goals and treat people on site in an orderly manner, and all that. We know that people do not promise more than they can hold."

The shared experiences helped them agree on arrangements in the current project. They generally agreed on the work norms and behavior towards external partners. This common philosophy was discussed and further developed in their weekly meeting. By setting a common standard, the team members were better coordinated towards their external partners. The quote from one team member demonstrates:

"For it is about building a team and building a mentality and a spirit that one can gather around. And if you don't, then you also get trouble out there [on the construction site]."

5.3. Open communication

Several team members described the communication climate as open and supporting. When asked how prior ties influenced their work, one team member responded:

"I think it has a great deal to say. Because – for one thing, one feels safer with one another, and it is easier to ask each other questions when you know each other."

Many emphasized that they felt safe in expressing themselves and that no questions were too silly. They were not afraid to "lose face" because they knew that they all had common interests. They felt safe in asking each other for assistance and it was appropriate to admit mistakes and shortcomings. One team member explained it like this:

"And we have made it very clear that the offices are always open. We should always come to each other and clarify things. This is much better when you are unsure of things, instead of doing something wrong."

The common understanding was that if something went wrong they should report it immediately, instead of hiding it and trying to get away with it. The following quote expresses this and the importance of familiarity in this respect:

"Of course it is allowable to fail too. But … if you are familiar with the person then you dare to admit a mistake. If you don't know the person – then you are afraid to get into trouble and the reprimand it can create."

This demonstrates an open communication climate where team members felt safe enough to admit or let the others know their inadequacies and insecurities. The project team managed to create a mutual understanding of norms for communication early in the project and this continued throughout the period.

5.4. Clear role expectations

Since several of the team members knew each other previously, they were familiar with each other's strengths, weaknesses, and preferences for working procedures. They explained that they could predict the others' behavior more easily because they knew how they would evaluate different situations. This knowledge made it easier to distribute the resources and know when different team members needed support. The following quote from a team member demonstrates this:

"If you know that his [the construction manager's] strength is out at the construction site but that he needs more backing with papers, economics, and that sort of thing, then you know you have to go in and support those things. While on the things he is good at, well, then you can 'drop the reins' a bit, because then you know that he has full control of the operation."

The content of the roles and functions in the project team was decided shortly after startup. Their mutual understanding made it possible to evaluate how they executed their roles.

"I think that you allocate responsibility on the various things much better when you know each other, know that HE is very good at this and HE is good at that and HE is good with those groups or professionals. So this is really – it is the essence of all building projects, that we have this."

The existence of mutual understanding and clear role expectations was considered crucial for the functioning of the project team, as reported by all team members. As one team member put it:

"We all have our tasks, and then – then we know what we should relate to it. So it is not crisscrossing. If it is, then there could be a crisis."

5.5. Shared trust climate

Sharing information and having open communication indicated a high level of trust. Team members emphasized the importance of trust, as this quote shows:

"We are loyal to the group. […] we trust each other, we keep together. We can't have somebody who does their own thing

… who runs to their mom. It gets a little tough sometimes, you know."

They trusted each other's intentions to be loyal to the team and to prevent hidden agendas. They described working in the construction industry as harsh at times, an environment where important decisions had to be made involving money and the safety of workers. All team members emphasized mutual trust as crucial.

The trust climate was evident from the beginning. Team members reported in an early phase that they were not afraid to reveal to the other team members if they were unsure about something or if something was bothering them. They also reported that they could rely on their team members to do their tasks. When they asked someone to do a task, they reported that everyone did what they promised. This indicates a shared climate of trust, meaning that team members had shared perceptions of the level of trust in the group. They describe a feeling of safety and comfort following the high level of trust:

"When we trust each other then there is also a reassurance – so you can be gone for a few days without worrying somehow. It goes well anyway. We are all pawns in the big game and if one chip is gone for a while, it will go well anyway."

This quote demonstrates that they rely on each other's abilities to perform well even without control. This relates to their mutual reliance as honest and sincere persons who would not pretend to have competence in something that they did not possess, as this quote shows:

"There is no one who pretends to be an expert if he or she is not, that would backfire on you and the group. So if we need help then we consult someone who is skilled on timber or concrete, for example, so we don't need to worry about that. If there are things that are a bit outside [our competence] then we ask someone else and find out how it is. And we also check with each other before we proceed. That is because we trust each other – we rely on each other."

6. Discussion

The analysis indicates that positive prior ties affect the development of trust in the project team significantly, suggesting that prior ties may facilitate the early establishment of working practices as well as trust development. The team members who had worked together in the past brought their shared experiences into the project, including an awareness of the necessity of establishing mutual arenas for information sharing and integration of different perspectives. The former project had been challenging and they drew on this shared experience by establishing weekly meetings with the project team and the support functions of procurement and controller. They continued with these meetings throughout the project period and members considered them imperative for their successful collaboration. By having this regular arena for interaction, all members were kept informed. This provided an opportunity for cross-functional integration, where everyone could contribute with their perspective on matters according to their professional background and their personal experience and interpretation of situations. Frequent interaction within a team is considered important for team effectiveness (Cooper, 1996; Webber, 2008). Cooper (1996), for instance, found that high-quality teams interact well and often, holding weekly meetings to ensure that the entire team was up to speed. Furthermore, teams with frequent interaction are more likely to develop strong relationships among the team members, resulting in higher trust (Webber, 2008).

The results also indicate that the shared experience enabled the team to develop a common philosophy and norms of behavior. The shared beliefs further facilitated the team in acting in a coherent and coordinated way when interacting with external partners, and prevented them from communicating conflicting views. As noted earlier, the construction team is mutually dependent on various partners to obtain the project goals. To have shared beliefs and aligned actions was thus crucial for success. The common beliefs and norms also increased the cohesiveness, team identity, and their feeling of unity.

Prior ties also laid the ground for an open communication climate, characterized by widespread acceptance of asking questions and revealing sensitive information. We will argue that while this is generally important, it is especially imperative for project teams in the construction industry with high interdependence and uncertainties. The ability to discuss possible pitfalls and potential solutions openly, even if that means disclosing inadequacies and mistakes, makes the project team capable of averting potential negative events. Alexopoulos and Buckley (2013) suggest that disclosing sensitive information to colleagues with whom one has little shared experience is likely to result in negative consequences unless it is clear that both parties share clear norms for disclosure. In our study, the prior ties made it easier to be vulnerable, to communicate freely in an early phase of the project, and to establish this as a norm. Our findings are consistent with prior research stating that team members' recurring interactions help to establish communication channels and a common language (Weber and Camerer, 2003). When teams communicate openly, their ability to share important information about the team task increases, improving the team's progress in completing the task, and ameliorating any challenges that the team is facing (Webber, 2008).

Further, we found that prior ties were positively associated with early and explicit role expectations. Early clarification of roles and reconciliation of expectations made it easier to assess each other's competence, contributions, and ability to follow through. These findings are in line with those of Reagans et al. (2005), who found that team members' prior experience in working together helped them to allocate tasks effectively and coordinate across specialized roles. When team members without knowledge of each other form as a team, they may spend a great amount of time in getting to know each other and clarifying their mutual roles and expectations. In the current construction company, the roles and functions were not predefined and stable

across projects, and each project had to negotiate what the different roles should imply in its own context. In particular, the interfaces and interdependencies between the roles were areas where they had to negotiate responsibilities.

The project team in this study had a high level of trust at an early stage, and this climate of shared trust grew even stronger through the project. Team members expressed reliance in each other's competence, integrity, and goodwill. Since key team members had interacted previously, their mutual experiences enabled them to understand each other's motives, preferences, and routines, and they were able to predict each other's behavior. Prior ties and shared experiences provided opportunities to obtain trust in the early phases of the project. We propose, in line with McKnight et al. (1998) and Webber (2008), that this early trust had a positive impact on trust development later in the team's life.

The open sharing of information and communication patterns enabled team members to develop strong relationships, resulting in higher levels of trust. This is in line with previous research suggesting that trust building is influenced by open communication (Johnson and Johnson, 1989; Lewicki and Bunker, 1996) and a shared language (Levin et al., 2006). Lewicki and Bunker (1996) found that regular communication allows the exchange of information about each other's preferences, values, and approaches to problems, thereby creating knowledge-based trust. In the project context, Lee et al. (2010) found that team members' personal trust was positively associated with knowledge sharing by motivating them to disclose their "ideas, beliefs, and feelings about the project for the greater good of the team" (p. 478).

If there is a lack of trust in a relationship, the amount of information sharing is often restricted (Munns, 1995), and the nature of the information changes. Team members act as information gatekeepers (Munns, 1995), and if any team member withholds information this may reduce the chances of project success. In trusting relationships, information is disclosed even though it makes one team member vulnerable to exploitation by the others. Communication and trust create a reinforcing cycle where open communication builds trust, which leads to more open communication, and again to even more trust. Full and open information in a project team is thus important for project success (Munns, 1995).

We also suggest that the early clarification of role expectations and the feeling of team coherence and team identity had a positive impact on trust development, consistent with previous research. The feeling of team identity (Jarvenpaa et al., 1998) facilitates trust development and people perceive others as more trustworthy when they embrace similar values and outlooks (Gillespie and Mann, 2004; Levin et al., 2006). Further, relationships between people are particularly influenced by role expectations (Gabarro, 1987), and a lack of clearly defined roles, inconsistent role behavior, and "blurring" of roles can erode trust (Jarvenpaa and Leidner, 1999; Meyerson et al., 1996). Without prior knowledge, it can be rather difficult to assess others' abilities in the early stages of a project team due to unclear roles and different expectations. This can affect the level of trust, as competence and ability are viewed as strong predictors of trust (Mayer et al., 1995; McAllister, 1995). We could assume that there would be evidence of swift trust (Meyerson et al., 1996) in the project team without members knowing each other previously. Swift trust is based on presumptive knowledge about the competence of the other team members and their compliance with their professional roles (Meyerson et al., 1996). When swift trust is present, team members rely on defined roles. Since we found that the roles and functions had to be negotiated and adopted accordingly, we propose, in line with Rusbult and Van Lange (2003) that the concept of swift trust is more adaptive to situations in which people engage in routine interactions that require clearly established and predefined roles.

The three bases of trust identified by Lewicki and Bunker (1996) highlight the different ways in which confident positive expectations of trust are established. The climate of trust that was evident in our case study indicated a high level of knowledge-based trust. Team members reported strong confidence in each other's predictability, dependability, and reliability. This confidence requires considerable information about each other across different situations. The deep interpersonal relationships and understanding that had emerged made it possible to develop this kind of trust. The early establishment of integrative working practices and the open communication climate enhanced the development of a shared notion of trust that included members who did not have prior experience in working with any of the others. This starting condition of a high level of trust was, in line with Zand's (1972) spiral reinforcement model, further reinforced by behavior that confirmed their expectations and predictions. High trust levels may also have contributed to the development of commitment among team members early on. Research has shown that trust is a major determinant of commitment (e.g. Costa and Anderson, 2011). Further, project commitment has been found to be positively related to team performance (Hoegl et al., 2004). Early commitment is particularly important in projects as committed team members are likely to sustain their motivation irrespective of external circumstances throughout the project (Tremblay et al., 2015).

Our findings also shed some light on the ongoing debate about whether temporary organizations are unique or repetitive (Engwall, 2003). Prior ties, where project team members continue to work together across different projects, can be considered repetitive action. This provides evidence for the context dependency of projects, with both unique and repetitive activities.

Trust is particularly important in temporary project teams in the construction industry, as was claimed earlier. The mutual interdependency of these cross-functional teams makes the process of defining tasks clearly challenging, and members must interrelate to a great extent to achieve the project outcomes. The ability of a temporary project team to execute a project successfully relies on the team's ability to integrate the relevant knowledge, expertise, and skills that are distributed among the project team members. Moreover, this integration of the capabilities in the team depends on the way they work together and their interpersonal relationships, such as trust. Our results are in line with Jassawalla and Sashittal's (1998) findings that trust acted as a strong cohesive force, increasing

cross-functional collaboration in the team. The presence of positive relationships from the beginning can serve as an integrating mechanism and facilitate coordination of the project team. Social integration and coordination are important, as they facilitate interaction and thereby encourage the development of trust (Grandori and Soda, 1995). Without social integration, the project team can remain fragmented and unable to work together effectively. Blame cultures with mistrust and adversarial relationships may be the result (Baiden et al., 2006). Mechanisms that foster the integration of work and different disciplines into a cohesive unit are of pivotal importance for project success.

Taken together, our findings indicate that positive prior ties enhance a high level of trust and thus create conditions for a good start to the project. It is at the beginning of the project that many of the premises for how the work will be conducted are developed. Decisions and experiences in the beginning can have a tremendous impact on the whole course of the project. A good start lays the foundation for a good continuation of the project and contributes to team members' satisfaction and commitment, helping them stay for the whole project period. We argue that trust is a determining factor for cross-functional integration and that positive prior ties can create good conditions for early trust and integration in the project.

6.1. Limitations

Our study represents an important contribution to research into work in temporary project teams by providing insights into how prior ties affect the way in which teams function and how trust is developed. However, we must put forward a word of caution, as this study is restricted to a single project from a single organization and, consequently, is limited to the context of this organization and the particular local conditions. As noted earlier, case studies are a particularly good method for understanding underlying complex, social processes (Yin, 2003) such as trust, but this obviously presents inherent limitations to generalizability. Although formal generalization is not the aim of this study, there are some limitations in the use of a single case study. In addition, this study mainly focused on interviews as data sources and did not make use of extensive triangulation of methods. Triangulation provides multiple perspectives on issues and allows for cross-checking of interpretations. To remedy this lack, member checking was conducted as a way of ensuring the trustworthiness of the study. We must also acknowledge that there might be factors in the project teams contributing to the findings, such as team composition in terms of personality and trust propensity and other compositional factors, which might affect trust development. Nevertheless, the findings reflect the team members' attributions about how prior ties influenced the work in the project team.

In spite of the limitations outlined above, we argue that the single case study allowed us to undertake an in-depth examination of the influence of prior ties on trust development in a cross-functional project team.

6.2. Implications and future research

Project teams are a prevalent fact of organizational life today, and advances in understanding how prior ties between team members can influence trust development should be valuable to project organizations and project managers of such organizational settings. This research finds that positive prior ties can have a substantial effect on trust development, and thus that their existence is of great importance to take into account when staffing projects in order to create good conditions for successful teamwork. Project staffing that pays attention to prior relationships can thereby create some stability and a long-term basis for team member interaction. If some team members have positive prior ties from previous collaborations, this could provide opportunities to obtain trust in the early phases of the project. Moreover, as suggested by McKnight et al. (1998), early trust is essential, as it appears to be an important contributor to future trust.

Our study show how *positive* prior ties can influence work in a temporary organizational setting. However, there might also be several instances where *negative* prior experiences between participants can affect the work in project teams as well. Thus, being aware of the nature of the relationship is essential when studying the effects of prior ties in temporary systems. Future research should therefore explore how negative experiences can affect project work and how to overcome such undesirable effects. As noted earlier, Poppo et al. (2008) suggest that trust is based on positive past interactions and favorable expectations of future relationships, a combination of the shadow of the past and the shadow of the future. We have focused on the effects of prior relations, or the shadow of the past; we did not specifically concentrate on the participants' expectations of future interactions. In such project work, team members often have little influence on their selection and the project staffing typically opts for the optimal composition of professions and availability of team members. Nevertheless, future research could also include team members' expectations of future interactions when examining trust development in temporary organizational settings.

7. Conclusion

Our research question addressed how prior ties between team members influence trust development in cross-functional project teams, and we have focused on trust within project teams. We have conducted research using a single case from a large construction company, considering cross-functional teams experiencing uncertainties and a high level of time pressure. Our study shows that positive prior ties can have a substantial effect on the development of trust at the beginning of the project. However, we lack evidence of the effect of negative prior ties, and future research should explore how negative experience can affect project work. Our findings suggest that positive prior ties between team members seem to stimulate early trust formation and integration within the team through their effect on central team processes. We identify these team processes as the early establishment of integrative work practices,

development of a common philosophy, open communication, clear role expectations, and a shared climate of trust within the team. The prior ties made it easier to be vulnerable and communicate freely, and thus to establish common norms and good team practices. In addition, prior ties were positively associated with explicit role expectations, which improved the working practice and increased the level of trust. Hence, this study underlines the effect of positive prior ties in creating favorable conditions for early integration of the team, the development of trust, and obtaining a good start to the project.

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Paper II

Buvik, M. P., & Tvedt, S. D. (2016). The impact of commitment and climate strength on the relationship between trust and performance in cross-functional project teams: A moderated mediation analysis. *Team Performance Management*, *22*, 114–138.

Paper III

Buvik, M. P., & Tvedt, S. D. (2017). The influence of project commitment and team commitment on the relationship between trust and knowledge sharing in project teams. *Project Management Journal, 48*, 5–21.

PAPERS

The Influence of Project Commitment and Team Commitment on the Relationship Between Trust and Knowledge Sharing in Project Teams

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ABSTRACT

The purpose of the study is to enhance our understanding of the relationship among trust, commitment, and knowledge sharing in project teams. We examine how trust directly and indirectly affects knowledge sharing. We include two different foci of commitment that are highly relevant to project teams: team commitment and project commitment. A mediation analysis is conducted on data from 179 project team members in 31 Norwegian construction project teams. Our results suggest different effects of the two foci of commitment, indicating that, in a project team context, project commitment is more important for knowledge sharing than team commitment.

KEYWORDS: trust; knowledge sharing; commitment; project teams; construction industry

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INTRODUCTION

Knowledge is considered a key organizational resource (Nonaka & Takeuchi, 1995), and the effective sharing of knowledge is critical to an organization's success (Argote, Ingram, Levine, & Moreland, 2000; Mueller, 2014). Knowledge sharing is especially important in a project setting where people work together and interact closely to perform temporary tasks (Nesheim & Hunskaar, 2015). Knowledge sharing occurs regarding expert knowledge, relevant experiences, and information among project team members, which can lead to enhanced project performance (Liu, Keller, & Shih, 2011). How people feel about one another can be a critical determinant of knowledge sharing because the sharing of knowledge is a social phenomenon that involves interpersonal relationships and social interactions (Chowdhury, 2005). Two of the most prominent relational factors that influence individuals' behaviors in organizations are trust and commitment (Morgan & Hunt, 1994). Indeed, trust has been recognized as a key factor affecting knowledge sharing in teams (Andrews & Delahaye, 2000; Holste & Fields, 2010; McEvily, Perrone, & Zaheer, 2003), and several studies have found a positive relationship between commitment and knowledge sharing (Hislop, 2003; Swart, Kinnie, van Rossenberg, & Yalabik, 2014; Van den Hooff & De Leeuw van Weenen, 2004).

Trust is often viewed as a critical factor in the development of effective teamwork (Webber, 2008) and is recognized as a key factor contributing to project success (Wong, Cheung, Yiu, & Pang, 2008). However, there is limited research on the impact of different trust dimensions on knowledge sharing in a project environment (Ding, Ng, & Cai, 2007; Maurer, 2010). Therefore, the objective of this study is to examine how trust may promote knowledge sharing in a project team setting. Project teams typically perform defined, specialized tasks within a definite time period; are cross-functional; and disband after the project ends (Sundstrom, McIntyre, Halfhill, & Richards, 2000). Chiocchio (2015) highlights the fact that project teams have varied knowledge, expertise, and experience and that these teams must acquire and pool vast amounts of information across boundaries. It is of pivotal importance for project team members to share their diverse knowledge in order to establish mutual understanding and effective collaboration (Zhang & Ng, 2012), and thus, to promote project performance (Robinson, Carrillo, Anumba, & Al-Ghassani, 2005). The relationship between trust and knowledge sharing has drawn researchers' attention in recent years (Koskinen, Pihlanto, & Vanharanta,

2003), but little research has addressed potential mediators between trust and knowledge sharing (Ding, Ng, & Li, 2014). Some mixed findings on the relationship between trust and knowledge sharing exist (e.g., Bakker, Leenders, Gabbay, Kratzer, & van Engelen, 2006; Ozlati, 2015), and more research is needed to identify and investigate the potential mechanisms through which trust may influence knowledge sharing (Chowdhury, 2005; Mayer & Gavin, 2005; Renzl, 2008; Wang & Noe, 2010). Commitment has been associated with successful project outcomes (Chan, Ho, & Tam, 2001; Leung, Chong, Ng, & Cheung, 2004) and may be related to the effects of trust on knowledge sharing. Prior studies suggest that trust is a major determinant of commitment to a relationship (Costa & Anderson, 2011; Ferres, Connell, & Travaglione, 2004), and we predict that commitment may play an important role in influencing the relationship between trust and knowledge sharing in project teams. Few studies on commitment have been conducted on project teams, and our knowledge of how different foci of commitments influence knowledge sharing is limited (Tremblay, Lee, Chiocchio, & Meyer, 2015). In this study, we explore two different foci of commitment that are highly relevant to project teams: team commitment and project commitment. Whereas team commitment pertains to the project team as a social entity, project commitment relates to the task at hand.

The overall aim of the study is to enhance our understanding of the relationship among trust, commitment, and knowledge sharing within a project team context. More specifically, our study provides a detailed examination of how trust directly and indirectly, through different foci of commitment, affects knowledge sharing. The concept of trust is complex and multidimensional (Costa & Anderson, 2011); nevertheless, trust is often considered a one-dimensional concept in research on its relationship to knowledge sharing (Bakker et al., 2006). Similarly, knowledge sharing is a multifaceted construct and can, in a project team context, be conceptualized in terms of team members' actual knowledge sharing behaviors, as well as the shared perceptions and norms of knowledge sharing, which constitute the knowledge sharing climate within the team. We conceptualize trust as a multidimensional concept, including propensity to trust and trustworthiness, and we investigate its direct or mediated relationship to both knowledge sharing behavior and knowledge sharing climate. We examine these questions with data from 31 project teams in the Norwegian construction industry. The construction industry is a key example of a project-based sector in which the complexity and temporal nature of work may create challenges for managing project knowledge (Zhang & Ng, 2012).

Theoretical Foundations

Knowledge Sharing in Project Teams

Knowledge can be defined in diverse ways; we follow Bartol and Srivastava (2002) when they consider knowledge in organizations to include information, ideas, and expertise relevant for tasks performed by individuals, teams, work units, and the organization as a whole. Knowledge is typically classified into two categories: explicit and tacit (Nonaka, 1994; Polanyi, 1966). Although explicit knowledge is regarded as knowledge that can be articulated and systematically stored, tacit knowledge reflects an individual's know-how and experiences, which are more difficult to imitate, acquire, and share. We define knowledge sharing as the exchange of explicit and tacit knowledge relevant to the task (Lee, Gillespie, Mann, & Wearing, 2010); it involves communication, interaction, and the implicit coordination of expertise about who knows what within the group (Cohen & Bailey, 1997; Faraj & Sproull, 2000). The sharing of tacit knowledge may be crucial for task completion and group performance (Yang & Farn, 2009). We conceptualize knowledge sharing as a team-level behavior, and we therefore assume that the nature of social relations within the team will affect knowledge sharing.

Though knowledge sharing can be operationalized in several ways, we focus on two related dimensions that are considered essential within a project team setting: knowledge sharing behavior and knowledge sharing climate. In this study, knowledge sharing behavior refers to the specific action of transferring or disseminating knowledge that is particularly relevant in a (construction) project team context, whereas knowledge sharing climate denotes the shared perceptions, expectations, and norms of behavior regarding the sharing of knowledge that exist within the project team (Anderson & West, 1998).

The ability to share knowledge between units has been shown to contribute significantly to the performance of organizations (Argote et al., 2000). Knowledge sharing is also positively associated with team performance (Choi, Lee, & Yoo, 2010; Lee et al., 2010; Van der Vegt & Bunderson, 2005; Wang & Noe, 2010) and project performance (Liu et al., 2011). Knowledge sharing is of particular importance in project-based work. The construction sector is a prime example of a project-based industry, and is one of the multidisciplinary domains in which collaboration and relationships among related parties are of utmost importance (Pektasx & Pultar, 2006). In construction projects, team members possess valuable knowledge that can be shared and applied throughout the construction process (Zhang & Ng, 2012). Construction teams must utilize diverse knowledge and create new knowledge in order to meet strict requirements and constraints, and to fulfill changing needs (Fong, 2003). These teams are typically cross-functional, composed of team members from various functional units who possess specialized knowledge and skills relevant to the completion of projects (Ghobadi & D'Ambra, 2012; Holland, Gaston, & Gomes, 2000). This variety makes the team capable of conducting multiple activities simultaneously and is thus advantageous for

accomplishing complex non-routine tasks (Hambrick, Cho, & Chen, 1996). However, to benefit from this variety, project teams must integrate their capabilities; thus, knowledge sharing is a key mechanism by which variety may promote project performance. Without the effective sharing of knowledge, a project may suffer from coordination problems, leading to unsuccessful collaborations (Herbsleb & Moitra, 2001). Further, accumulated knowledge throughout a project can be irretrievably lost if it is not shared among project team members and other project stakeholders. However, knowledge sharing within project teams can be a complex task and a challenging process (Sethi, Smith, & Park, 2001). These teams sometimes consist of members who are working together for the first time, and for a limited period of time. They may also lack a shared social context as a result of differences in professional and functional affiliations. These factors may inhibit the knowledge sharing process. Further, team members might be reluctant to share their knowledge (Ipe, 2003) because knowledge is their primary source of value and sharing may potentially weaken this value (Alvesson, 1993). This might cause team members to guard their knowledge and reduce their willingness to engage in knowledge sharing.

Trust and Knowledge Sharing

Knowledge sharing in a team context is likely to be influenced by team members' beliefs and feelings about one another, particularly their trust in one another (Lee et al., 2010). According to Whitener, Brodt, Korsgaard, and Werner (1998), teams require more trust because of their interdependent tasks. In a project setting, interdependence is high, and team members must rely on one another for task performance, thus making trust particularly important.

Most scholars recognize that trust is a complex and multidimensional construct (Costa & Anderson, 2011; Kramer, 1999; Mayer, Davis, & Schoorman, 1995; Rousseau, Sitkin, Burt, & Camerer, 1998). Many definitions exist, but scholars seem to agree that trust includes "positive" or "confident" expectations about another party, and a "willingness to accept vulnerability" in the relationship, under conditions of interdependence and risk (e.g., Bigley & Pearce, 1998; Kramer, 1999; Lewicki, Tomlinson, & Gillespie, 2006; Mayer et al., 1995; Rousseau et al., 1998). Propensity to trust and trustworthiness have been the two most common measured components of trust and constitute formative indicators of the higher-order construct (trust) (Costa & Anderson, 2011). Costa and Anderson (2011) contended that in a team setting, trust can be conceptualized as a latent construct based on an individual's own propensity to trust others and on the perceived trustworthiness of the other team members, which then leads to behaviors of cooperation and monitoring among team members. In line with Bakker et al. (2006), we retain only the formative indicators of trust in order to examine how trust relates to (knowledge sharing) action. The propensity to trust is referred to as a general willingness to trust others (Rotter, 1980); in teams, this propensity is likely to influence, and be influenced by, other team members (Costa & Anderson, 2011). Trustworthiness, which is defined as the extent to which individuals expect others to uphold and behave according to their claims, has both cognitive and emotional grounds (McAllister, 1995), and develops from perceptions and information regarding competence, benevolence, and integrity (Mayer et al., 1995).

A vast amount of research has suggested that trust facilitates knowledge sharing (e.g., Andrews & Delahaye, 2000; Connelly & Kelloway, 2003; Holste & Fields, 2010; Inkpen & Tsang, 2005; Levin & Cross, 2004; McEvily et al., 2003; Zand, 1972). According to Dirks and Ferrin (2001), trust encourages knowledge sharing by increasing the disclosure of knowledge to others and by granting others access to one's own knowledge. In this way, trust affects knowledge sharing from the perspectives of both the knowledge sender and receiver (McEvily et al., 2003). Knowledge that comes from a trusted teammate is perceived as reliable, and people are more inclined to accept such knowledge at face value. Trust may also enhance knowledge sharing because it reduces our inclination to monitor others and to safeguard ourselves. People are better able to both acquire and share knowledge if they do not anticipate harmful consequences of doing so. Conversely, if team members do not perceive one another as capable and trustworthy, they are less likely to accept one another's knowledge. Moreover, distrust is associated with knowledge-hiding behaviors (Connelly, Zweig, Webster, & Trougakos, 2012).

Social exchange theory (Blau, 1964) is commonly used to explain how trust relates to knowledge sharing. Social exchange refers to voluntary actions that are motivated by expected returns and actual returns. Knowledge sharing is largely a voluntary behavior with uncertain rewards (Davenport & Prusak, 1998). Because trust is one of the underlying percepts of an effective social exchange, it may also affect knowledge sharing behaviors (Staples & Webster, 2008). When team members trust one another, they will be more sensitive to their colleagues' needs and more willing to help them; hence, social exchange will be more likely to take place. As a result, team members will be more likely to engage in the sharing of knowledge without hoarding (Wu, Hsu, & Yeh, 2007).

Commitment and Knowledge Sharing

Commitment has been recognized as an important variable in explaining knowledge sharing (Van den Hooff & De Leeuw van Weenen, 2004). A majority of the literature on commitment examines commitment to an organization, and the typology that has received the most research attention is the three-component model of organizational commitment proposed by Allen and Meyer (1990). They identified three

different forms of commitment: affective (emotional attachment, a desire to remain), normative (the felt obligation to remain), and continuance (the need to remain because of loss of investments or lack of alternatives). When commitment to the organization is affective in nature, members experience strong emotional attachments to, and personal identification with, the goals and values of the organization (Allen & Meyer, 1990). This type of commitment is further linked to individuals' willingness to commit extra effort to their work, and can therefore be expected to be related to knowledge sharing. Indeed, studies have found affective organizational commitment to be positively associated with knowledge sharing (Hislop, 2003; Jarvenpaa & Staples, 2001; Lin, 2007; Van den Hooff & De Leeuw van Weenen, 2004). Van den Hooff and De Leeuw van Weenen (2004), for example, found that employees with greater organizational commitment were more willing to donate and receive knowledge.

Research has shown that employees identify more closely, and feel more committed, to their work group than to the organization as a whole (Riketta & van Dick, 2005); however, there is a lack of studies on commitment to teams in general (Neininger, Lehmann-Willenbrock, Kauffeld, & Henschel, 2010). Nevertheless, some such studies exist, and these have found that commitment to the team may lead to greater knowledge sharing (Chang, Yen, Chiang, & Parolia, 2013; Swart et al., 2014). Team commitment can be understood as the relative strength of team members' involvement and identification with the team (Bishop & Scott, 2000). When team commitment is high, team members value the relationship, and they are willing to exert effort to maintain it and make it work. The interests and goals of the team become important, giving team members a sense of responsibility to help one another (Chang et al., 2013). This feeling of obligation may make them more willing to provide relevant and useful knowledge to the team.

In a project setting, people may have multiple foci of commitments: team commitment, project commitment, professional commitment, organizational commitment, and so on. Few studies on commitment have been conducted on project teams, and our knowledge of how different foci of commitments influence knowledge sharing is limited (Tremblay et al., 2015). In this study, we focus on two different foci of commitment: project team commitment (team commitment) and project commitment. Whereas team commitment pertains to the project team as a social entity, project commitment relates to the task at hand. Moreover, project commitment can be characterized by the acceptance of and strong belief in the goals and values of the project, the willingness to engage in the project, and the desire to maintain membership in the project (Hoegl, Weinkauf, & Gemuenden, 2004).

Commitment is likely to influence team members' efforts, and has been associated with enhanced team performance (Hackman, 1990; Hoegl et al., 2004; McDonough, 2000). In a project context, a recent study by Ehrhardt, Miller, Freeman, and Hom (2013) demonstrated that project commitment significantly predicts team performance in cross-functional product development teams. By identifying with the team and the project, team members can be expected to see themselves as responsible not only for their own performance, but for the overall outcomes of the project. Conversely, if team members are not committed to the project, they will most likely not exert the level of effort necessary for project success. Within the context of construction projects, studies have shown that the commitment of team members is critical to the timely completion of projects (Iyer & Jha, 2006), and a successful outcome (Chan, Ho, & Tam, 2001; Leung et al., 2004). For a project to succeed, team members from different disciplines and organizational departments must work collaboratively, set aside competing interests, and commit to the goals of the project (Ehrhardt et al., 2013; Sethi & Nicholson, 2001). To be able to interact and share knowledge effectively in such a setting, team members must be motivated to do so. We will argue that this motivational element can be found in team members' commitment. When team members are committed to the team and/or the project, their feeling of affiliation is broadened and they will feel responsible for the outcomes of the project. The sharing of knowledge assumes that team members are willing to contribute to a common goal, and we therefore expect both foci of commitment to be positively related to knowledge sharing in project teams.

Trust, Commitment, and Knowledge Sharing

As we have seen, both trust and commitment are recognized as key antecedents of knowledge sharing. However, how these two concepts relate to knowledge sharing is less clear from earlier research. Though many studies report a positive effect of trust on knowledge sharing, some mixed evidence also exists (Bakker et al., 2006; Ozlati, 2015). Chow and Chan (2008), for example, found that social trust did not play a direct role in sharing knowledge. Further, Bakker et al. (2006) found that team membership and team-level characteristics, such as team size and team tenure, are more important than trust in explaining knowledge sharing. In their study of new product development teams, they did not find trust to be a main driver of knowledge sharing, and they posit that the absence of trust has a greater effect on knowledge sharing than its presence. In their view, trust is merely a condition for knowledge sharing, not a motivator. This leads to the question of whether the relationship between trust and knowledge sharing is direct or mediated.

Trust is a major determinant of commitment to a relationship (Costa & Anderson, 2011; Costa, Roe, & Taillieu, 2001; Ferres et al., 2004; Morgan & Hunt, 1994). When trust within the team is high, and team members perceive one another as

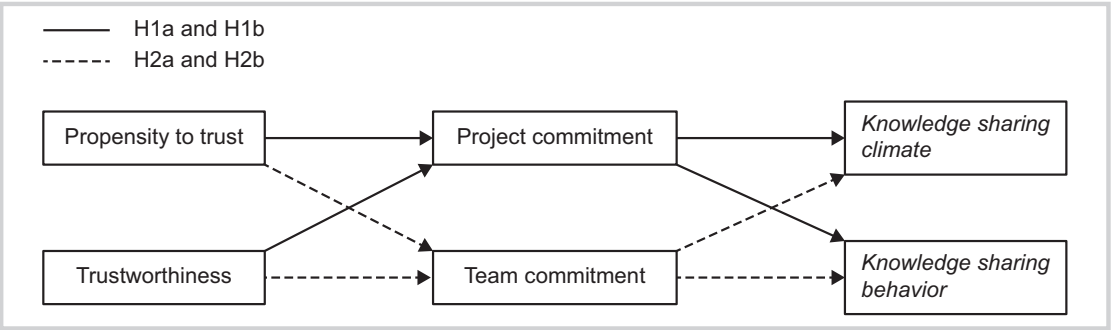

Figure 1: Hypotheses.

competent, honest, and benevolent, team members should be motivated to form an attachment to the team and identify with the team's goals and values, thus enhancing team commitment. Regarding project commitment, team members' confidence in their teammates may increase the willingness of team members to commit themselves to making a project successful (McDonough, 2000). By contrast, if team members lack confidence in their teammates and feel that their fellow team members are not competent enough to complete the required tasks, they may not be willing to exert the effort and energy necessary for project success. Thus, we assume that team trust will be positively related to project commitment. This corresponds to previous research on goal commitment suggesting that individuals will be more likely to commit to a task when they believe a positive outcome is attainable (Klein, Wesson, Hollenbeck, & Alge, 1999). When team members trust one another and work within a climate of cooperation, they may also perceive the likelihood of project success to be greater. As a result, team members would be expected to develop stronger project commitment and ultimately take on greater attachment to the superordinate goals of the project team.

As noted above, commitment has been positively associated with knowledge sharing (Hislop, 2003; Swart et al., 2014; Van den Hooff & De Leeuw van Weenen, 2004), and we therefore predict that commitment to the team and to the project plays an important role in influencing the relationship between trust and knowledge sharing in project teams. More specifically, we predict that the relationship among trust (as measured by the two formative dimensions of propensity and trustworthiness), knowledge sharing behavior, and knowledge sharing climate will be positively mediated by team commitment and project commitment. Specifically, we hypothesize the following in the context of project teams (see Figure 1 for illustrations):

H1a: *The relationship between the propensity to trust and trustworthiness and knowledge sharing climate will be positively mediated by project commitment.*

H1b: *The relationship between the propensity to trust and trustworthiness and knowledge sharing behavior will be positively mediated by project commitment.*

H2a: *The relationship between the propensity to trust and trustworthiness and knowledge sharing climate will be positively mediated by team commitment.*

H2b: *The relationship between the propensity to trust and trustworthiness and knowledge sharing behavior will be positively mediated by team commitment.*

Method

Procedure and Sample

The study was conducted in four large construction companies in Norway. The researchers contacted the companies and selected project teams to participate in the study. The project teams came from independent projects within the four construction companies, thus representing different projects. All project team members' email addresses were provided to the researchers and the questionnaires were distributed and data collected electronically via an online survey platform. Project team members identified which projects they belonged to, so that grouping of respondents belonging to the same project team was possible. Prior to the dispatching of the questionnaire, the respondents received an email with an invitation to participate in the survey, including information about data protection and confidentiality, and about the study itself.

A total of 184 team members from 34 project teams participated in the study, providing an overall response rate of 77%. Three project teams were excluded from the sample because they consisted of two or fewer participants. The remaining teams (31) ranged from 3 to 10 members, with an average of 5.7 individuals per team. Of the 179 team members, 154 (86%) were male. Age was evenly distributed, with 95% of the sample being ages 20 to 60: 19.6% were 20 to 29, 27.4% were 30 to 39, 20.7% were 40 to 49, 26.8% were 50 to 59, and 5.6% were 60 or over. The project teams in this study are what Chiocchio (2015) refer to as *core project teams*, that is, teams responsible for the overall

integration of the project and for the planning, controlling, and closing of the project. Being responsible for the project, core project teams consist of members who are highly knowledgeable and experienced, and who are moderately heterogeneous in terms of knowledge distribution. Most of the project teams (67%) were sampled during the execution phase of the project.

Measures

The measures were given on a seven-point scale, ranging from 1 ("completely disagree") to 7 ("completely agree"). In order to insure the accuracy of the translation we used a back-translation approach (Brislin, 1970) where all measures first were translated into Norwegian and then translated back to English.

Trust was measured using trust scales, propensity to trust, and perceived trustworthiness, as developed and validated by Costa and Anderson (2011). Propensity to trust refers to a general willingness to trust others and is commonly viewed as a dispositional trait (Costa & Anderson, 2011). This was measured using a six-item scale (Cronbach's alpha = 0.864). One example of an item is: "In this team most people stand behind their convictions." Perceived trustworthiness refers to the extent to which individuals expect others to be and behave according to their claims (Costa & Anderson, 2011), and was measured using a six-item scale (Cronbach's alpha = 0.860). An example of an item is: "In this team people can rely on one another."

Team commitment was measured using five items from Allen and Meyer's (1990) affective commitment scale (Cronbach's alpha = 0.900), adapted to the team level per Van der Vegt and Bunderson (2005). Affective commitment concerns "identification with, involvement in, and emotional attachment to the organization (*project team*)" (Allen & Meyer, 1996, p. 253). An example of an item is: "I feel a strong sense of belonging to the project team."

Project commitment was measured using a five-item scale (Cronbach's alpha = 0.933) developed by Hoegl et al. (2004). The items addressed how positively team members related to the overall project and its objectives. An example of an item is: "Our team feels fully responsible for achieving the common project goals."

Knowledge sharing was measured with items derived from two existing measures. The first four items (Cronbach's alpha = 0.909) measured knowledge sharing behavior and were adopted from Zhang and Ng (2012) and adjusted to the team level. These items measured the team's knowledge sharing behavior with reference to Ma, Qi, and Wang's (2008) description of knowledge involved in construction project teams. An example of an item from this index is: "In this team we share project knowledge with one another." The second measure of knowledge sharing focuses on more tacit types of knowledge, such as ideas and expertise, and is called knowledge sharing climate. It captures the team's perception of the shared norms and practices of knowledge sharing within the team. The measure consists of five items (Cronbach's alpha = 0.871), and is derived from Connelly and Kelloway's (2003) scale. An example of an item is: "People in this team share their ideas openly."

Common Method Variance

Procedural remedies were undertaken to minimize common method variance (CMV), such as clearly separated sections with instructions provided to respondents, in order to maximize the salience of the referent in questions and emphasize confidentiality, reducing the potential bias in survey response as a result of social desirability, demand characteristics, and so forth. In addition, to check for the severity of CMV, Harman's single-factor test was performed for all variables included in the study. Because of sample size limitations, this test was performed utilizing exploratory factor analysis in IBM SPSS 23.0. For the analyses including propensity to trust, 21 items were subjected to principal axis factoring. The Kaiser-Meyer-Olkin was above the requested threshold at 0.632, and the Bartlett's test of sphericity reached statistical significance. A five-factor solution explained 81.1%, whereas a one-factor solution explained 45.9%. For the analyses including trustworthiness, 21 items were also subjected to principal axis factoring. The Kaiser-Meyer-Olkin was above the requested threshold at 0.612, and the Bartlett's test of sphericity reached statistical significance. A five-factor solution explained 82.8%, whereas a one-factor solution explained 49.6%. These results indicate that common method variance is within acceptable limits (Podsakoff, MacKenzie, & Podsakoff, 2012).

Aggregation

The unit of analysis is the team level and, thus, interrater agreement is necessary to justify aggregation to the team level. The variables propensity to trust, perceived trustworthiness, project commitment, knowledge sharing behavior, and knowledge sharing climate all assumed a referent-shift consensus model (Chan, 1998), meaning that the item referent is directed toward the team as a whole. The definitions of these constructs are collective in nature even though they are being assessed at the individual level. Rather than asking team members about their own individual perceptions, referent-shift incorporates the group as a whole. In contrast, the team commitment variable assumed a direct consensus model (Chan, 1998) with the item referent directed toward the individual. This is because this construct resides in individuals' owns perceptions and feelings and individual team members form their own perceptions of how committed they are to the team. Both forms of models assume that group members share a common perception and that a certain level of agreement within the team is necessary to justify aggregation to the team level. Within-unit agreement was assessed for all measures

prior to aggregation by the within-group agreement index (James, Demaree, & Wolf, 1984). When multiple judges rate a single target on a single variable using an interval scale of measurement, within-group agreement may be assessed using the r_{wg} index, which defines agreement in terms of the proportional reduction in error variance. This index can further be extended to the multi-item $r_{wg(j)}$ index (LeBreton & Senter, 2008). A common rule of thumb suggests that values should be equal to or greater than 0.70 to justify aggregation (Lance, Butts, & Michels, 2006; LeBreton, Burgess, Kaiser, Atchley, & James, 2003). All measures had acceptable mean values greater than 0.70: propensity to trust ($r_{wg(j)} = 0.93$), perceived trustworthiness ($r_{wg(j)} = 0.90$), team commitment ($r_{wg(j)} = 0.84$), project commitment ($r_{wg(j)} = 0.94$), knowledge sharing behavior ($r_{wg(j)} = 0.89$), and knowledge sharing climate ($r_{wg(j)} = 0.91$).

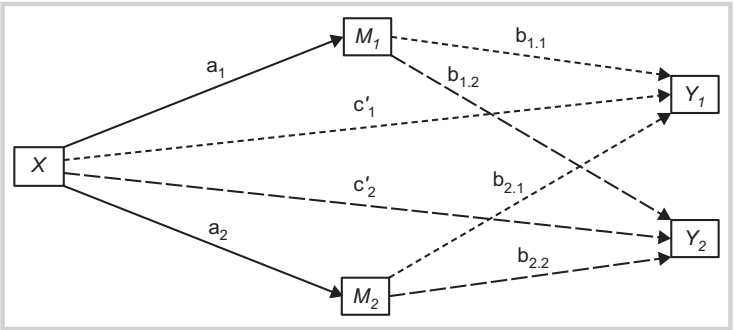

Figure 2: Conceptual model for the mediation models as reported in Tables 2 and 3. The predicted variables and their corresponding coefficients are performed in separate regressions, indicated in the model with different line styles. Constant coefficients, denoted i_{Mk} and i_{Yk} in the tables are not represented in the figure.

Data Analysis

All descriptive statistics were computed with IBM SPSS 23.0. The hypotheses were tested with the process macros developed by Hayes (2013) through IBM SPSS 23.0. The macros are based on standard ordinary least squares (OLS) regression (see Figure 2 for a conceptual model). As demonstrated by Preacher and Hayes (2004), this macro produces a test that is more rigorous than that of Baron and Kenny (1986) and at the same time avoids the bias of the Sobel (1982) approach. Preacher and Hayes (2004) achieved this by employing a bootstrapping procedure. Bootstrapping works by basing inferential procedures on concrete sampling distribution from the sample at hand, rather than traditional sampling distribution created by a hypothetical infinite number of samples from the population of interest (Efron, 1982). The concrete sampling distribution thus reflects the distribution of the sample, rendering the assumption of normality superfluous, and allows the testing of mediators on small samples ($N > 25$) (Preacher & Hayes, 2008). A bootstrap sample of 10,000 was drawn (with replacement) and used for analysis of the mediation model.

Results

Descriptive Results

Descriptive results and the correlational matrix of the aggregated sample for all variables included in the mediation tests are listed in Table 1. As is evident from the correlation matrix, most variables are moderately to strongly correlated on a 0.001 significance level, except team commitment, which only correlated to project commitment and knowledge sharing climate.

Tests of Hypotheses

The results pertaining to the hypotheses testing are presented in Tables 2 and 3. All the hypotheses entail mediations, and the conceptual model for the regressions involved are given in Figures 3 and 4, along with annotations for the variables and coefficients used in Tables 2 and 3.

H1a posited that the relationship between the propensity to trust and trustworthiness and knowledge sharing climate will be positively mediated by project commitment. The indirect effect statistic of Table 2 fully supported H1a; however, because the direct effect of perceived trustworthiness (c'_1) remains

Variable	Abbreviation	*M*	*SD*	1	2	3	4	5	6
Propensity to trust	(X_1)	5.37	0.44	—					
Trustworthiness	(X_2)	5.41	0.48	0.66***	—				
Project commitment	(M_1)	5.95	0.50	0.63***	0.71***	—			
Team commitment	(M_2)	5.44	0.51	0.22	0.26	0.50***	—		
Knowledge sharing	(Y_1)	5.91	0.43	0.64***	0.72***	0.80***	0.41*	—	
Knowledge behavior	(Y_2)	5.52	0.56	0.58***	0.65***	0.76***	0.32	0.63***	—

*$p < 0.05$ **$p < 0.01$ ***$p < 0.001$

Table 1. Correlational matrix for all study variables with mean and standard deviation.

The Influence of Commitment on the Trust-Knowledge Sharing Relationship

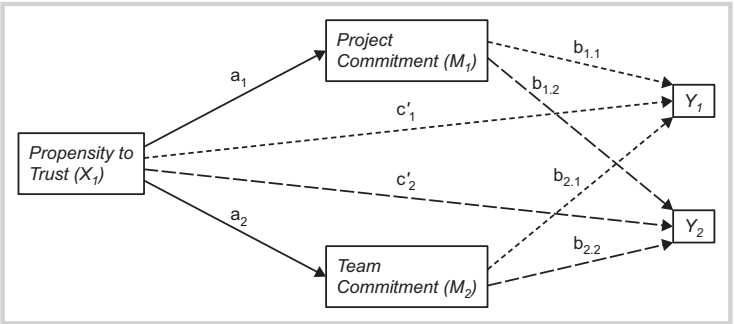

Figure 3: Conceptual model for the mediation models as reported in Table 2. The predicted variables and their corresponding coefficients are performed in separate regressions, indicated in the model with different line styles. Constant coefficients, denoted i_{Mk} and i_{Yk} in the table are not represented in the figure as they only have technical statistical interest.

significant after controlling for the indirect effects, the mediation is only partial for this variable.

H1b posited the same mediational relationship regarding knowledge sharing behavior as an outcome variable. The indirect effect statistics supported H1b; hence, the mediations here are full. The results for H1a/b are supported by the significance of the regression model for M1 and Y1 and Y2 in both tables, as well as the significance of coefficients a1, and b1.1 and b1.2 in both tables. Coefficient a1 in model M1 supports the path from propensity to trust to project commitment, and coefficients b1.1 in model Y1 and b1.2 in model Y2 support the path from project commitment to knowledge sharing climate and behavior, respectively, controlled for the direct paths c'1 and c'2 from propensity to trust to knowledge sharing (climate and behavior).

H2a correspondingly postulated that the relationship between propensity to trust and perceived trustworthiness and knowledge sharing climate will be positively mediated by team commitment. H2a was not supported, as indicated by the indirect effect statistic of Table 3. H2b, which posited the same mediational relationship regarding knowledge sharing behavior as an outcome variable, was also not supported, as indicated by the indirect effect statistic of Table 3. The lack of support for H2a/b can be seen by the

	Project Commitment (M_1)		Team Commitment (M_2)	
	Coeff.	**95% CI**	**Coeff.**	**95% CI**
Propensity to trust (X_1)	$a_1 \rightarrow$ 0.709*** (0.162)	0.377, 1.040	$a_2 \rightarrow$ 0.254 (0.209)	−0.174, 0.682
i	$i_{M1} \rightarrow$ 2.141* (0.875)	5.802, 6.091	$i_{M2} \rightarrow$ 4.080** (1.128)	1.774, 6.387
Sum.	$R^2 = 0.397$, F (1.29) = 19.053***		$R^2 = 0.048$, F (1.29) = 1.473	
	Knowledge Sharing Climate (Y_1)		**Knowledge Sharing Behavior (Y_2)**	
	Coeff.	**95% CI**	**Coeff.**	**95% CI**
Propensity to trust (X_1)	$c'_1 \rightarrow$ 0.234 (0.141)	−0.056, 0.524	$c'_2 \rightarrow$ 0.210 (0.202)	−0.204, 0.623
M1	$b_{1.1} \rightarrow$ 0.539*** (0.141)	0.249, 0.829	$b_{1.2} \rightarrow$ 0.753*** (0.202)	0.340, 1.167
M2	$b_{2.1} \rightarrow$ 0.040 (0.110)	−0.185, 0.265	$b_{2.2} \rightarrow$ −0.052 (0.156)	−0.373, 0.269
i	$i_{Y1} \rightarrow$ 1.226 (0.711)	−0.234, 2.685	$i_{Y2} \rightarrow$ 0.199 (1.014)	−1.883, 2.280
	$R^2 = 0.666$, F (3.27) = 17.964***		$R^2 = 0.590$, F (3.27) = 12.948***	

Bootstrap Results for Indirect Effects

	Knowledge Sharing Climate (Y_1)				Knowledge Sharing Behavior (Y_2)			
Indirect effect	***M***	***SE***	**LL 95%**	**UL 95%**	***M***	***SE***	**LL 95%**	**UL 95%**
M_1	0.382**	0.156	0.130	0.723	0.534**	0.223	0.173	1.069
M_2	0.010	0.033	−0.030	0.123	−0.013	0.055	−0.225	0.049

*$p < 0.05$ **$p < 0.01$ ***$p < 0.001$. a_k = the direct effect of X on M_k. i_{Mk} = the direct effect of the constant on M_k. c'_k = the direct effect of X on Y. b_k = the direct effect of M on Y. i_{Yk} = the direct effect of the constant on Y.

Table 2. Regression results for the propensity to trust mediation model. Unstandardized OLS regression. Coefficients with confidence intervals (standard errors in parentheses) estimating project commitment, team commitment, knowledge sharing climate, and knowledge sharing behavior.

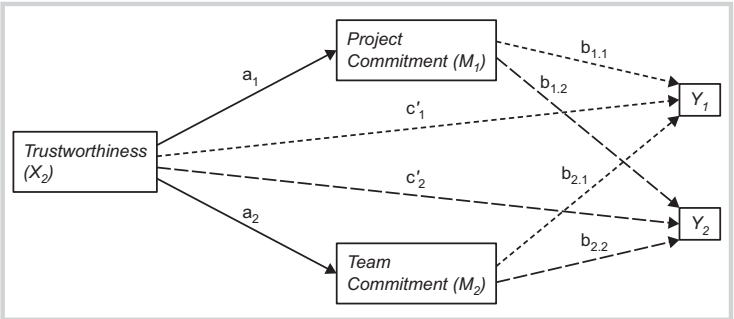

Figure 4: Conceptual model for the mediation models as reported in Table 3. The predicted variables and their corresponding coefficients are performed in separate regressions, indicated in the model with different line styles. Constant coefficients, denoted i_{Mk} and i_{Yk} in the table are not represented in the figure as they have only technical statistical interest.

absence of a statistically significant regression model for M2 and coefficients a2, b2.1, and b2.2 in both tables. Coefficient a2 in model M2 does not support the path from propensity to trust to team commitment, and coefficients b2.1 in model Y1 and b2.2 in model Y2 also do not support the path from team commitment to knowledge sharing climate and behavior, respectively, controlled for the direct paths c'1 and c'2 from propensity to trust to knowledge sharing (climate and behavior).

Discussion

This study was undertaken to enhance our understanding of the relationship among trust, commitment, and knowledge sharing within a project team context. Specifically, our research aimed to investigate whether the relationship between trust and knowledge sharing is direct or mediated by team and project commitment.

Our prediction that the relationships between propensity to trust and perceived trustworthiness, and knowledge sharing behavior and knowledge sharing climate are positively mediated by project commitment was supported. As expected, project commitment, which is a belief in the goals at hand and willingness to engage in the project, fully mediated propensity and perceived trustworthiness on knowledge sharing behavior, as well as propensity on knowledge sharing behavior, whereas perceived trustworthiness on knowledge sharing climate was only partially

	Project Commitment (M_1)		Team Commitment (M_2)	
	Coeff.	**95% CI**	**Coeff.**	**95% CI**
Trustworthiness (X_2)	$a_1 \rightarrow$ 0.735*** (0.137)	0.456, 1.014	$a_2 \rightarrow$ 0.278 (0.191)	−0.114, 0.669
i	$i_{M1} \rightarrow$ 1.974* (0.741)	0.459, 3.489	$i_{M2} \rightarrow$ 3.943** (1.039)	1.819, 6.067
Sum.	$R^2 = 0.500$, F (1.29) = 28.982***		$R^2 = 0.068$, F (1, 29) = 2.107	
	Knowledge Sharing Climate (Y_1)		**Knowledge Sharing Behavior (Y_2)**	
	Coeff.	**95% CI**	**Coeff.**	**95% CI**
Trustworthiness (X_2)	$c'_1 \rightarrow$ 0.296* (0.140)	0.010, 0.583	$c'_2 \rightarrow$ 0.270 (0.202)	−0.145, 0.685
M1	$b_{1.1} \rightarrow$ 0.464** (0.149)	0.157, 0.771	$b_{1.2} \rightarrow$ 0.683** (0.217)	0.238, 1.127
M2	$b_{2.1} \rightarrow$ 0.049 (0.107)	−0.170, 0.268	$b_{2.2} \rightarrow$ 20.044 (0.155)	−0.360, 0.274
i	$i_{Y1} \rightarrow$ 1.279 (0.656)	−0.066, 2.624	$i_{Y2} \rightarrow$ 0.239 (0.951)	−1.711, 2.190
	$R^2 = 0.685$, F (3.27) = 19.568***		$R^2 = 0.560$, F (3.27) = 13.495***	

Bootstrap Results for Indirect Effects

	Knowledge Sharing Climate (Y_1)				Knowledge Sharing Behavior (Y_2)			
Indirect effect	***M***	***SE***	**LL 95%**	**UL 95%**	***M***	***SE***	**LL 95%**	**UL 95%**
M_1	0.341**	0.150	0.077	0.676	0.502**	0.164	0.206	0.815
M_2	0.014	0.033	−0.031	0.116	−0.012	0.450	−0.178	0.043

*$p < 0.05$**$p < 0.01$***$p < 0.001$. a_k = the direct effect of X on M_k. i_{Mk} = the direct effect of the constant on M_k. c'_k = the direct effect of X on Y. b_k = the direct effect of M on Y. i_{Yk} = the direct effect of the constant on Y.

Table 3. Regression results for the trustworthiness mediation model. Unstandardized OLS regression coefficients with confidence intervals (standard errors in parentheses) estimating project commitment, team commitment, knowledge sharing climate, and knowledge sharing behavior.

mediated. This suggests that perceived trustworthiness has a direct effect on knowledge sharing climate, as well as an indirect effect through project commitment; however, the direct effect is rather small compared to the mediated effect. Contrary to our expectations, the results did not confirm the mediation of team commitment on the same relationships.

The findings suggest that the impact of trust on knowledge sharing is more complex than previous literature indicates, and can explain why some equivocal results on the relationship between trust and knowledge sharing exist (Ozlati, 2015). Moreover, our findings suggest that the different dimensions of trust affect knowledge sharing somewhat differently. Trust propensity only influences knowledge sharing (both knowledge sharing behavior and knowledge sharing climate) through project commitment, whereas perceived trustworthiness has a small direct impact on knowledge sharing climate. These findings suggest that when team members consider their team colleagues trustworthy—that is, believe them to be competent, honest, and reliable—they also view the knowledge sharing climate more positively. As we have seen, knowledge sharing climate pertains to the perceptions, expectations, and norms regarding the sharing of knowledge within the team, and includes tacit types of knowledge such as ideas and expertise. As noted above, trust may be of particular importance for the sharing of tacit knowledge, as it reduces the perceived uncertainty and risk associated with the sharing of this kind of knowledge (Nonaka & Takeuchi, 1995). Our findings are, thus, in line with previous studies that have found trust to be a significant predictor of the sharing of tacit knowledge (Foos, Schum, & Rothenburg, 2006; Holste & Fields, 2010).

Bearing in mind that the direct effect of trustworthiness on knowledge sharing climate is small, our findings give us reasons to believe that the effects of the formative indicators of trust on knowledge sharing are mostly indirect, and are conveyed through project commitment. This supports previous studies that have shown the same indirect effect of trust on performance through project commitment (Buvik & Tvedt, 2016). Although causality cannot be determined, our findings indicate a positive association between trust and commitment, suggesting that the higher the level of trust there is within the team, the more committed team members are to the project. This engagement, again, is associated with higher levels of knowledge sharing.

This study contributes to the literature in two important ways. The primary contribution is its demonstration of the mediating role of project commitment between team trust and team knowledge sharing. As we have seen, the literature has linked trust to commitment (Costa & Anderson, 2011; Morgan & Hunt, 1994), and commitment has further been found to facilitate knowledge sharing in teams (Chang et al., 2013; Swart et al., 2014). The findings correspond with Morgan and Hunt's (1994) Commitment-trust theory, claiming that when individuals trust others, they will be more committed to maintaining their relationship and be more likely to attach and involve themselves in activities such as sharing of knowledge. Our study indicates that confidence in their teammates seems to increase team members' willingness to commit to the project and share their knowledge. This parallels with research on goal commitment, suggesting that people are more willing to commit to a task when they believe a positive outcome is achievable (Klein et al., 1999). Team members may perceive the chances of project success to be greater when they believe that their fellow team members are competent and trustworthy, and thus develop stronger commitment to the project, which again makes them more willing to share their knowledge and contribute to the overall project goal.

Our finding regarding the mediated relationship between trust and knowledge sharing corresponds to a recent study of knowledge sharing in design project teams by Ding et al. (2014). They tested the parallel mediation of team-based self-esteem and team identification between trust and knowledge sharing and found that the relation between affect-based trust and knowledge sharing is completely mediated by team-based self-esteem and team identification. Although Ding et al. (2014) did not study commitment per se, identification and commitment are considered closely related (Riketta & van Dick, 2005).

Supplementing the findings of Ding et al. (2014), our results add nuance to the traditional view that trust has a direct effect on knowledge sharing. Though many studies have suggested a direct relationship between trust and knowledge sharing (e.g., Holste & Fields, 2010), others have not found this relationship (Bakker et al., 2006; Chow & Chen, 2008). As our findings suggest, the effect of trust on knowledge sharing in a project team setting is mainly indirect, rather than direct. This aligns with Bakker et al.'s (2006) doubt about the importance of trust as a main driver and motivator of knowledge sharing. They argued that trust has the greatest effect on knowledge sharing when it is absent, and that it does not have a positive effect on knowledge sharing per se. Our findings support the notion that trust is a condition, but not necessarily a sufficient motivator, for knowledge sharing within a project setting. The strong indications of the mediating effects of project commitment show that team members need to be motivated by their belief in the project goals, as well as their willingness to engage in the project. High project commitment makes team members more motivated to exert the effort and energy needed for project success, including sharing knowledge with other team members.

The second important contribution of this study is the finding regarding the different effects of the two foci of commitment on the relationship between

trust and knowledge sharing. By simultaneously studying team commitment and project commitment as mediators, we expand our understanding of how different foci of commitment relate to the relationship between trust and knowledge sharing. As noted above, our results showed no mediation of team commitment. This finding was contrary to our expectations; we predicted that both foci of commitment would have an effect on the relationship between trust and knowledge sharing. Findings from research on the related concept of cohesion in project teams may shed some light on our findings. Cohesion is typically divided into task and social cohesion (Chiocchio & Essiembre, 2009), with task cohesion corresponding to a group's shared commitment to the group task (Hackman, 1976) and social cohesion referring to the shared liking of and attraction to the group (Evans & Jarvis, 1980). Tremblay et al. (2015) proposed that social cohesion is commitment to people, and task cohesion is commitment to the task, resembling our concepts of team commitment and project commitment. Based on Chiocchio and Essiembre's (2009) meta-analysis on cohesion and performance, Tremblay et al. (2015) suggested that the social aspect of committing to the project team might be as or even more important to project performance than the task-specific focus of committing to the project. They argued that although team members who are more committed to the project may be more likely to be only task-oriented and focused on achieving the objectives of the project, team members who are more committed to the team would be more likely to engage in socially oriented behaviors that would benefit their team, such as organizational citizenship behaviors. Our results differ from Tremblay et al.'s (2015) proposal, and clearly show the primacy of project commitment over team commitment in relation to knowledge sharing. This is more in line with previous studies that have shown task cohesion to be more strongly linked to team performance than social cohesion (Carless & De Paola, 2000; Mullen & Copper, 1994). Scholars have suggested that task and social cohesion may play different roles depending on the outcome examined (Kozlowski & Bell, 2003), and Picazo, Gamero, Zornoza, and Peiró (2014) demonstrated that social cohesion plays a more important role in other types of effectiveness indicators, such as team members' satisfaction. In a project team setting, task cohesion would be expected to emerge before social or interpersonal cohesion because project teams often focus on task concerns, whereas relational aspects are considered a secondary concern (Keyton, 2000). Chioccio and Essiembre (2009) suggested that the inherent variety and cross-functionality of project teams may decelerate the emergence of social cohesion and stimulate task cohesion. Indeed, Picazo et al. (2014) found that task cohesion proved to be stronger than social cohesion during the first stages of teamwork in project teams. This implies that task cohesion, and thus project commitment, can be evident at the group level early on, whereas social cohesion, or team commitment, may take longer to emerge as an effective predictor of project team outcomes. Furthermore, a note on the context of construction projects is warranted here. The construction industry is predominantly an engineering culture, where we would expect task commitment to be stronger than the more affective commitment to the group. Additionally, another explanation for lack of influence of team commitment might be found in the way teams are composed in a project setting. Construction project teams may consist of team members who share a history of collaboration, or they may comprise strangers who have never worked together before. Moreover, some team members may change during the course of the project, and there is no guarantee that they will work together again in the future, making them less inclined to develop relationships with other team members (Groenenboom, Wilke, & Wit, 2001).

Practical Implications

One of the most important tasks of project management is managing the people who will do the work of the project—namely, the project team. Thus, several practical implications for project managers can be drawn from the present study. First, our findings suggest that the development of trustful relationships among team members should be encouraged. This, again, can result in an increased feeling of commitment to the project. These relationships can enable and foster the sharing of knowledge within the team, which can contribute to project success. Though our findings suggest that trust can, to some extent, affect knowledge sharing in project teams directly, our results imply that we need to go beyond trust building among team members and look to develop a strong sense of commitment to the project among project team members. Even though trust alone shows small direct effects on knowledge sharing, this does not suggest that trust should be ignored. Trust is important in itself, and without it, commitment to the project is unlikely to occur. If team members trust their colleagues and have confidence in their abilities, they may be more willing to commit themselves and exert the effort necessary to make the project successful. Thus, trust needs to be developed and cultivated within a project team setting. This can be done by engaging team members in collaborative processes and providing opportunities for team members to demonstrate their individual competency. Project commitment can be fostered by continually emphasizing the overall project objectives and highlighting the importance and dependence of all team members' contributions to reaching these goals.

The direct and indirect roles that trust plays in promoting knowledge sharing also suggest that managers should consider team composition when staffing project teams. A recent

study found that positive prior ties among project team members can have a substantial effect on trust development (Buvik & Rolfsen, 2015), suggesting that team composition should be taken into account when staffing projects in order to create good conditions for early team trust. If project teams have low levels of trust, managers should take proper actions to improve trust levels; project commitment will follow.

An interesting implication of the different results of project commitment and team commitment is that project commitment appears to be a better predictor of knowledge sharing. Whether this is a particularity of project teams with technically oriented engineers remains to be seen, and should be the subject of future research; however, it suggests that the belief in and identification with the goals of the project takes priority over social cohesion in affecting knowledge sharing. Overall, our findings suggest that relational aspects in project teams are of great importance and should be given more attention by project members, managers, and others concerned with successful project outcomes.

Limitations and Future Research

Though it provides promising contributions to the literature, the present study is subject to some limitations. First, some caution should be taken on the comparison between team commitment and project commitment. These constructs are not necessarily measured in terms of the same commitment constructs, as team commitment reflects affective commitment and project commitment shows more resemblance with normative commitment. Second, although the majority of the project teams were sampled during the execution phase of the project, we did not control for project phase in the analysis. We recognize that it is possible that the phase of the project could have some implications regarding the need for knowledge sharing and the level of project commitment. Some methodological limitations also deserve attention. A word of caution is necessary in relation to the limitations of OLS regression analyses, which cannot test the causality of the modeled structures, meaning that the directions of relationships given in the models cannot be taken for granted. In our study, trust is treated as an antecedent of knowledge sharing. Though this complements existing approaches (Lee et al., 2010; Usoro, Sharratt, Tsui, & Shekar, 2007), alternative causal directions have been suggested, and reciprocal effects are also probable. For instance, there could be a reciprocal or reversed effect of knowledge sharing and dimensions of trust. We also acknowledge that there might be alternative models explaining the influences of commitment on the relationship between trust and knowledge sharing, and we recommend that future research should be designed to test the causal and dynamic relationship among trust, commitment, and knowledge sharing. Further, the present study suffers from being limited to cross-sectional data. Despite noteworthy questioning of the accuracy of a cross-sectional approach for assessing mediation (Maxwell & Cole, 2007; Maxwell, Cole, & Mitchell, 2011), most studies involving mediation have used cross-sectional data (Mitchell & Maxwell, 2013). An apparent shortcoming of cross-sectional design is its lack of temporal ordering of variables, and longitudinal studies incorporating the time dimension may be a more appropriate design for studying mediation. Longitudinal studies, however, should not be regarded as a blanket solution, or as both necessary and sufficient, because simply ordering variables according to time does not in itself guarantee that conclusions regarding causation can be reached in nonexperimental studies (Shrout & Bolger, 2002). Likewise, following project teams over time would be more challenging, considering the temporal nature of these teams, and the potential dropout in such studies could decrease the sample size and, thus, their statistical power. Cross-sectional designs are clearly more efficient in this sense. Nevertheless, we cannot conclude with certainty the causal effect of the significant mediation relationships in our study. However, the directions of causation in our results followed theoretical reasoning and findings from previous research, supporting our model.

The current study also relied exclusively on self-reporting measures and may suffer from common method bias, despite undertaking certain procedural remedies (Podsakoff et al., 2012); however, according to Spector (2006), the automatic inflation of correlations as a result of CMV reported in the literature is an oversimplification verging on urban legend. Nevertheless, CMV can produce biased results and should be taken seriously (Antonakis, Bendahan, Jacquart, & Lalive, 2010). To address this issue, we conducted the widely used Harman's single-factor test, which suggested that common method bias is not a major limitation in this research (Podsakoff et al., 2012). In accordance with the above cautions, future research should test the models on other samples and in combination with data other than self-reports. It is also important to test the models in longitudinal and multilevel studies, in order to shed more light on the causal nature and possible reciprocal relationship across time and different levels. In addition, future research should test the nature of the relationship between project commitment and team commitment to explain knowledge sharing and other project outcomes. Task duration and familiarity among team members may also impact the development of both foci of commitment, and should be considered in future studies.

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