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Does Cohesion Predict Knowledge Sharing in Cross-Functional Work Groups? A Multilevel Approach

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Abstract

The aim of this study was to investigate whether task and/or social cohesion can predict knowledge sharing in cross-functional work groups. Norwegian employees working in cross-functional work groups (N = 425) completed an online survey measuring perceived task and social cohesion and the culture for knowledge sharing within their work groups. We empirically tested our hypotheses using hierarchical linear modeling. The results indicated that task cohesion significantly and positively predicted knowledge sharing in cross-functional work groups at both group and individual level of analysis. Social cohesion significantly and positively predicted knowledge sharing at individual level, however, not at group level. Implications and suggestions for future research are discussed.

Content

1.0 Introduction

It is argued that knowledge is an organization's only sustainable advantage in today's fast-pacing, competitive and increasingly global market (Civi, 2000; Jackson, Chuang, Harden, & Jiang, 2006; Reid, 2003). In fact, as much as 75 percent of a company's worth is due to employees' expertise, information, and skills (Civi, 2000). It is what employees know, and what they do with their knowledge that is the most valuable and strategic resource to ensure enduring competitive advantage (Civi, 2000). As knowledge will have limited effect on organizational performance unless it is shared (Nonaka & Takeuchi, 1995), it is only when knowledge flows effectively between group members that organizations best could take advantage of the human capital that resides in a company (Mohamed, Stankosky, & Murray, 2004). It has, indeed, been argued that an organizations' success depends on employees' ability to share knowledge successfully and efficiently (Ghobadi & D'Ambra, 2012). Furthermore, knowledge sharing has been found to increase group performance and efficiency, innovation, firm revenue, sales growth, as well as to reduce production costs (Arthur & Huntley, 2005; Bantel, 1993; Bantel & Jackson, 1989; Collins & Smith, 2006; Cummings, 2004; Hülsheger, Anderson & Salgado, 2009; Lin, 2007; McDonough, 2000; Mesmer-Magnus & DeChurch, 2009; Reid, 2003). Based on these benefits, it is highly valuable for companies to promote and utterly utilize knowledge sharing and it is, thus, of interest to identify and understand factors that facilitate and hinder the sharing of knowledge (Huang & Newell, 2003; Khoza & Pretorius, 2017; Mooradian, Renzl, & Matzler, 2006).

The competitive and intensifying market bring about unexpected threats and extreme changes, as well as increasingly complex and ambiguous challenges (Daily, Kieff, & Wilmarth, 2014; Reid, 2003). In order to respond to these new demands, companies are increasingly using interdisciplinary collaboration. Such collaboration can best be utilized when employees from different functional areas share their unique knowledge, skills, and ideas with each other, enabling cross-fertilizations of ideas (Hambrick, Cho, & Chen, 1996; Cummings, 2004). As sharing of diverse expertise allow work groups to go beyond the cognitive capabilities of each individual employee, the organization become able to respond more actively to new and complex demands (Szulanski, 2000).

However, the existing literature on knowledge sharing reveal that the more functional diverse a group is, the less knowledge is shared (Bunderson &

Sutcliffe, 2002; Lasalewo, Subagyo, Hartono, & Yuniarto, 2016). It is, therefore, of interest to understand how to enhance knowledge sharing in functional diverse groups. Indeed, Cheung, Gong, Wang, Zhou, and Shi (2016) expressed a need for further research to investigate group affective factors that could trigger knowledge sharing in functional diverse groups, and proposed cohesion as such a potential factor. This need is further emphasized by Wang and Noe (2010), claiming that there is a lack of studies examining group cohesion and diversity in relation to knowledge sharing. Since previous research has suggested that high degree of cohesion towards a common goal and other group members are positively related to knowledge sharing (Hirunyawipada, Beyerlein, & Blankson; 2010, Nahapiet & Ghoshal, 1998; Reagans & McEvily, 2003; Zaccaro, Gualtieri, & Minionis, 1995), task and social cohesion may be significant conditions in which knowledge sharing is facilitated in functional diverse groups. Thus, we ask the following: Does cohesion positively predict knowledge sharing in cross-functional work groups?

The main purpose of this thesis is to contribute with empirical evidence to fill the gap in the research literature on group diversity and knowledge sharing, as well as to provide insight into cohesion, functional diversity and knowledge sharing from a multilevel perspective. These constructs have by researchers been claimed to be group phenomena (Choo, 2003; Dion, 2000; Gully, Devine, & Whitney, 2012; Litvin, 1997), however, few have treated it accordingly in research. We therefore find it valuable to use a multilevel approach to investigate cohesion and knowledge sharing in cross-functional groups.

The presented problem formulation will be answered throughout this thesis. First, the relevant theoretical framework of functional diversity, knowledge sharing, and task and social cohesion will be expounded, and our hypotheses will be presented. In the following method section, we will present how the hypotheses were tested. Further, results from our analyses will be discussed and assessed in relation to previous research, and methodological limitations and suggestions for future research will be presented. Lastly, implications of our findings and a conclusion of our study will be outlined.

2.0 Theory

2.1 Cross-functional work groups

People from diverse backgrounds with subsequently diverse human capital are increasingly interacting in the workplace (Mor Barak, 2013). Actively dealing with diversity has, therefore, become an important part of managing organizations. In order to do this effectively, organizations need to understand how to best manage and utilize the potential resources provided by a diverse workforce (Jackson, May, & Witney, 1995). Mannix and Neale (2005) mention three approaches commonly used to understand how diversity affects processes and outcomes in organizations. Whereas *Similarity Attraction Theory* (explaining that group members attract individuals with the same attributes, attitudes, and values), and *Social Identity and Self-Categorisation theories* (explaining consequences of diversity through individuals' social identity) can explain the potential negative effects of diversity in organizations, *information processing or problem-solving approaches* have been used to explain the positive effects. According to the latter view, diversity increase access to different types of information, knowledge, and perspectives, which ultimately result in better solutions and more thorough information processing in a company (Mannix & Neale, 2005). In today's market, increasingly more companies apply this positive approach to diversity and structure their workforce in groups based on diverse functional backgrounds, known as cross-functional teams (Nasta, Pirolo, & Wikstrom, 2016; Parker, 2003). Such work groups have, in fact, become the most favorable group design for many companies (Denison, Hart & Kahn, 1996; Swamidass & Aldridge, 1996).

According to Forsyth (2010), cross-functional teams can be defined as "individuals with different backgrounds and areas of expertise who join together to develop innovative products and identify new solutions to existing problems" (pp. 353-354). Cross-functional teams can be characterized in several ways and may differ in their *purpose or goal*, varying from, among other, system and product development to problem-solving. Further, they can differ in *duration*, ranging from temporary to more permanent teams (Parker, 2003). Lastly, they may vary in their *membership*, as they may not only include employees stationed in the organization, but also consultants, suppliers, customers, and others (Parker, 2003). Despite these variations, all cross-functional teams are based on the premise of diversity in functional background.

In this thesis, we will use the term "work group" instead of "team", as the latter term often is associated with dependencies between members (e.g. Cohen & Bailey, 1997), which we do not explicitly take into account.

2.1.1 Conceptualization of functional diversity

Functional diversity has been conceptualized in various ways in the field of organizational psychology (Bunderson & Sutcliffe, 2002; Harrison & Klein, 2007). Bunderson and Sutcliffe (2002) emphasize the importance of proper conceptualization and measures of functional diversity in studies, as the previous unconscious use of different conceptualizations have resulted in contradicting observed effects. This has further been supported by Harrison and Klein (2007), who suggested a new typology of within-unit diversity to sharpen researchers' predictions, findings, and theoretical discussions. They proposed three different types of diversity, which vary in their substance, pattern, operationalization, and most likely their effects. The first type, *separation*, address "differences in position or opinion among unit members" (Harrison & Klein, 2007, p. 1200), and reflect different views, attitudes, or values between the members. *Disparity,* as another type, represent "differences in concentration of valued social assets or resources such as pay and status among unit members" (Harrison & Klein, 2007, p.1200). Lastly, *variety* concerns **"**differences in kind or category, primarily of information, knowledge, or experience among unit members" (Harrison & Klein, 2007, p. 1200). According to Harrison and Klein (2007), diversity as variety is based on the assumptions that members within units differ qualitatively from each other (e.g., in their functional background), as well as in the distribution of categories. Additionally, differences in the relative spread between units are usually positively related to vital unit consequences (Harrison & Klein, 2007). Moreover, as illustrated by Figure 1, groups may have different degrees of variety and can vary from minimum, moderate, to maximum variety. While groups with minimum variety consist of members from the same category, units with maximum variety consist of members from unique categories.

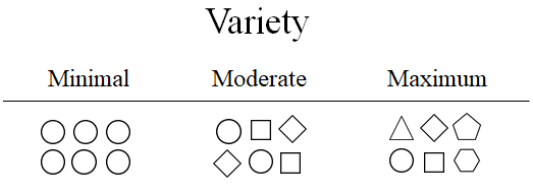

Figure 1: Illustration of functional diversity as variety. Based on the illustration by Harrison and Klein (2007)

In in light of Harrison and Klein's (2007) typology, functional diversity as variety is the most suitable conceptualization for this study. Therefore, when referring to functional diversity or cross-functional groups in this thesis, we allude to diversity as variety, ranging from minimal to maximum variety.

2.1.2 Benefits of cross-functional work groups

Cross-functional groups have been related to multiple benefits both at the individual, group, and organizational level. At the individual level, research has proposed that working in cross-functional groups positively influence individuals' learning and professional development (Edmondson & Harvey, 2017). Furthermore, a work group's access to miscellaneous perspectives, knowledge, and skills will have various positive group outcomes, such as increased group performance (Zhou, Vredenburgh & Rogoff, 2015). In fact, in their meta-analysis, Joshi and Roh (2009) found that functional diversity is the aspect of diversity that has the strongest positive effect on group performance. At the organizational level, functional diversity has been related to increased innovation (Bantel and Jackson, 1989; Hülsheger, et al., 2009), performance benefits (Edmondsen & Harvey, 2017), as well as more effective development and greater quality of new products (Forsyth, 2010; Kessler & Chakrabarti, 1996). These numerous benefits make it intriguing to expand our insight into cross-functional work groups.

2.2 Knowledge sharing

Knowledge is "the awareness of what one knows through study, reasoning, experience or association, or through various other types of learning" (McInerney, 2002, p. 1009), and is said to be a firm's most valuable resource (Liebeskind, 1999). Knowledge may provide a competitive advantage in an increasingly dynamic economy (Hendriks, 1999; Ipe, 2003; Kogut & Zander, 2003), as it incorporates intangible assets and routines that are difficult to imitate (Liebeskind, 1999). Managing knowledge has, therefore, become a critical factor for organizational success. Since knowledge sharing is the fundamental means through which employees can contribute to knowledge application (Jackson et al., 2006), organizations need to consider how to transfer expertise and knowledge among the employees to better exploit and capitalize on knowledge-based resources that reside in an organization (Damodaran & Olphert, 2000; Davenport & Prusak, 1998; Hinds, Patterson, & Pfeffer, 2001). In fact, knowledge would most likely have limited effect on organizational performance unless it is shared within work groups and, thus, amplified and internalized into the groups'

knowledge base (Nonaka & Takeuchi, 1995; Van Knippenberg, De Dreu, & Homan, 2004).

Knowledge sharing refers to the sharing of information, expertise, ideas, and perspectives among group members (Cummings, 2004; Wah, Menkhoff, Loh & Evers, 2007, cited in Cheung et al., 2016), and can occur via written correspondence or face-to-face communications through networking, documenting, organizing or capturing knowledge from other experts (Cummings, 2004; Pulakos, Dorsey, & Borman, 2003). The term *sharing,* thus, implies a conscious act in which individuals convert their knowledge into a form that can be used and understood by others (Andrews & Delahaye, 2000; Ipe, 2003). This entails that the knowledge becomes available to others within the organization, and the sharing of knowledge would, therefore, provide a link between individual knowledge and organizational value (Hendriks, 1999). By allowing employees to discuss different viewpoints and, thus, to establish a common understanding of the problem at hand, knowledge sharing will lead to an agreement on which task to focus on, and what possibilities there are for improvement (Cheung et al., 2016). It is, thus, when individuals with different knowledge collaborate synergistically, and share experiences and perspectives that may contradict their own, that the organization could experience competitive advantage from diverse group members (Boland & Tenkasi, 1995; Cheung et al., 2016).

2.2.1 Advantages of sharing knowledge

Previous research indicates that knowledge sharing has multiple benefits for individuals and groups in organizations, as well as for organizations as a whole. Cerne, Jaklic, and Škerlavaj (2013) found that knowledge exchange in the organization predicts management innovation. This finding is supported by Hülsheger and colleagues' (2009) meta-analysis, which revealed that sharing of information and ideas is considerable and positively related to innovation. Indeed, Ghobadi and D'Ambra (2012) proposed that knowledge sharing in cross-functional projects is a key to project success and innovation. Additionally, Yang (2007) found in his study that knowledge sharing may amplify the capabilities that reside in a company and that it could facilitate organizational effectiveness. Furthermore, he argued that sharing of knowledge could work to prevent loss of knowledge value, known as knowledge depreciation. Since knowledge depreciation has multiple negative effects, such as decreased level of productivity, reduction of customer satisfaction, inaccurate strategic behavior, to mention a few

(Argote, 2012), it is important for individuals to share their knowledge in order to retain and intensify the value of their knowledge. Communicating information, best practices, experiences, insights, as well as common and uncommon sense is further argued to enhance organizational performance (von Krogh, 2002), and to contribute to organizational learning (Andrews & Delahaye, 2000; Yang, 2007).

2.2.2 Predictors of knowledge sharing

The mentioned advantages emphasize the importance of sharing knowledge among group members, as well as to identify ways to promote and facilitate sharing of information, expertise, ideas, and perspectives. Researchers investigating knowledge sharing claims various factors that influence variations in sharing knowledge (Cheung et al., 2016; Ipe, 2003; Khoza & Pretorius, 2017; Lin, Lee, & Wang, 2009; Razmerita, Kirchner, & Nielsen, 2016).

According to Ipe (2003), variations in knowledge sharing is, among other, influenced by whether the knowledge is tacit or explicit in nature. Explicit knowledge is easily articulated, transferred, codified, and stored and is independent of individuals, time, and space (Lam, 2000). It is often impersonal and formal in nature, and often take the form of written text (Nonaka, 1994; Nonaka & Konno, 1998). Explicit knowledge is, therefore, easier to share among individuals than tacit knowledge. Tacit knowledge is the type of know-how knowledge that is acquired through personal experience (Lam, 2000). This type of knowledge cannot be communicated or shared without the holder of the knowledge and is, thus, more difficult to articulate (Ipe, 2003). However, Holste and Fields (2010) state that much of the useful knowledge in organizations may be tacit in nature.

Ipe (2003) further argue that in order for individuals to share their knowledge, they must be motivated to do so. This is supported by Stenmark (2000), who claim that it is necessary that people have a strong personal motivation in order to share their knowledge. The motivation to share can be either internal or external. Internal motivation includes the perceived power of knowledge, as well as the expectation that the sharing of knowledge will be beneficial in itself (Ipe, 2003). External motivation is rather based on relationships, including power, status, and trust between those involved in knowledge sharing, as well as the possibilities for real and perceived rewards (Ipe, 2003).

The culture of the work environment has also been argued to influence knowledge sharing in organizations (Ipe, 2003). This notion is supported by De Longe and Fahey (2000), who claimed that organizations' culture could be a major impediment to knowledge creation, sharing, and use. In fact, McDermott and O'Dell (2001) have argued that it is the culture in the organization that ultimately determines how much knowledge that is shared. Furthermore, the culture may shape assumptions about what type of knowledge is important, it mediates the relationships between the levels of knowledge (organizational, group, and individual), and it may create a context for social interactions (De Long & Fahey, 2000). Culture can also work to shape the creation and adoption of new knowledge (De Long & Fahey, 2000). Based on these arguments, we chose to investigate the culture for knowledge sharing in this study.

Furthermore, as numerous researchers argue that cohesion is positively related to knowledge sharing (Hirunyawipada et al., 2010; Reagans & McEvily, 2003; Tabrizi, 2007; Toh & Srinivas, 2012), and several researchers have urged for more research on cohesion as a potential trigger of knowledge sharing (Cheung et al., 2016; Wang & Noe, 2010), we found it intriguing to look further into this construct.

2.3 Cohesion

For a long time, researchers have focused on the social and motivational forces that exist within groups (Beal, Cohen, Burke, & McLendon, 2003), and related theory has proposed that these forces create bonds, or cohesion, between group members (Forsyth, 2010). Cohesion is a widely studied concept and has been linked to a number of benefits for organizations, such as increased satisfaction, healthier workplace, productiveness, lower turnover, and performance enhancement (Forsyth, 2010).

2.3.1 Conceptualization of cohesion

Even though cohesion is one of the most studied group characteristics (Kozlowski & Ilgen, 2006), and has received a great deal of scientific attention, researchers have not yet agreed upon a common conceptualization or definition of the concept. Some researchers conceptualize cohesion as one unitary construct. For instance, Carron (1982), defined cohesiveness as "a process that reflects a group's tendency to stick together and remain united to reach a common goal" (cited in Kozlowski & Ilgen, 2006, p.88). Others conceptualize cohesion using several dimensions (Kozlowski & Ilgen, 2006). For instance, in 1950, Festinger

proposed that cohesion consists of three facets: member attraction, group activities (i.e., task commitment), and prestige or group pride (cited in Kozlowski & Ilgen, 2006). Similarly, Mullen and Copper (1994) suggested that cohesion comprises three components: interpersonal attraction (social cohesion), commitment (task cohesion), as well as group pride. Even though the three-factor conceptualization of cohesion has been a long-held notion within research on cohesion, later studies have struggled to find support for the component of group pride (Beal et al., 2003). This notion is supported by the recent meta-analyses by Chiocchio and Essiembre (2009), and Castaño, Watts, and Tekleab (2013). In line with these findings, the current study will focus on task and social cohesion.

2.3.2. Task and social cohesion

According to Carless and De Paola (2000), *task cohesion* refers to the extent to which a group is united and committed to achieving a common work task. It involves attraction and loyalty towards the task and activities focused on goal achievement (Ehsan, Mirza, & Ahmad, 2008). In addition to have a "general orientation toward achieving the group's goals and objectives" (Brawley, Carron, & Widmeyer, 1993, p. 248), groups with high levels of task cohesion also tend to be high in collective efficacy (Forsyth, 2010). This entails a shared belief within the group that they can coordinate their actions in a proficient way that will lead to effective goal achievement (Zaccaro, Blair, Peterson, Zazanis, 1995). In this way, it is argued that task cohesion involves a confidence in the group's ability to perform, a shared commitment to the group's objectives, as well as a shared vision for the steps necessary to operate successfully as a unit (Forsyth, 2010; Severt & Estrada, 2015).

Social cohesion, on the other hand, refers to "the nature and quality of the emotional bonds of friendship, liking, caring, and closeness among group members" (MacCoun, 1993, cited in MacCoun, Kier & Belkin, 2006, p. 647). Members of groups with high social cohesion like to spend time together - they enjoy each other's company, feel attracted to one another, and value the relationships and friendships provided by the group (Forsyth, 2010; Lott & Lott, 1965; MacCoun et al., 2006). Social cohesion is essentially the strength of the interpersonal ties between group members (Nakata & Im, 2010). Indeed, Mikalachki (1969) theorized that the social bonds between group members will manifest itself through feelings of emotional affect for the other members, such as trust and liking (cited in Severt & Estrada, 2015).

Both task and social cohesion serve as instrumental roles in groups, as they keep groups intact in an effort to maximize rewards and minimize losses (Severt & Estrada, 2015). In fact, groups without at least some degree of cohesion often dissolve, as members break out of the group (Forsyth, 2010). This instrumental function allows the group to achieve set goals in an effective and united manner (Severt & Estrada, 2015).

2.4 The role of cohesion for knowledge sharing in cross-functional work groups

It is reasonable to assume that organizations that operate with cross-functional work groups would not be able to take advantage of the different and unique expertise if individual group members keep their knowledge private. Group members from different functional areas must share their unique knowledge with one another in order to benefit from the broadened cognitive and behavioral repertoire that resides in a work group. This argument is supported by Cohen and Levinthal (1990), who claim that individuals with different knowledge need to interact in order to enhance the organization's ability to perform.

However, despite the importance of sharing knowledge and expertise in cross-functional work groups, researchers have previously claimed that members in such groups, in fact, fail to share their knowledge with each other (Bunderson & Sutcliffe, 2002; Lasalewo et al., 2016). Both Bunderson and Sutcliffe (2002), and Lasalewo and colleagues (2016) have argued that functional diversity reduces knowledge sharing. This might be due to increased stereotyping and in-group/out-group biases, lack of motivation to share, and perceived costs (Bunderson & Sutcliffe, 2002; Lasalewo et al, 2016). It is, thus, of interest to understand how to make knowledge sharing flourish in functional diverse work groups.

It is argued that cross-functional groups that are cohesive engage in more knowledge sharing (Tabrizi, 2007). More specifically, both social and task cohesion have been related to sharing of knowledge. In terms of *task cohesion*, Zaccaro and colleagues (1995) claim that groups with a high degree of task cohesion experience higher degree of communication and exchange more information than groups with low degree of task cohesion. This is supported by Toh and Srinivas (2012), who found that task cohesion is positively related to a willingness to share information. By emphasizing task cohesion, group members could focus on reaching high-quality decisions and cooperations (Knouse, 2006; De Dreu, Nijstad, & van Knippenberg, 2008). In cross-functional groups,

individuals may experience difficulties to unite multiple perspectives and areas of knowledge. Task cohesion may enhance the willingness to collaborate and interact purposefully to reach the best possible outcomes (Hirunyawipada et al., 2010). Indeed, Hirunyawipada and colleagues (2010) have argued that task cohesion is especially important in functional diverse groups as group members become coordinated towards a common task rather than tasks within their own functional domains. This increased collaboration will alter the interaction between members, leading to enhanced opportunities to transfer task related experiences and perspectives (Hirunyawipada et al., 2010). In this way, task cohesion may be an important condition for facilitating knowledge sharing in cross-functional work groups.

It is also argued that s*ocial cohesion* is positively related to knowledge sharing. According to Nahapiet and Ghoshal (1998), knowledge sharing is facilitated by personal relations and social networks within organizations. This is further emphasized by Reagans and McEvily (2003) who found that social cohesion eases the sharing of knowledge. They argue that the competition and motivational impediments that could arise in groups decreases due to close interpersonal relationships, and group members become willing to commit time and energy to share their knowledge (Reagans & McEvily, 2003). Furthermore, Xue, Bradley, and Liang (2011) argue in their study that group members with high social cohesion will feel obliged to share knowledge due to normative pressure in the group, and knowledge sharing will, hence, increase. In cross-functional work groups, it is, therefore, reasonable to assume that high-quality relationships involving trust and close ties would impair the potential barriers of knowledge sharing that may exist in functional diverse work groups.

As revealed by these findings, both task and social cohesion provide important contributions for understanding variations in knowledge sharing in work groups. It is, therefore, of interest to investigate whether the two dimensions of group cohesion can predict knowledge sharing in cross-functional work groups.

2.5 How and why cohesion works: coopetitive theory as a theoretical framework

To better understand how task and social cohesion could facilitate knowledge sharing in cross-functional work groups, the theory of coopetition may be applied. Coopetitive theory uses the term *coopetition* to describe when *cooperative* and *competitive* behavior exist concurrently (Tsai, 2002), and has

been used to describe when and how knowledge sharing occurs (Ghobadi & D'Ambra, 2012).

As knowledge is regarded as a competitive advantage for the individual knowledge holder, it also implies a position of power for those who possess it (Yang & Wu, 2008). The unique position and personal benefits affiliated with knowledge might, however, be lost by sharing. As a result, "the competitive advantage of knowledge may lead individuals to hoard their perceived important knowledge or to offer incomplete transfer of knowledge" (Ghobadi & D'Ambra, 2012, p. 286). There are also other risks related to sharing, such as the perceived time and effort required to help others understand the communicated information (Reagans & McEvily, 2003). Furthermore, people may worry that they will be criticized or embarrassed for their statements, or that other group members will use their knowledge to free-ride (Bunderson & Sutcliffe, 2002; Edmondson, 1999; Rosendaal & Bijlsma-Frankema, 2015). These sources of tension will, thus, inhibit knowledge sharing among group members, and is considered *competitive* factors. It is reasonable to assume that these competitive risk factors may be especially prevalent in functional diverse work groups. Ghobadi and D'Ambra (2012) have argued that cross-functional competition, indeed, impedes knowledge sharing. Competition among individuals from different functional units with dissimilar functional expertise might occur more frequently, as individuals may feel an urge to defend and/or promote their own functional area. Wasko and Faraj (2000) have, in fact, argued that due to loyalty to one's own functional unit, some individuals may treat knowledge as a private good rather than a public good of the group.

On the other hand, the *cooperative aspect* of knowledge sharing is "the collective use of shared knowledge to pursue common interests" (Tsai, 2002, p. 180) and, thus, involve a collective effort for mutual gain (Luo, 2007). As sharing knowledge is a conscious and voluntary act (Dixon, 2002; Ipe, 2003), it is reasonable to assume that the sharing of knowledge requires individuals to engage in cooperative behavior. In fact, cooperative interaction has been found to enhance knowledge sharing, also across different functional areas (Bengtsson, Eriksson, & Wincent, 2010; Ghobadi and D'Ambra, 2012; Naidoo & Sutherland, 2016). Since cooperation is ruled by trust and a desire to work together (Tjosvold & Deemer, 1981), it may be enhanced by high level of cohesiveness. Indeed, van Woerkom

and Sanders (2010) found in their study that cooperative knowledge sharing is affected by cohesiveness.

The coopetitive theory, hence, demonstrate situations where group members, on the one hand, can be motivated to withhold knowledge due to a desire to obtain personal benefits, while on the other hand, want to share information for the purpose of achieving the work groups' performance goals (Järvinen & Ylinenpää, 2017). Knowledge sharing is, thus, a social dilemma, due to the complex interactions between group members (Ghobadi & D'Ambra, 2012). The coopetitive theory also emphasizes that when cooperation is high and competition is low in cross-functional groups, knowledge sharing will be greatest (Ghobadi & D'Ambra, 2012). Since task and social cohesion may promote cooperative behavior and undermine competition, it is reasonable to assume that cohesion will be positively associated with knowledge sharing in cross-functional work groups.

3.0 Hypotheses

Based on the presented theoretical framework and the way in which task and social cohesion has been suggested to relate to knowledge sharing in functional diverse groups, we hypothesize that:

Hypothesis 1: Task cohesion will positively predict knowledge sharing in cross-functional work groups at (a) group level and (b) individual level

Hypothesis 2: Social cohesion will positively predict knowledge sharing in cross-functional work groups at (a) group level and (b) individual level

We summarize the general model and the two hypotheses tested in this study in Figure 2.

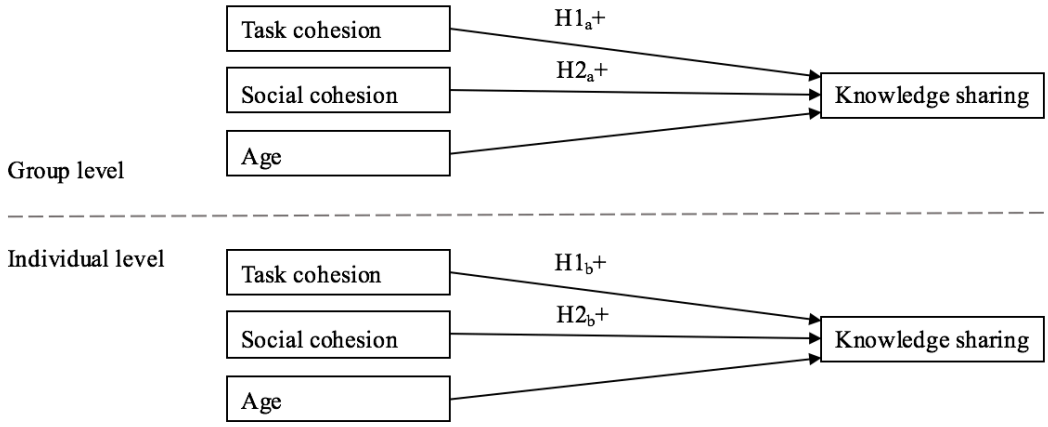

Figure 2: A multilevel research model

4.0 Method

4.1 Design and participants

To investigate whether task and/or social cohesion will positively predict knowledge sharing in cross-functional work groups, we conducted an empirical study with a quantitative design. Before collecting the data, we performed two a priori power analyses, using the statistical power analysis program G*Power, in order to determine the number of work groups that are necessary to achieve a satisfactory sample that will detect an effect with 80 percent confidence, proposed by Cohen (1992). In the first analysis, we used an effect size based on a study conducted by Toh and Srinivas (2011), who found a correlation of .49 between task cohesion and knowledge sharing. The result from the a priori power analysis indicated a requirement of 22 work groups for detecting a medium-sized effect (r = .49), applying a statistical significance criterion of .05. The second analysis was based on results from Reagans and McEvily's (2003) study, which revealed a correlation of .34 between social cohesion and knowledge sharing. The result from the second a priori power analysis indicated a requirement of 49 work groups for detecting a medium-sized effect (r = .34), applying a statistical significance criterion of .05. Maas and Hox (2005) further state that the number of 50 groups are frequently used in organizational research and that this is an acceptable number of groups in practice.

The data in this study was retrieved from 425 participants from 51 work groups within 19 Norwegian companies, operating within several industries ranging from IT to insurance and banking. The companies were recruited based on a desire to capture functional diverse work groups.

4.2 Procedure

In order to uncover work groups that could consider participating in our study, we contacted a total of 293 Norwegian companies. We reached out to either HR employees or the CEO's in the respective companies by telephone or email, who further presented our study for potential team leaders in the company. Further, in dialog with each individual team leader we received information about the size of the work group, the number of functions within the group, as well as the distribution of group members within each functional area. This provided us with the necessary information to later calculate the degree of functional diversity for each work group, as well as to ensure a minimum requirement of three members in each group (van Gompel, 2011). An email with a cover letter and a

unique survey link for each particular work group was then distributed to each accompanying team leader who forwarded this to his/her group members participating in the study. This made it possible to cluster and, hence, separate the data received from the different work groups. The cover letter informed participants that the survey was in line with requirements provided by the Norwegian Centre for Research Data (NSD), in terms of voluntary participation, confidentiality, and that it did not collect any direct identifying information (see Appendix A). The unique links led to a self-report questionnaire in the web-based survey software Qualtrics, measuring demographic variables, knowledge sharing, task cohesion, as well as social cohesion (see Appendix B).

To ensure clarity of the survey questions, we asked a random selection of non-participating employees to complete the survey and give feedback before distributing the survey to the team leaders. Their comments were taken into consideration, and necessary alterations were made.

4.3 Measures

In this study, we measured degree of functional diversity, knowledge sharing, task and social cohesion, as well as age. We measured all constructs using already existing and tested scales.

Functional diversity. To compute the functional diversity of work groups, we calculated Blau's (1977) index of heterogeneity. This is the most commonly used measure of diversity as a variety (Harrison & Klein, 2007), and was originally developed by Simpson in 1949 (Agresti & Agresti, 1978):

$$D = 1 - \sum_{\iota=1}^{k} p_i^2$$

The number of different categories are referred to as k, while p_i represents the proportion of individuals in the ith category/function ($i = 1, \ldots, k$) (Agresti & Agresti, 1978). The value of zero indicates a group that is absolutely homogeneous (e.g. all group members are data scientists), while higher index values up to 1 indicate greater functional diversity (i.e. a group where all members have different functions). However, the maximum value is limited by k (number of categories) and it is only when $k = +\infty$ that the index value can reach 1.0 (Harrison & Klein, 2007). This means that it may be problematic to compare groups with dissimilar number of categories, which in turn can lead to biased results. The group size might also bias the diversity index value, as the maximum possible variety increases with the size of the unit (Harrison & Klein, 2007). Since

our sample consists of a wide range with a number of categories as well as dissimilar work group size, we standardized the measure ensuring an upper limit of 1 regardless of the number of categories and unit size. We, hence, divided *D* by its theoretical maximum value: (*k* - 1)/*k*:

$$I = \left(1 - \sum_{i=1}^{k} p_i^2\right) / (1 - 1 / k)$$
$$= [k / (k - 1)]\, D$$

This measure of *I* is often called the Index of Qualitative Variation (IQV) (Agresti & Agresti, 1978).

Knowledge sharing. Knowledge sharing was measured using Connelly and Kelloways' (2003) five-item scale. It measures each individual employees' perception of the culture for knowledge sharing and is primarily concerned with the sharing of ideas and expertise. A sample item is "People in this team are willing to share knowledge/ideas with others". The response format was a 7-point Likert scale, ranging from 1 = completely disagree, to 7 = completely agree. In our particular sample, the alpha coefficient has a value of .89, indicating high internal consistency. The items were translated from English to Norwegian using a back-translation method (Brislin, 1970) (see Appendix B).

Cohesion. *Task cohesion* was measured using Carless and De Paola's (2000) 4-item scale, which is an adapted version of the Group Environment Questionnaire (GEQ) in order to suit a workplace environment. A sample item is; "Our team members have conflicting aspirations for the team's performance". The response format was a 7-point Likert scale, ranging from 1 = completely disagree, to 7 = completely agree. In our specific sample, the scale has a Cronbach's alpha coefficient of .71, which indicates an acceptable level of internal consistency. *Social cohesion* was measured using Nakata and Im's (2010) 4-item scale, based on Sethi, Smith, and Park (2001), and Zaccaro and McCoy (1988). Minor wording changes were made to adjust for a work group setting. A sample item is; "Members of the team are committed to maintaining close interpersonal relationships". The response format was a 7-point Likert-type scale, ranging from 1 = completely disagree, to 7 = completely agree. In our sample, the scale shows a Cronbach's alpha coefficient at .89, indicating high internal consistency. As with measures of knowledge sharing, the items measuring cohesion were translated

from English to Norwegian using a back-translation method (Brislin, 1970) (see Appendix B).

Control variables. We also included control variables in order to yield more accurate estimations of the relationships between the variables in our study. We controlled for the effect of age (1 = up to 25 years old; 2 = 26-35 years old; 3 = 36-45 years old; 4 = 46-55 years old; 5 = 56 years old or older), as it is argued that group members' age influence knowledge sharing, in that older workers share more (Sveiby & Simons, 2002). We also included degree of functional diversity as a control variable, in order to determine whether this may affect our results.

5.0 Analyses

5.1 Justification of a multilevel approach

When investigating individuals in organizations, few researchers have acknowledged that employees are nested within groups and different social contexts (Kashy & Kenny, 2000; Spink, Nickel, Wilson, & Odnokon, 2005). This has resulted in an abundance of analyses of group phenomena at an individual level, overseeing the interdependence between individual responses within groups. Ignoring these interdependencies could lead to an underestimation of standard errors, which in turn could produce spurious results and Type I error (Bovaird, 2012; Heck & Thomas, 2015; Raudenbush & Bryk, 2002**)**. Knowledge sharing, cohesion, and diversity have in previous literature been considered as group phenomena (Choo, 2003; Dion, 2000; Gully et al., 2012; Litvin, 1997) and we, thus, argue that the constructs must be treated accordingly in research to prevent loss of valuable information and false conclusions. We, therefore, find it appropriate to apply a multilevel approach when investigating the relationship between cohesion and knowledge sharing in functional diverse groups.

5.2 Preparing the data and analytic strategy

Before conducting our analyses, we prepared the raw data in the statistical software SPSS. This included reversing the scores on the negatively worded items in the scales, so that the numerical scoring runs in the same direction. We further calculated the degree of functional diversity in the work groups, and added it to the dataset. This was done to determine which work groups that fulfilled our requirement of a functional diversity score of .5. We deleted the two groups that did not meet this requirement, as well as the eight work groups that failed to deliver enough responses to meet our requirement of a minimum of three individuals. We, thus, ended up with the mentioned 425 responses from 51 work

groups. Our data was further structured in line with hierarchical linear modeling, where individual work group members (within level of analysis) were nested within work groups (between level of analysis).

To test our hypotheses, we used the statistical modeling program Mplus Version 8 (Muthén & Muthén, 1998-2017) with a robust maximum likelihood estimator (MLR). The item scores on task cohesion scale, the social cohesion scale, as well as the knowledge sharing scale were separately averaged into three total scores. We further conducted a correlation analysis to investigate the relationships between all the variables at both group level and individual level. Subsequently, we performed two hierarchical linear modeling analyses to examine whether task cohesion and/or social cohesion could significantly and positively predict knowledge sharing in our sample at both levels. Since our analyses were conducted at between level of analysis, group-mean centering was not an option. Furthermore, grand mean-centering produced minimal changes in our results, and was, therefore, omitted. Thus, is in line with Kelley, Evans, Lowman, and Lykes' (2017) recommendation, we chose not to center our variables

6.0 Results

6.1 Evaluating the appropriateness of multilevel modeling

To investigate the appropriateness of multilevel modeling of our sample, intraclass correlation coefficients (ICC) were evaluated. The intraclass correlations indexes the level of variance within groups, where values that are equal or close to zero indicate that the data are independent (Julian, 2001). In other words, if the ICC values in our analysis are small, the respondents' scores on social cohesion, task cohesion, and knowledge sharing are fairly similar to each other, indicating that a multilevel analysis is not necessary. The results in our study show that the intraclass correlation was .155 for task cohesion, .087 for social cohesion, while .077 for knowledge sharing (see Appendix C). This means that between 7.7 and 15.5 percent of the variance in our variables is due to differences between work groups. According to Murphy and Myors (1998), the value of .01 is considered a small effect, .10 is considered a medium effect, while .25 is considered a large effect (cited in LeBreton & Senter, 2008). Our ICC values, thus, indicate a small to medium effect, suggesting that group membership to some degree may influence individual ratings on task cohesion, social cohesion, and knowledge sharing. According to The Department of Statistics and Data Sciences at The University of Texas (2015), even small intraclass correlations

imply that multilevel analyses are appropriate. Furthermore, LeBreton & Senter (2008) claim that "values as small as .05 may provide prima facie evidence of a group effect" (p. 838). In addition, we calculated the design effect of the variables, which also take cluster size into account (Muthén, 1999). The results revealed that task cohesion exceeded the minimum recommended value of 2.0 (Deff = 2.085) (Muthén, 1999). Hence, the ICC values and the design effect for task cohesion provide evidence for group effects, and justify the necessity of aggregating scores within work groups. Based on this, we argue that multilevel analyses could be necessary for generating valid statistical inferences.

6.2 Sample statistics

Table 1
Correlations among variables at between level (lower diagonal) and within level (upper diagonal) of analysis

	Mean	SD	α	1	2	3	4	5
1. Knowledge sharing	6.10	0.28	.89		.54**	.52**	.05	
2. Task cohesion	5.76	0.42	.71	.91**		.44**	.05	
3. Social cohesion	5.74	0.31	.89	.54*	.56*		.04	
4. Age	3.13	0.48		-.48*	-.26	-.61*		
5. Functional diversity	0.78	0.17		-.14	.12	-.44**	.43**	

*p < .05.
**p < .01.
Note. Means, standard deviations, and reliability for scores from the variables at between level is reported in the lower diagonal. Correlations between scores from the three variables at within level are reported in the upper diagonal. Furthermore, SD was found by calculating the square root of the estimated variance, and mean and SD are measures at between level of analysis.
α = Reliability was measured at individual level using Cronbach's alpha in SPSS to enable comparison with other studies.

Our sample consisted of 138 females and 287 males, and the average size of the work group was approximately 13 members. As demonstrated in Table 1, group members were on average between 36 and 45 years old (M = 3.13, SD = .48). The mean index value of functional diversity was quite high (M = .78, SD = .17), indicating that our sample primarily consisted of work groups with high degree of functional diversity. High values were also found for task cohesion (M = 5.76, SD = .42) and social cohesion (M = 5.74, SD = .31), as well as for knowledge sharing (M = 6.10, SD = .28), indicating that on average the group members experience a high degree of cohesion, as well as a positive culture for knowledge sharing in their respective work groups. As expected, since our study only included observed variables, the model fit was close to perfect (CFI =.999, TLI = 1.00, RMSEA = .000).

6.3 Group level analyses

6.3.1 Correlation analysis

In order to find out whether task and/or social cohesion positively predict knowledge sharing in cross-functional work groups, we first investigated the relationships between the variables in our study by performing a correlation analysis (see Appendix D). The results at between level of analysis are demonstrated in the lower diagonal of Table 1. As expected, task cohesion was positively and strongly related to knowledge sharing, and the result was highly significant, $r = .91$, $p = .000$. According to Cohen (1992), correlation coefficients above .50 are regarded as a strong correlation. In other words, the more a work group experience a shared commitment to accomplish common work tasks, the more perceived knowledge sharing there is within the group. Social cohesion also demonstrated a significant and positive correlation with knowledge sharing at between level of analysis, $r = .54$, $p = .026$. This means that within work groups with strong social bonds, there is a positive culture for sharing knowledge among members. Furthermore, task and social cohesion are positively and significantly related to each other at between level of analysis, $r = .56$, $p = .048$, which means that work groups that experience a high degree of task cohesion also experience a high degree of social cohesion.

Regarding the control variables included in this study, only age was significantly related to knowledge sharing at between level of analysis, $r = -.48$, $p < .023$. The relationship is negative, meaning that work groups with younger group members share more knowledge within their group than work groups with older group members. Degree of functional diversity was not significantly correlated with knowledge sharing, $r = -.14$, $p = .568$. That is, the degree of functional diversity in cross-functional work groups is not related to how much knowledge group members share with each other and the variable was, thus, not included in further analyses.

6.3.2 Hierarchical linear modeling

Table 2

Predicting knowledge sharing with with task cohesion, social cohesion, and age

	β	b	p^a
Within level			
Task cohesion	.41**	.36	.000
Social cohesion	.38**	.33	.000
Age	.02	.01	.693
R^2	.31**		.000
Between level			
Task cohesion	.94**	.55	.000
Social cohesion	-.11	-.09	.536
Age	-.23	-.12	.184
R^2	.94**		.000

[a] p-values are reported for the standardized regression coefficients
*p < .05.
**p < .01.

Hierarchical linear modeling was used to statistically analyze whether task and/or social cohesion will positively predict knowledge sharing in cross-functional work groups at group level (between level of analysis) (see Appendix E). The results from the between level of analysis show that task cohesion strongly and significantly predicts knowledge sharing in functional diverse work groups, controlled for social cohesion and age (β = .94, p = .000) (see Table 2). Task cohesion was the only variable that added significantly to the prediction of knowledge sharing, and the model explained 94 percent of the variance in knowledge sharing (R^2 = .94, p = .000). That is, when functional diverse work groups experience high degree of commitment towards a common work task, they share more knowledge among each other regardless of social cohesion and age of the group members. Thus, hypothesis 1a was supported. As social cohesion did not significantly add to the prediction (β = -.11, p = .536) (see Table 2), hypothesis 2a was rejected. Thus, oppose to our initial assumption, the strength of social bonds is not related to knowledge sharing within cross-functional work groups.

6.4 Individual level analyses

Initial investigation of the data suggested that analyzing the variables at between level of analysis was appropriate. However, some of our results also indicated that it may be meaningful to investigate the variables at an individual level of analysis. The low, although significant, variance in knowledge sharing (*var* = .079, p = .032) and social cohesion (*var* = .097, p = .029) at between level of analysis indicate that there is minimal variance in these constructs across work

groups. Additionally, knowledge sharing and social cohesion demonstrated somewhat low ICCs of .077 and .087. Lastly, results from calculating the design effect of the mentioned variables revealed values lower than the recommended minimum value of 2.0 (Muthén, 1999) for social cohesion and knowledge sharing. Together, these results imply that knowledge sharing and social cohesion may, in fact, not be group phenomena but rather individual level constructs. That is, these constructs might vary independently of group affiliation, and rather depend on each individual's perception of his/her surroundings. We, therefore, found it interesting to investigate the results at individual level of analysis.

6.4.1 Correlation analysis

To find out whether perceived task and/or social cohesion predicts individuals' perception of knowledge sharing in functional diverse work groups, we first investigated the results from the correlation analysis at individual level (within level of analysis) (see Appendix D). The results are demonstrated in the upper diagonal of Table 1, and show a positive and significant correlation between knowledge sharing and task cohesion, $r = .54$, $p = .000$. Knowledge sharing and social cohesion was also significantly and positively correlated, $r = .52$, $p = .000$. Thus, in line with our previous assumptions, individuals who experience high task and social cohesion in their work group, also perceive that there is a positive culture for knowledge sharing in their group. Furthermore, task and social cohesion are moderately correlated with each other, and the result is highly significant, $r = .44$, $p = .000$. Thus, when work group members experience a shared commitment to achieve common work tasks, they also experience that the social bonds within the group are strong. Lastly, the results from the correlation analysis at within level revealed that age as a control variable did not significantly correlate with knowledge sharing, $r = .05$, $p = .279$. That is, the age of an individual work group member is not noteworthy associated with how s/he perceives knowledge sharing.

6.4.2 Hierarchical linear modeling

To find out whether perceived task and/or social cohesion predicts individuals' perception of knowledge sharing in functional diverse work groups, we further performed a hierarchical linear modeling analysis to investigate results at individual level (see Appendix F). It was found that task cohesion significantly predicted knowledge sharing, when controlled for social cohesion and age ($\beta = .41$, $p = .000$) (see Table 2). This provides support for hypothesis 1b. Social

cohesion also significantly and positively predicted knowledge sharing, when controlled for task cohesion and age (β = .38, p = .000) (see Table 2). This provides support for hypothesis 2b. The results of the regression indicated that the model significantly explain 31 percent of the variance (R^2 = .31, p = .000). Hence, at an individual level of analysis, both task and social cohesion provide unique contributions to the prediction of knowledge sharing. In other words, both when individuals perceive that there are strong social bonds, and when they experience shared commitment to objectives, individuals in cross-functional groups perceive that the group members share more knowledge with each other.

7.0 Discussion

In this study, we were interested in how organizations could facilitate knowledge sharing in cross-functional work groups, and raised the question whether task and/or social cohesion will positively predict sharing among functional diverse group members.

7.1 Does task cohesion matter?

7.1.1 Group level

As expected, our results indicate that at group level, task cohesion is positively associated with knowledge sharing within cross-functional work groups (r = .91, p = .000). Task cohesion was further shown to be a strong predictor of knowledge sharing at group level, when controlled for social cohesion and age (β = .94, p = .000). This implies that the more a cross-functional group is united towards goal achievement, the more group members will share information, knowledge, and ideas with each other within the group. However, the extremely strong correlation between task cohesion and knowledge sharing, as well as the strikingly high R-square (R^2 = .94, p = .000), could be questioned. This could be explained the small variations in knowledge sharing between work groups (var = .079, p = .032), and that these small variations are highly related to task cohesion. It is reasonable to assume that with greater variations in knowledge sharing between groups, the relationship between the two variables could have been less extreme. Nevertheless, our results provide a strong indication that the two factors are interrelated.

There could be several explanations for the positive association between task cohesion and knowledge sharing within cross-functional work groups. In the light of coopetitive theory, task cohesion might enhance cooperative behavior and inhibit perceived competitive risks factors, hence increase knowledge sharing

within the group. It reasonable to assume that cross-functional groups that experience similar aspirations for their performance will engage in cooperative behavior in order to reach a best possible outcome for the group (Knouse, 2006; De Dreu, et al., 2008). These shared aspirations for goal achievement may also lead group members to disregard possible risks that may arise when sharing one's unique expertise with members from other functional areas. Perceived competition may, hence, diminish, and knowledge sharing may flourish within the groups.

Perceived task cohesion may also lead to increased motivation to share ideas and knowledge within the group. As groups with high degree of task cohesion are focused on solving common tasks, group members will most likely do their utmost to achieve the best possible outcome for the group as a whole, and a common willingness to collaborate and interact purposefully may arise (Hirunyawipada et al., 2010). As previously argued, motivation is essential for individuals to share their unique knowledge (Ipe, 2003). This is supported by Toh and Srinivas (2012), who found that task cohesion is positively related to a willingness to share information.

Another explanation could be the group culture that may arise in work groups with high degree of task cohesion. According to McDermott and O'Dell (2001), culture is the ultimate determinant of how much knowledge that is shared in an organization. In groups characterized by high degree of task cohesion, we argue that a group culture that values sharing of knowledge, information, and expertise may arise due to a shared task commitment. In this manner, a culture characterized by unitedness and commitment towards common objectives could boost a common experience that knowledge is shared within the group.

7.1.2 Individual level

Results from the individual level analyses revealed that task cohesion is positively associated with knowledge sharing in cross-functional work groups (r = .34, p = .000). Furthermore, task cohesion was also a significant predictor of knowledge sharing at individual level, when controlled for social cohesion and age (β = .41, p = .000).

One reason for these findings may be that unitedness and commitment towards common objectives may lead to discussions regarding how to solve a task at hand, as well as the preparation of a strategy on how to reach set goals. This is supported by Forsyth (2010), as well as Severt an Estrada (2015), claiming that

task cohesion involves constructing a shared vision for the steps necessary for a group to operate successfully. In order to develop a shared strategy, it is reasonable to assume that group members must share their knowledge, expertise, and ideas to reach a best possible outcome. As some group members may be more participative in such a process, it is reasonable to assume that certain group members may experience a positive culture for knowledge sharing in the group.

The fact that task cohesion predicts knowledge sharing at both levels of analysis, indicates that a shared commitment to a common task is important for sharing knowledge both for individuals and for groups as a whole in cross-functional groups. Our findings are in line with previous research on the field, arguing that task cohesion is positively related to the willingness to share knowledge (Toh & Srinivas, 2012; Zaccaro et al., 1995). Furthermore, this study expands the knowledge in the field by claiming that the relationship also exists in functional diverse work groups, both at individual and group level.

7.2. Does social cohesion matter?

7.2.1 Group level

We also wanted to investigate whether social cohesion could positively predict knowledge sharing in cross-functional work groups. At between level of analysis, our results indicated that social cohesion was significantly related to knowledge sharing in such groups ($r = .54$, $p = .026$). That is, in cross-functional work groups, higher social cohesion is associated with more knowledge sharing. This aligns with previous research, claiming that social cohesion eases the sharing of knowledge (Reagans & McEvily, 2003). However, when controlling for task cohesion and age, hence, leaving their effect out of the equation, social cohesion did not significantly predict knowledge sharing in functional diverse groups ($\beta = -.11$, $p = .536$). As our correlation analysis revealed that both task cohesion ($r = .91$, $p = .000$) and age ($r = -.48$, $p = .023$) were strongly and significantly related to knowledge sharing at between level of analysis, it makes sense that controlling for these variables will affect the prediction in the regression model. Thus, by including task cohesion and age in the regressions model, the unique contribution of social cohesion seems to be hampered, making social cohesion an insufficient predictor of knowledge sharing at group level. There could be multiple explanations for this finding.

Applying coopetitive theory, we initially assumed that social cohesion would work as a cooperative mechanism that would surpass the perceived risks of

sharing knowledge and increase cooperation. However, our results imply that the emotional bonds of friendship, liking, caring, and closeness among group members are not enough to inhibit perceived competitive risks that may reside is cross-functional work groups. It is reasonable to assume that close ties and friendship within groups might be able to undermine *some* of the risk related to sharing (e.g. fear of criticism and embarrassment), however, group members could still experience *other* risks, such as possible loss of rewards (e.g. bonuses, promotions, etc.), loss of power, and fear of free-riding. A positive culture for knowledge sharing would, thus, not occur.

Another possible explanation may be that in functional diverse work groups with high degree of social cohesion group members share information aimed at nurturing interpersonal relations, rather than expert knowledge that could work to solve the task at hand. For instance, instead of sharing new ideas and solutions to a task, morning meetings might start with group members sharing information about their well-being and how they will spend their holidays. As a result, group members may not experience that knowledge and ideas are shared within the work group.

This result could further be explained by our finding that social cohesion and knowledge sharing may not be considered group phenomena in our sample. Our analysis showed that only 8.7 percent of variations in social cohesion can be explained by the group in which the individual is a member and that only 7.7 percent of variations in knowledge sharing can be explained by group membership. This was a surprising result, as it is reasonable to assume that both social cohesion and knowledge sharing are based on reciprocal relationships and that they are dependent on others in the group. Furthermore, previous research has argued that social cohesion and knowledge sharing is, indeed, group phenomena (Choo, 2003; Dion, 2000). However, since social cohesion and knowledge sharing did not seem to be group phenomena in our study, it makes sense that we could not find any support for social cohesion as a predictor of knowledge sharing at group level, when controlled for task cohesion and age.

The fact that social cohesion did not seem to be group phenomenon may be explained by the characteristics of our sample. Our sample consisted of cross-functional groups with several members in each of the functional areas (e.g. two analysts, three developers, two encoders, and four testers). As a result, subgroups may arise, and members might identify with individuals working within the same

functional area, rather than the cross-functional group as a whole (Dayan, Ozer, & Almazrouei, 2017). As it may be easier to tie strong bonds with others within the same subgroup, it could be difficult to establish a shared experience of the emotional bonds of friendship and liking within the group. This argument is supported by our finding that degree of functional diversity was significant and negatively related to social cohesion (r = -.44, p = 001). That is, the more functional diverse work group, the less group members enjoy each other's company. The lack of support for social cohesion as a group phenomenon can further be explained by the possibility that group members ascribe different meanings to the concept of social cohesion. That is, some group members who claim to experience a high degree of social cohesion within their work group, may refer to attraction and liking towards *specific* group members, rather than towards the group as a whole. As Forsyth (2010) argue, members that are attracted to one another do not necessarily feel attraction towards the group as a whole. For instance, it could be that in a group of five, two members are very close while the remaining group members are not. In that sense, a common experience of social cohesion in the group will not be present.

7.2.2 Individual level

On the within level of analysis we found a positive association between social cohesion and knowledge sharing (r = .52, p = .000). However, contrary to the between level of analysis, the within level of analysis revealed that social cohesion was a significant predictor of knowledge sharing, controlled for task cohesion and age (β = .38, p = .000). These results indicate that individuals who experience friendship and a pleasant working atmosphere in their cross-functional work group, also experience that group members share their ideas openly with each other. One might wonder why social cohesion is able to predict knowledge sharing at individual level and not at group level of analysis.

This finding might be explained by the characteristics of an individual's function and the associated task interdependence. Certain functions and work areas might have higher task interdependence than others. That is, members within such functions are more dependent on others' work in order to complete their tasks, which may result in a higher need for interaction (Mooney, Holahand, Amazon, 2007). Individuals working within such functions might over time develop strong social bonds with whom they interact with, and they will further share more information and knowledge with each other.

The finding that individuals who experience close ties in cross-functional groups also experience high degree of knowledge sharing, could also be explained by individuals' personal characteristics. For instance, an extrovert and/or agreeable group member may to a larger extent develop strong ties with others in the group than a more introvert and/or neurotic group member. Extroverts often tend to enjoy socialization (Wanberg & Kammeyer-Mueller, 2000) and may, therefore, experience close ties and friendship with other group members. Furthermore, it has been argued that extroverts often have great confidence in themselves (von der Pütte, Krämer, & Gratch, 2010) and they may experience less risks of sharing and seeking information. It has also been argued that individuals who are agreeable tend to be more cooperative and keen to maintain social relations (Doeven-Eggens, Fruyt, Hendriks, Bosker, & Van der Werf, 2008; Nielsen & Knardahl, 2015). As a result, such group members may experience both high degree of social cohesion and knowledge sharing. Based on these arguments, it seems reasonable that personal characteristics could work as a reason for our significant finding at the individual level of analysis. Personal characteristics, type of function and task interdependence, however, have not been taken into account in our study and we are, thus, not able to know how these construct may have affected our results.

Lastly, even though it is, based on previous research, reasonable to assume that task and social cohesion enhance knowledge sharing in cross-functional work groups, it is important to mention that this study is not able to make causal conclusions.

7.3 Age and knowledge sharing

Oppose to our initial assumption, age demonstrated a negative association with knowledge sharing at group level, indicating that groups with younger members tend to share more knowledge between each other than groups with older members ($r = -.48$, $p < .023$). This is contrary to previous research, where it has been found that knowledge sharing tends to improve with age (Sveiby & Simons, 2002). A possible explanation for this could be that older group members have accumulated extensive knowledge and know-how expertise throughout their career. Sharing of information between older workers within a group may, therefore, be perceived as redundant, and such group members will not feel the need to share excessive information within the group. Furthermore, as knowledge acquired through experience, known as tacit knowledge (Lam, 2000), is more

difficult to articulate (Ipe, 2003), older group members may share less knowledge with each other within the group. In groups consisting of younger members, on the other hand, individuals may feel an urge to share in order to learn, to assert themselves as competent workers, as well as to satisfy their curiosity and, therefore, share more knowledge and ideas with each other within the group. Despite the significant association between age and knowledge sharing at group level, age was not able to significantly predict knowledge sharing when controlled for task and social cohesion (β = -.23, p = .184). Additionally, at individual level, the age of an individual group member was not related to how s/he perceives knowledge sharing in the group (r = .05, p = .279).

8.0 Limitations and future research

Although our results may constitute a valuable addition to the existing literature, they must be interpreted within the limitations of the study. First of all, there might be some limitations related to our sample. Since the links to the survey were distributed by team leaders in their respective companies, we are not sure which and how many group members received the link to the survey. Furthermore, we also know that some individuals are members of several work groups, and even though they were informed to answer in accordance to their specific group from whom they received the link, we have no control whether they actually acted upon this request. Additionally, as some groups were projects teams where individuals may be more or less temporary members, some members might be unsure exactly who is a part of the team and, thus, not take all the members into consideration when answering the questions in the survey. Future research may be more specific regarding work group membership, so members can respond more accurately to the survey questions. Furthermore, since our sample only consisted of employees from Norwegian companies, we question the generalizability of the results. There may be differences in nationalities and cultures, and conducting uni-cultural studies could be criticized. For instance, Yu (2014) found that individualism and collectivism orientations significantly impact intentions to share knowledge. Thus, it is unknown whether our study would have yielded the same results in more collectivistic oriented country than Norway. Cross-cultural studies may, therefore, be informative for future studies. Future studies may also benefit from a larger sample size as well as a larger number of groups within each industry to enhance generalizability as well as statistical power.

Secondly, there may also be limitations in relation to the retrieval of the data in our study. The fact that it was the team leaders who distributed the survey to their group members could hamper the validity of the responses in the survey. Regardless of our reassurance of anonymity and confidentiality, the respondents may have been concerned about their confidentiality and risk for identification, which in turn could have impeded the genuineness of the group members' answers. To increase the group members' assurance of anonymity and confidentiality, future research could benefit from distributing the survey directly to the work group members. Our choice of using self-report questionnaires can also be a target of criticism, as it may involve common method bias. Respondents may try to be consistent and rational in their responses, known as consistency motif. This may result in a search for similarities in the questions asked and, hence, produce relationships that would not otherwise exist (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). We suggest that future research randomize the questions in the survey to minimize the risk of consistency motif. Furthermore, social desirability may be an issue in our sample and may have been enhanced by the mentioned fact that the team leaders distributed the surveys. Social desirability is the desire to present oneself in a favorable light, regardless of one's true meaning or feeling about an issue (Podsakoff, et al., 2003). By applying a mixed method design (e.g. by including interviews and/or observations), future research could minimize the risks of these common method biases.

There may also be limitations related to the constructs and measures used in our study. In terms of the former, it may be that respondents have different understandings of the concepts used in our survey, and we cannot be sure what meaning respondents ascribe to them. In relation to our measures, functional diversity is of special interest. When we gathered information necessary to calculate the work groups' functional diversity, we trusted the different team leaders to provide us with the correct number of functions as well as the distributions of members within each function. As we cannot be sure whether the team leaders have provided us with the correct information, we do not know whether our calculations of functional diversity are based on the correct foundation. Furthermore, as suggested by previous researchers, knowledge sharing is a complex process that should be understood in terms of more than a few factors (Jo & Joo, 2011). Future research should make a more comprehensive model in order to be better able to explain the process of sharing knowledge.

Lastly, we chose to only distribute the survey in Norwegian, which excluded the English speaking group members from participating in the study. Their perception of group cohesion and knowledge sharing may differ from the Norwegian members, and including their responses could, thus, have yielded different results. By distributing questionnaires in several languages, future research can capture differences between nationalities in the same working group.

It should also be mentioned that based on the extremely high correlation between task cohesion and knowledge sharing, one could be questioning whether the scales in this study actually measure two different phenomena. However, this study applied acknowledged scales and our focus was not to establish knowledge about the factor structure. Future studies could, however, benefit from further investigating this relationship.

9.0 Implications

9.1 Practical implications

This study provides support for the notion that task cohesion is able to predict knowledge sharing in functional diverse groups, both for individuals and for the group as a whole. It is, thus, of interest for organizations that apply cross-functional work groups to find ways to promote and facilitate a common commitment to objectives and tasks at hand, so that the functional diverse work group can benefit from the various knowledge, information, and expertise that resides in the group by sharing such content. Furthermore, as social cohesion was shown to be a significant predictor for knowledge sharing at an individual level, it is also important to facilitate a friendly working atmosphere, so that the individuals feel safe and motivated to share their unique knowledge and ideas. However, since task cohesion seemed to be a stronger predictor for knowledge sharing, and demonstrated significant prediction at both levels, we suggest that organizations should prioritize to promote common goals and unitedness, loyalty, and commitment towards activities focused on goal achievement, rather than emotional bonds of friendship, liking, caring, and closeness among group members, in their effort to enhance knowledge sharing in cross-functional work groups. This could be particularly relevant if an organization has limited resources.

9.2 Theoretical implications

Our study also offers some theoretical implications. While we might question whether social cohesion and knowledge sharing is group phenomena, our

study indicated that task cohesion, indeed, is a group phenomenon. These findings were somewhat surprising and demonstrates the importance to determine whether a concept needs to be investigated at different levels of analyses. Conducting analyses at the appropriate level of analysis could enhance the likelihood of making more accurate conclusions and obtain more nuanced results (Bovaird, 2012; Heck & Thomas, 2015; Raudenbush & Bryk, 2002**)**. Lastly, as far as we know, no other studies have investigated cohesion and knowledge sharing in a context of functional diverse groups, applying a multilevel approach. This study, therefore, provides a valuable contribution to the field of knowledge management.

10.0 Conclusion

In order for organizations to benefit from the diverse knowledge and expertise that reside in cross-functional work groups, the sharing of such content is essential (Cohen & Levinthal, 1990; Damodaran & Olphert, 2000; Davenport & Prusak, 1998; Ghobadi & D'Ambra, 2012; Hinds et al., 2001; Yang, 2007). Communicating information, best practices, experiences, and insights has been related to multiple benefits, such as innovation, organizational learning, effectiveness, and performance (Andrews & Delahaye, 2000; Cerne et al., 2013; Hülsheger et al., 2009; van Krogh, 2002; Yang, 2007). Despite this, research has demonstrated that it may, in fact, be less knowledge sharing in cross-functional groups (Bunderson & Sutcliffe, 2002; Lasalewo et al., 2016). It has, hence, been urged for new empirical findings of when and how knowledge sharing occurs in functional diverse work groups, as well as strategies for increasing knowledge sharing (Cheung et al, 2016; Frank, Ribeiro, & Echeveste, 2015). Our findings at group level of analysis provide strong empirical evidence that task, and not social cohesion, is able to predict knowledge sharing in cross-functional work groups, while the results from individual level of analysis indicate that both social and task cohesion significantly predict knowledge sharing in such groups. Moreover, the surprising finding that neither social cohesion nor knowledge sharing appears to be group phenomena in our study should be further explored. Future research could benefit from assessing whether a phenomenon varies at more than one level, then investigating relationships at the appropriate level of analysis. The present study adds to the growing body of multilevel research and contributes with valuable knowledge to the fill the gap in the research literature on group diversity and knowledge sharing.

11.0 References

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12.0 Appendices

Appendix A: Cover letter

Hei!

For å levere i et stadig mer konkurransepreget og krevende marked, benytter bedrifter i økende grad team der individer har ulik ekspertise og kunnskap. Deres bedrift har i den sammenheng takket ja til å bli med på en undersøkelse om funksjonelt mangfold og kunnskapsdeling i team. Dette vil være grunnlaget for vår masteroppgave ved Handelshøyskolen BI.

Spørreundersøkelsen består av 16 spørsmål som omhandler funksjonelt mangfold, kunnskapsdeling og opplevd samhold i teamet, og vil ta under 5 minutter å gjennomføre. For å forsikre en forsvarlig behandling av innhentet informasjon er undersøkelsen vurdert og godkjent av NSD – Norsk senter for forskningsdata. Alle personopplysninger vil bli behandlet konfidensielt, og informasjon fra undersøkelsen vil kun være tilgjengelig for oss og masterveileder. Vi vil heller ikke registrere ditt navn. Deltakelse i undersøkelsen er frivillig, og du kan når som helst trekke deg uten å oppgi noen grunn.

Vi setter stor pris på din deltakelse i studien, og dine svar vil være svært verdifulle for denne forskningen. Vær vennlig å svare på undersøkelsen så fort du har tid, og ikke nøl med å ta kontakt dersom du har spørsmål vedrørende studien. På forhånd takk!

Du starter spørreundersøkelsen ved å trykke på denne linken:
(link)
Eller kopier denne URL´en inn i din nettleser:
(Survey URL)

Med vennlig hilsen,
Torun Kaspersen og Elisabeth Pettersen
Handelshøyskolen BI
Epost: torun.kaspersen@student.bi.no og elisabeth.pettersen@student.bi.no
Telefon: 907 70 309 og 926 63 245

Follow the link to opt out of future emails:
(OptOutLink = Click here to unsubscribe)

Appendix B: Items used in questionnaire (Norwegian)

Kjønn:

- Kvinne
- Mann

Hvor gammel er du?

- 25 år eller yngre
- 26-35 år
- 36-45 år
- 46-55 år
- 56 år eller eldre

Når du svarer på de neste spørsmålene, tenk på hvordan du opplever å være en del av ditt team, og hvordan dere sammen jobber mot måloppnåelse.

Oppgavesamhold

I hvilken grad er du enig eller uenig i følgende påstander:

- I vårt team er vi forente i å forsøke å nå våre oppgavemål
- Jeg er ikke fornøyd med teamets oppslutning om oppgaven
- I vårt team har vi motstridende ambisjoner om hvor godt vi bør prestere
- Dette teamet gir meg ikke nok muligheter til å forbedre mine prestasjoner

Sosialt samhold

I hvilken grad er du enig eller uenig i følgende påstander:

- Vi er svært komfortable med hverandre i dette teamet
- Vi er svært vennlige mot hverandre i dette teamet
- Det er en svært hyggelig arbeidsatmosfære i dette teamet
- I dette teamet er vi opptatt av å opprettholde gode og nære relasjoner med hverandre

Kunnskapsdeling

I hvilken grad er du enig eller uenig i følgende påstander:

- I dette teamet holder man sine beste ideer for seg selv
- I dette teamet er vi villige til å dele kunnskap/ideer med hverandre
- I dette teamet deler vi ideer åpent med hverandre
- Teammedlemmer med ekspertkunnskap er villige til å hjelpe andre i teamet
- I dette teamet er vi gode på å nyttiggjøre oss av ansattes kunnskap/ideer

Appendix C: Syntax and output of estimated Intraclass Correlations (ICC)

```
INPUT INSTRUCTIONS
DATA:        FILE IS Final_dataset.dat;

VARIABLE:    NAMES ARE
             Finish Team_nr FD Size Bransje Sex
             Age Tenure TC1 TC2 TC2_R TC3 TC3_R
             TC4 TC4_R SC1 SC2 SC3 SC4 KS1 KS1_R
             KS2 KS3 KS4 KS5;
             CLUSTER IS
             Team_nr;
             usevariables =
             FD SC TC KS;
             BETWEEN = FD;
             MISSING ARE ALL (99999);

DEFINE:      TC = MEAN (TC1 TC2_R TC3_R TC4_R);
             SC = MEAN (SC1 SC2 SC3 SC4);
             KS = MEAN (KS1_R KS2 KS3 KS4 KS5);
              FD = FD*10;

ANALYSIS:    TYPE = twolevel basic;

MODEL:

OUTPUT:      SAMPSTAT;
             STAND;
```

Estimated Intraclass Correlations for the Y Variables

Variable	Intraclass Correlation	Variable	Intraclass Correlation	Variable	Intraclass Correlation
SC	0.087	TC	0.155	KS	0.077

Appendix D: Syntax and output of correlations among variables at between level of analysis and within level of analysis

INPUT INSTRUCTIONS

```
DATA:       FILE IS Final_dataset.dat;

VARIABLE:   NAMES ARE
            Finish Team_nr FD Size Bransje Sex
            Age Tenure TC1 TC2 TC2_R TC3 TC3_R
            TC4 TC4_R SC1 SC2 SC3 SC4 KS1 KS1_R
            KS2 KS3 KS4 KS5;
            CLUSTER IS
            Team_nr;
            usevariables =
            FD age TC SC KS;
            BETWEEN = FD;
            MISSING ARE ALL (99999);

DEFINE:     SC = MEAN (SC1 SC2 SC3 SC4);
            KS = MEAN (KS1_R KS2 KS3 KS4 KS5);
            TC = MEAN (TC1 TC2_R TC3_R TC4_R);

ANALYSIS:   TYPE = twolevel;

MODEL:      %WITHIN%
            ks WITH sc tc age;
            sc WITH tc age;
            tc WITH age;

            %BETWEEN%
            fd WITH ks sc tc age;
            ks WITH sc tc age;
            sc WITH tc age;
            tc WITH age;

OUTPUT:     SAMPSTAT;
            STAND;
```

STANDARDIZED MODEL RESULTS
STDYX Standardization

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Within Level				
KS WITH				
SC	0.522	0.050	10.472	0.000
TC	0.540	0.035	15.562	0.000
AGE	0.045	0.042	1.082	0.279
SC WITH				
TC	0.444	0.041	10.941	0.000
AGE	0.037	0.047	0.785	0.432
TC WITH				
AGE	0.052	0.050	1.029	0.303
Variances				
AGE	1.000	0.000	999.000	999.000
TC	1.000	0.000	999.000	999.000
SC	1.000	0.000	999.000	999.000
KS	1.000	0.000	999.000	999.000
Between Level				
FD WITH				
KS	-0.140	0.244	-0.571	0.568
SC	-0.440	0.138	-3.192	0.001
TC	0.124	0.234	0.529	0.597
AGE	0.433	0.135	3.202	0.001
KS WITH				
SC	0.538	0.242	2.223	0.026
TC	0.906	0.145	6.263	0.000
AGE	-0.484	0.213	-2.272	0.023
SC WITH				
TC	0.561	0.284	1.976	0.048
AGE	-0.610	0.196	-3.119	0.002
TC WITH				
AGE	-0.263	0.220	-1.194	0.233
Means				
FD	4.536	0.755	6.005	0.000
AGE	6.540	0.764	8.555	0.000
TC	13.793	2.202	6.264	0.000
SC	18.452	4.190	4.403	0.000
KS	21.634	5.123	4.223	0.000

Variances				
FD	1.000	0.000	999.000	999.000
AGE	1.000	0.000	999.000	999.000
TC	1.000	0.000	999.000	999.000
SC	1.000	0.000	999.000	999.000
KS	1.000	0.000	999.000	999.000

Appendix E: Syntax and output of hierachical linear modeling at between level of analysis

INPUT INSTRUCTIONS

```
DATA:       FILE IS Final_dataset.dat;
VARIABLE:   NAMES ARE
            Finish Team_nr FD Size Bransje Sex
            Age Tenure TC1 TC2 TC2_R TC3 TC3_R
            TC4 TC4_R SC1 SC2 SC3 SC4 KS1 KS1_R
            KS2 KS3 KS4 KS5;
            CLUSTER IS
            Team_nr;
            usevariables =
            age FD TC SC KS;
            BETWEEN = FD;
            MISSING ARE ALL (99999);

DEFINE:     TC = MEAN (TC1 TC2_R TC3_R TC4_R);
            SC = MEAN (SC1 SC2 SC3 SC4);
            KS = MEAN (KS1_R KS2 KS3 KS4 KS5);
            FD = FD*10;

ANALYSIS:   TYPE = twolevel;

MODEL:      %WITHIN%
            KS WITH TC SC age;

            %BETWEEN%
            KS ON TC SC age;

 OUTPUT:    SAMPSTAT;
            STAND;
```

MODEL RESULTS

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Within Level				
KS WITH				
TC	0.339	0.050	6.765	0.000
SC	0.315	0.061	5.187	0.000
AGE	0.012	0.030	0.398	0.690
Variances				
AGE	0.889	0.078	11.380	0.000
TC	0.929	0.070	13.227	0.000
SC	0.943	0.104	9.039	0.000
KS	0.735	0.069	10.637	0.000

Between Level

KS	ON			
	TC	0.547	0.139	3.921	0.000
	SC	-0.087	0.151	-0.577	0.564
	AGE	-0.117	0.090	-1.307	0.191
Means					
	FD	7.812	0.241	32.392	0.000
	AGE	3.125	0.082	38.238	0.000
	TC	5.762	0.078	74.345	0.000
	SC	5.734	0.065	88.564	0.000
Intercepts					
	KS	3.814	0.995	3.834	0.000
Variances					
	FD	2.966	0.869	3.412	0.001
	AGE	0.220	0.052	4.216	0.000
	TC	0.173	0.051	3.378	0.001
	SC	0.086	0.038	2.238	0.025
Residual Variances					
	KS	0.003	0.015	0.232	0.816

STANDARDIZED MODEL RESULTS
STDYX Standardization

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Within Level				
KS	WITH			
	TC	0.410	0.049	8.418	0.000
	SC	0.379	0.063	5.992	0.000
	AGE	0.015	0.037	0.399	0.690
Variances					
	AGE	1.000	0.000	999.000	999.000
	TC	1.000	0.000	999.000	999.000
	SC	1.000	0.000	999.000	999.000
	KS	1.000	0.000	999.000	999.000
Between Level					
KS	ON			
	TC	0.937	0.134	7.015	0.000
	SC	-0.106	0.170	-0.620	0.536
	AGE	-0.226	0.170	-1.328	0.184
Means					

FD	4.536	0.755	6.005	0.000
AGE	6.671	0.813	8.202	0.000
TC	13.861	2.097	6.611	0.000
SC	19.576	4.329	4.522	0.000
Intercepts				
KS	15.726	5.853	2.687	0.007
Variances				
FD	1.000	0.000	999.000	999.000
AGE	1.000	0.000	999.000	999.000
TC	1.000	0.000	999.000	999.000
SC	1.000	0.000	999.000	999.000
Residual Variances				
KS	0.059	0.256	0.232	0.817

R-SQUARE
Between Level

Observed Variable	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
KS	0.941	0.256	3.674	0.000

Appendix F: Syntax and output of hierachical linear modeling at within level of analysis

INPUT INSTRUCTIONS

```
DATA:       FILE IS Final_dataset.dat;
VARIABLE:   NAMES ARE
            Finish Team_nr FD Size Bransje Sex
            Age Tenure TC1 TC2 TC2_R TC3 TC3_R
            TC4 TC4_R SC1 SC2 SC3 SC4 KS1 KS1_R
            KS2 KS3 KS4 KS5;
            CLUSTER IS
            Team_nr;
            usevariables =
            age FD SC TC KS;
            BETWEEN = FD;
            MISSING ARE ALL (99999);

DEFINE:     TC = MEAN (TC1 TC2_R TC3_R TC4_R);
            SC = MEAN (SC1 SC2 SC3 SC4);
            KS = MEAN (KS1_R KS2 KS3 KS4 KS5);
            FD = FD*10;

ANALYSIS:   TYPE = twolevel;

MODEL:      %WITHIN%
            KS ON SC TC age;

            %BETWEEN%
            KS WITH SC TC age;

OUTPUT:     SAMPSTAT;
            STAND;
```

MODEL RESULTS

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Within Level				
KS ON				
SC	0.334	0.060	5.592	0.000
TC	0.364	0.045	8.164	0.000
AGE	0.013	0.034	0.394	0.693
Variances				
AGE	0.889	0.078	11.377	0.000
SC	0.943	0.104	9.030	0.000
TC	0.929	0.071	13.113	0.000

Residual Variances				
KS	0.506	0.051	10.022	0.000
Between Level				
KS WITH				
SC	-0.007	0.027	-0.277	0.782
TC	0.094	0.045	2.092	0.036
AGE	-0.026	0.027	-0.960	0.337
Means				
FD	7.812	0.241	32.392	0.000
AGE	3.125	0.082	38.241	0.000
SC	5.734	0.065	88.593	0.000
TC	5.762	0.078	74.230	0.000
KS	6.097	0.057	107.214	0.000
Variances				
FD	2.966	0.869	3.412	0.001
AGE	0.220	0.052	4.207	0.000
SC	0.086	0.041	2.108	0.035
TC	0.173	0.052	3.294	0.001
KS	0.059	0.037	1.607	0.108

STANDARDIZED MODEL RESULTS
STDYX Standardization

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
Within Level				
KS ON				
SC	0.379	0.062	6.066	0.000
TC	0.410	0.047	8.669	0.000
AGE	0.015	0.038	0.395	0.693
Variances				
AGE	1.000	0.000	999.000	999.000
SC	1.000	0.000	999.000	999.000
TC	1.000	0.000	999.000	999.000
Residual Variances				
KS	0.689	0.042	16.425	0.000
Between Level				
KS WITH				
SC	-0.106	0.365	-0.289	0.772
TC	0.937	0.181	5.182	0.000
AGE	-0.226	0.219	-1.035	0.301

Means				
FD	4.536	0.755	6.005	0.000
AGE	6.671	0.815	8.188	0.000
SC	19.576	4.602	4.253	0.000
TC	13.861	2.143	6.468	0.000
KS	25.139	7.895	3.184	0.001
Variances				
FD	1.000	0.000	999.000	999.000
AGE	1.000	0.000	999.000	999.000
SC	1.000	0.000	999.000	999.000
TC	1.000	0.000	999.000	999.000
KS	1.000	0.000	999.000	999.000

R-SQUARE
Within Level

Observed Variable	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
KS	0.311	0.042	7.427	0.000