Decision Making in the Modern Workplace:

The Impact of Team and Knowledge Structure

Inaugural-Dissertation

zur Erlangung der Doktorwürde

der Fakultät für Humanwissenschaften

der Universität Regensburg

vorgelegt von

Magdalena Lavinia Fuchs

aus Starnberg

2020

Regensburg 2020

Erstgutachter: Prof. Dr. Peter Fischer

Zweitgutachter: Prof. Dr. Andreas Kastenmüller

In the end, the location of the new economy is not in the technology, be it in the microchip or the global communications network. It is in the human mind.

Alan Webber (1993, p. 27)

Table of Contents

Acknowledgements

To my advisor Prof. Dr. Peter Fischer, who came to my aid when – after a year of failed attempts – I was about to give up my industry-sponsored doctoral studies. You demonstrated that the practical demands of businesses and sound academic research can be reconciled. Your advice and contagious enthusiasm were a source of motivation throughout the last years. I thank you for making me feel welcome and involving me in your work projects despite the physical distance. I will treasure the memories of all my visits to Regensburg, even the memories of simple things like sitting on the big old leather couch in your office, trying to keep pace with your thoughts while making notes. You always encouraged me to persevere, trusting in me and my work. I am so grateful that you became my advisor.

To Prof. Dr. Andreas Kastenmüller, my second reviewer, for the time you took and the effort you applied to evaluate this dissertation. Thank you.

To Dr. Norbert Koppenhagen, my former manager, teammate, and now friend, who accompanied me through the different stages of this endeavor and through multiple reorganizations. From the early struggles to the final draft, you were there to help. I am particularly grateful for your support in navigating the pitfalls of corporate policies and power games. It would not have been possible to conduct the studies without you backing me up. Even after you were no longer my formal manager, you continued to show great interest in both my research and my personal development. I really appreciate that. Here's to more Brlo meetups!

To my fellow doctoral students – Denise Huber, Hanna Heinrich, Shengjia Feng, Simon Wagner, and Susanne Gaube – for the sense of solidarity you gave me. While I wish I could have worked more closely with you, we formed strong bonds over the years. You commiserated with me in difficult times and helped me out whenever my research project had stalled. I owe special thanks to Susanne Gaube, who often hosted me during my visits to Regensburg (which included homemade Käsespätzle), let me use her office, and stayed in touch with me regardless of the distance between us. I not only benefited from your expert advice and research experience but even made a new friend. Special thanks also go to Simon Wagner, who was always available for a chat about my research projects and made sure that I could present them at the department's colloquia. I remember entering your office in a desperate state one time because my experimental paradigm was not working as it was supposed to. Although you were in the middle of something, you stopped and took the time to talk the issue through with me. When I left, I had a game plan.

To Simone Zwerenz for patiently answering all my questions about administrative formalities and facilitating the cooperation between my employer and the university. Thank you for your support, your sense of humor ("Es lebe die Bürokratie!"), and all the coffee breaks I had in your office.

To my numerous study participants for the time and effort you put into filling out questionnaires or performing experimental tasks. Your feedback regarding the practical relevance of my research was an incentive to keep going. Most importantly, you enabled me to gain the exciting insights presented in this dissertation.

To my sister, Lilly Fuchs, and my brother, Juri Fuchs, whose emotional support I would have never wanted to miss. Although I am the oldest, I often needed your shoulders to cry on in the last few years. You understood me. You coached me. You were always there for me. Lilly, thank you for the many small gestures that made me feel thought of and cared for such as giving me a gift to take along on my trips or sending me an encouraging text message. Juri, thank you for helping me recruit participants, for sharing the experience of being a doctoral student, and for enabling me to commute for so many years. I feel truly blessed to have you both as siblings.

To my parents. I could not have accomplished this without you. Throughout my whole life you have made me feel loved and protected. This feeling has carried me through rough patches and times of crisis. I can always turn to you for comfort and you will help me regain my strength. I know, you would move heaven and hell for me. Thank you.

To my mother, Gabriele Fuchs, for giving me security and taking pride in me. You always knew how to brighten my mood when I was down. I am so grateful for your relentless efforts to find solutions to any problem I encountered over the last years. Your own energy was a source of strength for me.

To my father, Thomas Fuchs, for giving me security and caring about my research. It meant so much to me that you would always take the time to listen to my thoughts, discuss research issues, and give advice. You were able to relate to my ambivalence and helped me cope with it. I also thank you for enabling me to recruit participants from two different locations and reading my manuscripts. It was your feedback with all the appreciative comments and compliments that made me not lose courage during the writing process.

To my husband-to-be, Daniel Hawthorne, who has sacrificed so much for this. Only the two of us really know how challenging the last four years have been. You have stood by my side through all of it, unwaveringly. You endured the distance between us, you showed faith in me, and you remained optimistic. I am deeply grateful that you guided me through the challenges of being a graduate student, drawing on your own experiences. You related to me in a way no one else could. Thank you for discussing my study designs, for helping me with all my statistical questions, and for giving me feedback on my presentations and papers. I have always felt your love – even through the conflicts and distance.

List of Abbreviations

AIC	Akaike Information Criterion
ANOVA	Analysis of variance
CFI	Comparative fit index
CI	Confidence interval
df	Degrees of freedom
GDP	Global gross domestic product
IT	Information technology
KIM	Kurzskala intrinsischer Motivation (shortened *Intrinsic Motivation Inventory*)
KMS	Knowledge management systems
M	Mean
N / n	Sample size
OR	Odds ratio
RMSEA	Root mean square error of approximation
SD	Standard deviation
SE	Standard error
SEM	Structural equation modeling
SRMR	Root mean square residual
TMS	Transactive memory system

List of Tables

List of Figures

Overview

The present dissertation contributes to an increasingly important research area: team effectiveness in the context of knowledge work. It demonstrates that self-organized teams are capable of making better decisions on the basis of distributed knowledge than hierarchically structured teams. This yields important insights for the future implementation of self-organized teams in modern organizations.

In response to a growing competition and pressure to innovate, organizations have started to structure work around groups of multiple employees. Instead of breaking down tasks into individual pieces, larger clusters of tasks are assigned to teams of knowledge workers with different fields of expertise. This shift in work design is supposed to provide organizations with an increased access to the expertise and knowledge of their workforce (Kellermanns, Floyd, Pearson, & Spencer, 2008). Teams are assumed to integrate multiple perspectives and different skill sets into high quality decisions and innovative products (Brodbeck, Kerschreiter, Mojzisch, & Schulz-Hardt, 2007). However, research has repeatedly cast doubt on the intuitive expectation that groups benefit from a lager body of knowledge and collective processing of information. Not only do their members often succumb to cognitive biases when processing available information (e.g., Fischer, Greitemeyer, & Frey, 2008; Janis, 1982; Kray & Galinsky, 2003), they also most commonly fail to disseminate unshared information in the first place (e.g., Stasser, 1992; Stasser & Titus, 1985; for a review, see Wittenbaum & Park, 2001).

In order to improve team performance, organizations typically invest in optimizing team composition. Attracting the greatest talents, selecting team members based on cultural fit, or ensuring diversity are popular examples of how companies try to influence their teams' functioning (e.g., Bell, 2007; Moreland, 2006). Yet, in order to actually reach superior solutions, knowledge worker teams must also coordinate their distributed expertise, share information effectively, and integrate individual viewpoints into their final decisions. Thus, it is equally important to learn which structures and processes help these teams – once they are set up – to actually pool their informational resources. While researchers have started to study the impact of structural components on team performance, inconsistent findings call for a deeper understanding of the factors that determine when and why these components should be employed.

The present dissertation aims to enrich our understanding of how teams should be structured internally to make high quality decisions. It focuses on fundamental group structures and members' collective knowledge structure while taking the conditions of the modern workplace into account. Two studies provide much needed empirical data by directly comparing the decision making performance of self-organized versus hierarchically structured teams. In addition, the studies give insights into the role of meta-knowledge structures, as defined by a transactive memory system (TMS), in group decision making.

This thesis includes four main chapters. A general introduction is given in Chapter 1. It illustrates the importance of group decision making in light of current economic trends and reviews the scholarly literature on team effectiveness and decision making. Two research papers, presenting the empirical studies of this dissertation, will follow in Chapter 2 and Chapter 3. Although the studies are connected, each chapter covers a standalone research paper with an introduction, a method and results section, as well as a discussion of the findings.

Research Paper I (Chapter 2) examines the causal effects of group structure and TMS on decision quality under conditions of distributed knowledge. Employing the hidden profile paradigm (Stasser & Titus, 1985), a group experiment was conducted in the laboratory. Groups had to solve a decision making task that necessitated the exchange of information in order to reach the best result. Both group structure (self-organized vs. hierarchically structured) and knowledge structure (with TMS vs. without TMS) were manipulated, resulting in a two by two factorial design. A total of 267 university students participated in the experiment. The results of this experiment revealed two main effects. First, decision quality was higher in self-organized than in hierarchically structured groups. Second, groups with TMS made better decisions on average than groups without TMS. Both effects were found to be mediated by improved information sharing among group members during discussions. Specifically, group members' bias towards already shared information was attenuated by a self-organized group structure as well as by the development of a TMS.

Overall, the findings presented in Research Paper I suggest that a self-organized internal structure and a TMS are conducive to groups' decision quality when knowledge is distributed among group members such that they have to work interdependently (i.e., they need each other to accomplish the task). It is precisely these circumstances that are becoming increasingly relevant in present-day organizations.

Research Paper II tests a path model derived from the experimental findings by using field data from a large organization. This two-step approach served to increase the external validity of findings. A cross-sectional survey study was conducted at a publicly traded company in the information technology sector. Data from a total of 1129 employees largely confirmed the hypothesized model. In support of the experimental study, both the degree of self-organization and the development of a TMS were positively related to teams' perceived decision quality. Improved knowledge sharing among team members partially explained these positive relationships. Results further showed that task interdependence is a moderator of the indirect effects of TMS and team structure on decision quality through knowledge sharing. More precisely, the mediated relationships were stronger for higher levels of task interdependence compared to lower levels of task interdependence.

Together, the two studies provide strong empirical evidence for the advantage of more autonomous team structures over hierarchical ones in decision making situations that involve a high degree of interdependence. They further point to the supportive role of TMSs in exactly these situations. Additionally, this research started to explore the mechanism underlying the positive effects of self-organization and TMS. It finds knowledge sharing to be an important mediator for the success of knowledge worker teams.

In the final chapter, this thesis closes with a general discussion of the two studies, including a synthesis of their findings, suggestions for future research, and an evaluation of the theoretical and practical implications.

In conclusion, the present dissertation combines previous research on cognitive team processes (e.g., Lewis, 2003; Mohammed & Dumville, 2001), hierarchy (e.g., Anderson & Brown, 2010), and socio-technical systems theory (e.g., Cummings, 1978; Pasmore, Francis, Haldeman, & Shani, 1982), thus bridging separate research traditions. Its empirical findings endorse the efforts of organizations to flatten their structures and promote knowledge sharing.

1 General Introduction

> Because the modern organization consists of knowledge specialists, it has to be an organization of equals, of colleagues and associates. No knowledge ranks higher than another; each is judged by its contribution to the common task rather than by any inherent superiority or inferiority. Therefore, the modern organization cannot be an organization of boss and subordinate. It must be organized as a team.
>
> (Drucker, 1992, para. 48)

1.1 The Challenges Organizations Are Facing Today

In times of an increasingly dynamic and complex world of work, organizations are seeking for ways to enhance their adaptability and innovation. The pressure on organizations, particularly businesses, is mirrored in the fact that the average lifespan of companies listed in Standard and Poor’s (S&P) 500[1] has dropped from almost 60 years in the 1950s to around 15 years today (e.g., Anthony, Viguerie, Schwartz, & Van Landeghem, 2018; Foster & Kaplan, 2001). Experts predict that over the next ten years 50% of the current S&P 500 will be replaced. Against this background, conventional approaches to structuring organizations are being called into question. On the one hand, given the need for more flexibility and creativity, the hierarchical distribution of responsibility and control that has been prevailing in organizations over hundreds of years does not seem to fulfill its purpose anymore. In contrast, more democratic or self-organized structures that assign more power to individual workers or teams could instill organizations with more flexibility. On the other hand, the clear shift from manual to knowledge work and an exponential increase in the volume of information are calling for a distributed structure of expertise that replaces the traditional centralization of knowledge in one person or

[1] Standard & Poor’s 500 (also *S&P 500* or just *S&P*) is a stock market index measuring the performance of 500 large, often multinational, companies listed in the United States. After first being compiled in March 1957, it has been continuously updated and is considered one the most widely used equity indices (Siegel & Schwartz, 2006).

unit. Such a structure of knowledge, which implies an interconnection of decentralized knowledge owners, could help to better manage the growing quantity of information.

This dissertation aims at investigating the organizational structures that are best suited to meet the new demands faced by organizations in the 21st century. In what follows, I will first outline major developments that have shaped work life in past decades in order to then describe possible options for organizations to adapt to these changing conditions, focusing both on *team structures* and *knowledge structures*.

A number of intertwined societal developments have contributed to the heightened complexity of the modern economy. In the context of this dissertation, four of them stand out as particularly relevant. First, *globalization* has dramatically altered the way organizations operate and has led to an extended, cross-border competition. This is evident in the proportion of production for export versus for the domestic market: While exported goods and services accounted for merely 13.6% of the global gross domestic product (GDP) in 1970, their share had risen to almost 30% last year (The World Bank, 2019). Companies have been outsourcing production to countries where labor is cheap and governments are the most accommodating (Komlosy, 2014). Workers are migrating to enhance their job prospects, or – in the case of qualified workers – to maximize their career opportunities. Thus, economic fluctuations or trade regulations of one country have far-reaching consequences for others. Enterprises are competing globally. A company's failure overseas can lead to job cuts in its country-of-origin. The appeal of a company, on the other hand, can pool talents from all over the world. With the burgeoning cross-border movement of goods, services, and resources – such as technology, data, or capital – the world's markets have become highly interdependent and unpredictable.

Second, *digitalization* constitutes another challenge no organization can insulate themselves from. The continuous progression of digital data processing is changing whole business models, forcing not only start-ups but also big firms to pivot. Products and services have to be continually adapted while others are destined for obsolescence. Entirely new products and services are virtually springing up like mushrooms. Advanced technologies enable enterprises for the first time to collect, store, and integrate huge amounts of data. Feeding sophisticated algorithms, these data unlock unforeseen opportunities. They are used to inform strategic and operational decisions, driving internal efficiency and helping to understand customers' needs. But *Big Data* is not only an important asset to every organization, it is the very core of some business models. Sometimes being referred to as the "most valuable resource" (The Economist, 2017), it has spawned a new industry of giants like Amazon, Facebook, or Google.

Peoples' day-to-day work is also profoundly impacted by the digitalization. More and more tasks are becoming computer-based, and digital process flows are already prevailing within the supply chain. Economists assume that automation will eliminate the majority of routine and office jobs in the next decades (Autor, 2015; Chui, Manyika, & Miremadi, 2016; Lee, Huang, & Ashford, 2018). While work processes are certainly transforming, digitalization also entails growth potential, productivity gains, and the emergence of new occupational fields. The demand for job profiles that involve creative problem solving, critical thinking, and a high degree of autonomy, for example, is increasing (World Economic Forum, 2018). Furthermore, the introduction of digital technologies in the workplace, most importantly mobile devices, has uncoupled work from location to some extent. Sitting at home, it is now possible to cooperate with colleagues from around the globe. Although this can be convenient and time-saving, permanent availability and interconnectedness also lead to more communication and widen the scope of activities, duties, or projects.

Third, we are witnessing an *acceleration* of innovation cycles and technological change. One of the hallmarks of this acceleration is "Moore's law" which states that the capacity of micro-chips doubles about every two years (Moore, 1998; Takahashi, 2005). In combination with the internet and mobile devices, this enables real-time communication and transactions that literally span the globe. At the same time, the rate at which innovative technologies spread has multiplied. New internet platforms such as *Twitter* or *YouTube* now reach several million users within a few years, whereas inventions like the automobile or the light bulb did not hit similar numbers of users until after half a century. Disruptive technologies and inventions thus make the market even more volatile.

Fourth, there is also an exponential *increase of information*. Knowhow has to be produced, gained, disseminated, and connected faster and faster. For example, the number of scientific publications has boomed from about 700,000 in 1980 to more than 1,700,000 in 2012 (Bornmann & Mutz, 2015). Studies have shown that the world's specialized knowledge doubles every 10 to 15 years (Price, 1965; Tabah, 1999). However, this acceleration in the production of information is more of a quantitative than a qualitative nature. The gap between the amount of available information and its quality or actual usefulness is widening. Thus, it is becoming more and more difficult to find and isolate *relevant* knowledge. The overload of information exceeds the selection ability of individuals (Edmunds & Morris, 2000; Eppler & Mengis, 2004). To reduce the quantity of input and to deal with the ever-growing knowledge, employees have to specialize, but also to create teams or networks where distributed knowledge can be shared. Only by pooling highly specialized knowledge of individual members will organizations be able to keep pace with changing trends and tackle sophisticated problems.

Taken together, these trends result in evermore complex economic systems, rendering processes more intertwined, incalculable, and difficult to manage. At the same time, society is facing a major transition from *manual and analog work processes* to *knowledge work* (Drucker, 1980). Unlike manual work, which is based on materials, knowledge work is based on information. It mainly consists in processing information, converting it from one form to another. Simply put, "the essence of the knowledge organization is that work is done in the head" (Zand, 1981, p. 6). This requires highly qualified employees leveraging information technology (IT) and, increasingly, artificial intelligence. Thus, knowledge becomes one of the major resources of economy, sometimes being considered as the primary driver of an organization's value today (e.g., Bock, Zmud, Kim, & Lee, 2005; Stewart, 1997). However, it can no longer be mastered by individuals. It is rather only available in the form of distributed expertise and specialized skills. As a consequence, the organization of work is characterized by interdependence, exchange of expertise, and the need for continuous communication. This, in turn, leads to a changed profile of the workforce: highly skilled employees know their own worth; instead of simply exchanging manpower for money, they are seeking a work environment that facilitates self-development, autonomy, and a sense of purpose. The corresponding change of attitudes and values calls for different organizational structures that can meet these expectations.

1.2 How Organizations Can React to These Challenges in Order to Remain Successful

To stay competitive under conditions of an increasingly complex economy and a demanding work environment, organizations, and companies in particular, are confronted with a high pressure for innovation and flexibility. There are a number of possible reactions and measures they can take in order to capitalize on the transformation under way, such as lean production, outsourcing of task components, acceleration of communication, flexibilization of work processes, or planning. Yet, the pivotal point for tackling the challenges described above consists in *successful decision making.* The capacity to make deliberate decisions is arguably one of the most important advantages our species has evolved (Hammerstein & Stevens, 2012). It allows for highly flexible and adaptive coping with environmental challenges. Decision making is no less crucial for organizations. They, too, must steer their own development and “lay their path in walking” in a rapidly changing environment. However, decision making in organizations is a much more complex process than in personal life; hence, it has to be carefully tuned to the varying demands it faces, taking into consideration the function, goals, and size of the organization.

In order to generate optimal outcomes, decision making processes should generally be designed to

- react flexibly to fast changing demands;
- integrate multiple perspectives and time frames;
- take the distributed knowledge and expertise of participants into account;
- consider interdependencies, short-term and long-term consequences on different levels of the organization, allowing for balanced as well as sustainable decisions.

In the following section, I will explore possible structures of decision making that are suited to meet these requirements.

1.3 How to Improve Decision Making Processes in Organizations

Again, the above-mentioned demands may be addressed by various designs and structures of decision making. Sometimes such designs may only be adequate to respond to one of those demands. If, for example, merely short-term flexibility and rapid decisions are sought, top-down, one-person decision making might be the best choice. However, organizations are increasingly structuring decision making tasks around teams rather than single individuals (e.g., Hollenbeck et al., 1995; Lawler, Mohrman, & Ledford, 1995; Mesmer-Magnus & DeChurch, 2009). These teams take on a variety of forms – project and consulting teams, committees, think tanks, advisory boards, commissions, or multidisciplinary expert groups. Yet, all are deliberately formed to generate high-quality decisions. The basic rationale behind group decision making is twofold (Brodbeck et al., 2007): First, the participation of multiple individuals is expected to result in a smoother implementation and higher acceptance of decisions made. Indeed, research has demonstrated that people perceive decision processes as more just and feel more strongly committed to decision outcomes if their various viewpoints are considered and integrated (for a review, see Moscovici & Doise, 1994). Second, group settings imply a larger pool of available information. The exchange of members' unique knowledge and perspectives is believed to promote creativity and contribute to better decisions. Given that more and more decisions have to be made under conditions of distributed knowledge and expertise, this potential advantage is obviously gaining in importance.

Despite the popularity of teams as basic building blocks for structuring organizations, they often fall short of expectations when it comes to making informed decisions. An extensive body of research suggests that groups predominantly fail to utilize collective knowledge effectively (for a review, see, e.g., Kerr & Tindale, 2004). In a groundbreaking study, Stasser and Titus (1985) first revealed a robust bias towards discussing shared information. They developed a paradigm that became subsequently known as *hidden profile*. In a hidden profile situation, a group is presented with information about a number of discrete choices that they are invited to discuss and decide between. The task is set up such that only some of the information is *shared* (i.e., it is available to all group members prior to discussion), while the rest of the information is *unshared* (i.e., it is merely available to individual members prior to discussion). Thus, no single member has all the information necessary to detect the best alternative. Being *hidden* from each individual, the best decision can only be reached by pooling members' idiosyncratic information. Yet, Stasser and Titus (1985) found that groups tend to focus on *shared* information at the expense of *unshared* information, which ultimately leads to suboptimal decision outcomes. This finding has proven to be quite robust (for overviews, see Brodbeck et al., 2007; Sohrab, Waller, & Kaplan, 2015; Wittenbaum, Hollingshead, & Botero, 2004). The question how this disadvantage may be countered by inter-individual knowledge transfer will be a topic of the studies presented here.

Another direction of research that points to flaws in groups' decision processes has emerged from *Groupthink Theory* (Janis, 1972). Groupthink describes a dysfunctional tendency of groups to seek consensus and to avoid dissent. Janis (1972), who coined the term, defines it as "a mode of thinking that people engage in when they are deeply involved in a cohesive in-group, when the members' strivings for unanimity override their motivation to realistically appraise alternative courses of action” (p. 9). He postulated a number of antecedents to groupthink, such as high cohesiveness, time pressure, or directive leadership (Janis, 1982). Groups or teams that succumb to groupthink are hypothesized to consolidate information poorly, have biased discussions, and not examine alternatives thoroughly. Eventually, these characteristics of consensus-seeking behavior result in a defective decision making performance. Although empirical studies of Janis’s theoretical model are scarce and their findings ambiguous, research on groupthink has undoubtedly drawn attention to the unfavorable and, occasionally, disastrous consequences of group decision making in recent history (for reviews, see Esser, 1998; Park, 1990).

Not every task and not every decision in an organization necessarily requires a team. Whenever a single person possesses all the information vital to making a well-considered decision, it is both more cost-efficient and time-efficient to avoid group decision making. This is true for most routine decisions as, for instance, placing an order with the supplier or assigning shifts to workers. With the rise of “smart” machines and systems[2], such decision tasks will mostly be taken off our hands in the future. Instead, there is a growing need to solve complex problems through collective knowledge and human creativity. For now, our ability to make sense of data, create new insights or ideas, and exchange them with each other, remains indispensable. There will still be plenty of decisions left to us. However, these decisions will not become easier to make. On the contrary, the uncertainty and complexity involved in strategic decision making will only intensify. Making use of the perspectives, expertise, and motivation of multiple individuals, group decision making clearly seems advantageous under these circumstances. Yet, it does not guarantee success, as research has repeatedly shown (for an overview,

[2] The term *smart machine* or *smart system* generally refers to computer-assisted, technical systems that incorporate regulating functions in order to react to data input in an adaptive or predictive manner. They can generate outputs that were not anticipated or directly determined by people (Kohlhoff, 2017).

see, e.g., Kozlowski & Ilgen, 2006). In order to harness their potential, groups or teams must coordinate members' distributed expertise and share information effectively.

Information sharing or *knowledge sharing* is the fundamental process through which team members can exploit their resources, actually providing the competitive advantage for organizations that is expected from them (e.g., Jackson, Chuang, Harden, & Jiang, 2006; Wang & Noe, 2010). In the literature, the terms 'knowledge sharing' and 'information sharing' are sometimes used interchangeably (Ipe, 2003). While being closely related, they reference different contents of what is shared: individually acquired knowledge, which is often predicated on long-term learning, versus gathered information, which can be disseminated quickly. *Knowledge sharing* can also be considered as the overarching concept, including the provision and receipt of factual information. When referring to teams, it is defined as "the exchange of explicit and tacit knowledge relevant to the team task" (Lee, Gillespie, Mann, & Wearing, 2010, p. 474). *Explicit knowledge* consists of knowledge we are aware of and able to communicate easily, whereas *tacit knowledge* is intuitive, often based on personal experience, and cannot be articulated easily (Polanyi, 1958). Thus, the two categories of knowledge subsume people's skills, know-how, and information. Not surprisingly, knowledge sharing has been found to directly predict superior decision quality and overall team performance (e.g., Bunderson & Sutcliffe, 2002; Kim, Atwater, Patel, & Smither, 2016; Lee et al., 2010; Moye & Langfred, 2004; Srivastava, Bartol, & Locke, 2006, for a review, see Wang & Noe, 2010).

In summary, employing team-based structures is promising but not sufficient if decision making processes should reach a balanced or optimized realization of the different demands in a complex environment. Simply selecting groups of individuals who are highly qualified and offer diverse expertise is not enough for an organization to achieve a competitive advantage. They also need to motivate employees to act on their knowledge and share it with each other. This raises the question of how to encourage knowledge sharing, stimulate cross-fertilization among team members, and ultimately improve decision making processes. Several researchers have acknowledged that the *structural* characteristics of teamwork play an important role in explaining variation in team performance (Cohen & Bailey, 1997; Hackman, 1987; Ilgen, Hollenbeck, Johnson, & Jundt, 2005; Mathieu, Maynard, Rapp, & Gilson, 2008). I will therefore take a closer look at different (1) team structures and (2) knowledge structures in organizations.

1.3.1 The Role of Team Structures in Decision Making Under Conditions of High Complexity and Interdependence

Although numerous definitions of teams have been offered over the years, they have many attributes in common and can be distilled down to the following notion: a team is an entity of two or more individuals who work interdependently towards at least one common goal, interact socially and recursively, and are embedded in a larger social system, such as a company (see Guzzo & Dickson, 1996; Mathieu et al., 2008; Salas, Priest, Stagl, Sims, & Burke, 2007). Most theoretical models that were developed to study the effectiveness of teams are grounded in McGrath's (1964) *Input-Process-Output* (IPO) framework. Building on classic system models, it suggests a causal link between a team's output and multiple input factors that is mediated by team processes. *Input* variables are antecedent factors that permit or restrict team members' interactions and influence team performance. Three levels of input factors are distinguished: individual member characteristics (e.g., personalities, skills), team-level factors (e.g., size, diversity, task characteristics), and organizational or contextual factors (e.g., resources, policies). *Processes* refer to the interactions between team members while executing tasks (e.g., planning, monitoring progress, coordinating). They elucidate how inputs are transformed into outcomes. *Output* variables describe "results and by-products of team activity that are valued by one or more constituencies" (Mathieu, Heffner, Goodwin, Salas, & Cannon-Bowers, 2000, p. 273). The most commonly studied outcome criteria are team performance (e.g., quality and quantity of outputs, customer satisfaction, innovation), team members' attitudes (e.g., satisfaction, motivation), and their behavior (e.g., absenteeism, turnover).

While it has been modified and extended in various ways over the last decades, the IPO framework has helped researchers to identify a set of input factors that influence team effectiveness (Cohen & Bailey, 1997; Ilgen et al., 2005; McGrath, Arrow, & Berdahl, 2000). Since input factors can be directly manipulated, they are the primary point of leverage for maximizing team effectiveness and receive a great deal of attention in applied research (Cohen & Bailey, 1997; Guzzo & Dickson, 1996). *Team structure* is one such input variables that has been found to significantly affect team processes and outcomes (e.g., Campion, Medsker, & Higgs, 1993; Delarue, Van Hootegem, Procter, & Burridge, 2008; Manz, 1992). It is commonly defined by organizational theorists as the configuration of relationships between team members that governs the allocation of power, responsibility, and tasks (see Stewart & Barrick, 2000, p. 135). However, the expression *team structure* is not used consistently. Some authors interpret it quite broadly, referring to various structural components of a team setting, such as team size, task characteristics, and group composition (Bunderson & Boumgarden, 2010). Others apply it to the function of teams in relation to their organization (Mathieu et al., 2008). More specifically, they distinguish between *functional* team structures (i.e., individuals are grouped by similarity of task or role) and *divisional* team structures (i.e., individuals are grouped by region or product). I will use the term *team structure* or *group structure* in its narrower sense, describing the internal relations among members with regard to authority and responsibility. Based on this definition, two fundamental structures can be distinguished: *self-organization* versus *hierarchy*.

The origin of the word hierarchy dates as far back as the sixth century, when its meaning arose from theology (Verdier, 2006). Initially referencing the divine order of different choruses of angels, it was first transferred to the relations of subordination among ecclesiastics (churchmen), and ultimately became a general concept of order between elements. In terms of social systems, hierarchy, also called *social* hierarchy, “is an implicit or explicit rank order of individuals or groups with respect to a valued social dimension” (Magee & Galinsky, 2008, p. 354). A *rank order* implies that at least one person is subordinate to at least one other. This order can either be *explicitly* established by law, rules, or agreement; or, it is *implicitly* understood and accepted without consideration. In other words, people’s awareness of the hierarchical system they are part of can vary. The phrase *valued social dimension* means that there is at least one dimension people in the hierarchical system acknowledge and appreciate. Everyone is rank ordered along this valued dimension, with higher ranks possessing more of the valued dimension than lower ranks. In addition, social hierarchies are categorized by the degree of formalization. A hierarchy is considered *formal* if institutional structures and official rules are in place that assign formal roles and positions at different levels. In comparison, an *informal* hierarchy is an unofficial stratification of people that emerges from conscious or unconscious social processes (Diefenbach & Sillince, 2011; Magee & Galinsky, 2008).

The term self-organization was coined in the context of *general system theory* (GST) in the mid-20th century. Originally proposed by biologist von Bertalanffy (1968) as an interdisciplinary scientific approach, GST describes universal principles and regularities that underlie any kind of system (e.g., mechanical, physical, biological, social). It aims at understanding system behavior over time in order to make predictions. One overarching principle that was outlined and defined by researchers in many different fields (e.g., cybernetics, biology, sociology) is self-organization (e.g., Ashby, 1947; Kauffman, 1993; Kriz, 1999). In the most general sense, it characterizes a process where a pattern or form of overall order evolves from the interactions of a system’s elements without centralized control or intervention by external agents. A self-organized system is *non-deterministic* and *autonomous* in the sense that it has its own dynamic that can never be predicted by simply aggregating the features of all single elements. The system’s order is *emergent*, that is, it is constituted by the relations and interactions of its elements.

Due to the ability of self-organized systems to reconfigure themselves in response to disturbances or changing conditions, they are regarded as adaptive and robust (Heylighen, 2001).

Focusing on social systems, self-organization and hierarchy can be conceptualized as opposites. In a hierarchical organization, the structure is essentially linear and based on different levels of power, authority, or management. Higher levels imply superiority over lower levels, with one person or group being at the top. This is usually visualized by a pyramid shape. Decisions and commands flow mainly from the top to the bottom of the organization. By contrast, self-organization is a bottom-up approach. People are not allocated to ranks but rather form small cells or teams that pursue a set of objectives and collaborate in networks. Instead of a chain of command, decisions are decentralized. In the absence of an appointed leader who is in charge, members tackle issues on their own initiative.

Similarly, a hierarchical team structure can be contrasted with a self-organized team structure. Forming a small pyramid, hierarchically structured teams are led by a manager who is ultimately responsible for the team's output and superior to all other members. In self-organized teams, the members themselves assume managerial responsibility with power being distributed among them. They lead themselves, organize their daily work, and have a high degree of autonomy over work-related decisions. More specifically, Cohen, Ledford, and Spreitzer (1994) provide the following definition:

> Self-managing work teams [SMWTs] are groups of interdependent members organized around a particular customer service or equivalent responsibility, characterized by high levels of employee involvement in decisions such as task assignments and methods for carrying out the work. SMWTs are responsible for regulating their performance by setting their own goals and objectives, obtaining performance feedback, and making necessary corrections. (p. 653)

In the literature, many labels are used interchangeably to refer to self-organized teams, such as *self-managing*, *self-designing*, *self-determining, self-directed, autonomous*, *semi-autonomous,* *or empowered* (Guzzo & Dickson, 1996; Magpili & Pazos, 2018; Parker, Morgeson, & Johns, 2017). While team structures also develop informally, the distinction between a self-organized and a hierarchical team is usually drawn on the basis of their *formal* structure. Organizations have a big say in how teams are structured by setting them up intentionally and assigning public roles and functions. This official set-up largely determines their internal structure. However, there is not always a clear line between self-organized and hierarchically structured teams. In the field, hybrid forms where a team is embedded in a hierarchical system but operates basically autonomously can be found as well. For example, some teams are self-organized with regards to a project and yet have an external manager who performs an advisory function or has only personnel responsibility. The manifestations of team-level self-organization are as diverse as their labels are numerous. In fact, even teams with the same label can differ dramatically in their scope of responsibility and authority. According to Stewart, Courtright, and Manz (2011), "self-leadership falls along a continuum ranging from low for behavior that is externally governed to high for individuals or teams who determine not only how to carry out tasks but also what those tasks are and why they should be done" (p. 190).

Historically, organizational researchers have placed special emphasis on hierarchy and top-down leadership (Stewart et al., 2011). Given the ubiquity of hierarchical structures in human organizations, they have been focusing on understanding how leadership emerges, how leaders influence their followers, and whether leadership improves group functioning. Being deeply rooted in our social behavior, hierarchical differentiation usually emerges spontaneously and quickly (Anderson, John, Keltner, & Kring, 2001; Berger, Rosenholtz, & Zelditch, 1980; Eagly & Karau, 1991), occurs both explicitly and implicitly (Blau & Scott, 1962), and exists in all cultures (Sidanius & Pratto, 2001).

Yet, evidence of the effects of hierarchy on group performance has been less conclusive. Some authors argue that vertical differentiation is ubiquitous as it facilitates cooperation and satisfies the psychological need for order, thus enhancing groups' survival and success (e.g., Friesen, Kay, Eibach, & Galinsky, 2014; Halevy, Chou, & Galinsky, 2011). This view is often referred to as *functionalist theory* of power and contrasted with the *conflict theory* of power (Lammers & Galinsky, 2009). The conflict theory posits that hierarchy is inherently detrimental to group performance, as it leads to suppression of and discrimination against the interests of subordinates. Thus, it causes dissatisfaction, tension and conflict (e.g., Greer & van Kleef, 2010; Siegel & Hambrick, 2005). More integrative notions of hierarchy suggest that its influence may be positive or negative, depending on various contextual factors (Lammers & Galinsky, 2009). Previous research has found empirical support for both adverse and productive effects of hierarchy (for a review, see Anderson & Brown, 2010). However, "very little of that recent research has actually examined hierarchy on the group or organizational levels, assessing how differences in hierarchy steepness impact the entire collective" (Anderson & Brown, 2010, p. 80). Having only scratched the surface, we cannot yet explain the mechanisms that underlie the paradoxical effects of hierarchy on group performance.

More recently, an alternative perspective, which centers on how groups lead and manage themselves, has attracted growing interest (Stewart et al., 2011). Pervasive criticism of hierarchy and its bureaucratic structures has prompted organizations to experiment with more flexible and participative approaches. In Western economies, companies are increasingly embracing self-organized structures to attenuate hierarchy. By the mid-2000s, about 75% of the top 1000 U.S. firms had implemented some form of self-managing teams (Douglas & Gardner, 2004). This has been proclaimed as a paradigm shift in management (Druskat & Wheeler, 2003; Manz & Sims, 2001).

Management practices and organizational structures as we know them today were established at a time when automation was in its early stages, a poorly educated workforce was carrying out manual tasks, and mass markets were relatively stable. Businesses could focus on increasing production and efficiency at a steady pace. In those days, hierarchical management practices enabled a few educated people to instruct others on how to complete tasks effectively.

Conventional educational institutions, like schools and universities, were the gatekeepers of knowledge. Thus, hierarchy was justified by meritocratic principles and an increase in efficiency (i.e., the knowledge of the few ensuring the productivity of the many).

Today, managerial positions are less often substantiated by superior skills or knowledge. In modern organizations, highly educated and highly mobile knowledge workers must configure their own responses to unforeseen events and do no longer execute meticulous plans (Drucker, 1973). The nature of knowledge work is such that it demands a significant amount of control by the *worker* over how work is done. Linear work processes that correspond to simple input-output patterns are disappearing or being automated. The pace of environmental changes and the sheer magnitude of available information render it virtually impossible for a single leader to stay on top of things and instruct others on what they need to do. Organizations now tend to be composed of specialists, each with his or her own narrow area of expertise. As a consequence, efficiency can no longer be raised by exercising control over the worker and management is urged to question its legitimacy.

Tracing back to socio-technical systems theory (Cummings, 1978), the use of self-organized teams is intended as a substitute for the traditional management hierarchy. Not only do self-organized teams promise a way out of the corset of hierarchy, they are also anticipated to improve productivity, promote innovation, and boost organizational competitiveness (e.g., Campion et al., 1993; Goodman, Devadas, & Hughson, 1988; Manz, 1992; Pearson, 1992). In general, a higher level of autonomy is associated with stronger feelings of ownership and responsibility, which leads to higher intrinsic motivation. Members of self-organized teams are therefore expected to be more productive and satisfied with their jobs (e.g., Hackman & Oldham, 1980; Kirkman & Shapiro, 2001; Seibert, Wang, & Courtright, 2011). Theoretically, the proximity of self-organized teams to the product and business processes should also enable them to respond more quickly to changes in customer demands or organizational direction (Johnson, Hollenbeck, DeRue, Barnes, & Jundt, 2013; Wageman, 1997). It has further been suggested that they foster innovation by harnessing their members' specialized skills and knowledge (Muthusamy, Wheeler, & Simmons, 2005).

For all their claimed benefits, however, self-organized teams do not consistently contribute to success. Empirical findings on their effectiveness are mixed (for a review, see Magpili & Pazos, 2018). Some studies have corroborated the hypotheses that self-organization is related to more innovative behavior, employee satisfaction, and team performance (e.g., Cohen & Ledford, 1994; De Dreu & West, 2001; de Jong, de Ruyter, & Wetzels, 2006; Fredendall & Emery, 2003; Wall, Kemp, Jackson, & Clegg, 1986). As opposed to this, other studies could either not confirm the positive impact of self-organized teams (e.g., DeVaro, 2006) or even revealed negative consequences of their implementation, such as higher levels of stress (e.g., Barker, 1993; van Mierlo, Rutte, Seinen, & Kompier, 2001).

The inconsistencies in the effects of both hierarchy and self-organization indicate that neither of the two team structures is uniformly superior to the other. Instead, the question arises *which circumstances* determine whether one of them has an advantage over the other. Moderating or mediating variables that have been proposed previously include corporate culture, fit with the workforce, and task characteristics (for reviews, see Magpili & Pazos, 2018; Parker et al., 2017). In a study by Stewart and Barrick (2000), for instance, team self-leadership was only positively related to performance when teams were performing *conceptual* tasks, whereas the opposite was true for teams carrying out primarily *behavioral* tasks. Several authors have further emphasized the role *task interdependence* plays in moderating the relationship between team structure and effectiveness (e.g., Langfred, 2005; Wageman, 1995).

Thus, it is imperative to detail the defining characteristics of decision situations in the modern workplace before hypothesizing which team structure might be advantageous. Based on McGrath's (1984) circumplex model of group tasks, decision making inherently falls into the category of conceptual or cognitive tasks. It can imply a correct answer (i.e., an intellective task) or rest entirely upon judgment. Regardless of the type of answer, decision making tasks vary greatly in their level of interdependence and complexity. If relevant information and expertise are distributed across team members, the decision making process becomes highly interdependent, as the best answer can only be generated by collaboration. The level of complexity, on the other hand, increases with the amount of information and the number of potential consequences that can be or should be factored into the decision. Despite being separate dimensions, interdependence and complexity are not completely independent of each other. The more knowledge is required to make a sustainable decision, the more likely it will be that multiple individuals are needed to deal with it. In other words, higher complexity tends to necessitate interdependent processes. This kind of interaction also pervades decision making in organizations. Facing increasingly complex situations that demand a multi-faceted approach, organizational decision making tasks are largely characterized by high interdependence. Team discussion has become a common and important component of decision making, with team leaders and members depending on each other for insight into different aspects of a decision at stake.

I hypothesize that a self-organized team structure will be more conducive to decision quality than a hierarchical team structure if the decision situation is characterized by high interdependence and complexity. While leaders have been shown to discuss more information overall compared to other team members (e.g., Larson, Christensen, Abbott, & Franz, 1996; Larson, Christensen, Franz, & Abbott, 1998), they also tend to seek compliance and sanction dissent (Baron, Kerr, & Miller, 1992). Thus, they exert leverage on team members to conform, which is hypothesized to severely impair knowledge sharing and very likely provoke premature consensus-building (De Dreu & West, 2001). Yet, it is essential to share information openly and evaluate each individual viewpoint carefully when making non-routine decisions under conditions of asymmetrically distributed knowledge. Although self-organized teams are certainly not immune to groupthink or shared information bias, they might be less prone to withhold information, squelch dissent, or jump to conclusions. With *all* members being on equal terms and bearing the responsibility for any ramifications of their decision, a self-organized structure should encourage a frank exchange of views, motivate every participant to engage in discussion, and allow for a careful weighing of interests.

While researchers have started to investigate the factors that govern success of self-organized teams, there is a lack of studies *directly* comparing conventional with more autonomous team structures under specified conditions (Tost, Gino, & Larrick, 2013). It should be added that the vast majority of findings rests on field data. Experimental tests of the effects of different team structures remain scarce. An exception constitutes a more recent series of studies published by Tarakci, Greer, and Groenen (2016). Comparing the performance of teams with high versus low power disparity, the authors conducted both a decision making experiment and a subsequent field study. They found that "the performance differences between teams with high and low power disparity are contingent on whether the power holder has high or low competence" (p. 423). That means, teams with a leader outperformed egalitarian teams if the power holder was the *most competent* group member. Egalitarian or self-organized teams, on the other hand, gained the advantage over hierarchical teams whose leader was not the most competent member.

Despite the commendable multimethod design, Tarakci et al.'s findings are limited to conditions that do not reflect the main challenges of group decision making as pointed out above. Most notably, the decision task groups were assigned to in the experimental study was designed such that, theoretically, one person could have solved it single-handedly. The level of interdependence among team members was therefore extremely low. Since a leader has to make the final call and is considered the most influential team member, their own competence has a tremendous impact on the outcome if they *alone* can master the task. The relevance of a leader's competence notwithstanding, it is still an open question how hierarchical and self-organized groups compare when performing cognitive tasks under conditions of distributed expertise and high interdependence. I have therefore dedicated two empirical studies to address this question (see Research Paper I in chapter 2 and Research Paper II in chapter 3).

1.3.2 The Role of Knowledge Structures in Decision Making Under Conditions of Distributed Knowledge

The concept of knowledge is commonly recognized as the most important resource of organizations today (e.g., Drucker, 1992; Nahapiet & Ghoshal, 1998; Spender & Grant, 1996). While it has always been an important asset for companies, only in recent decades has it been proclaimed to be the primary source of competitive advantage and critical to organizations' long-term prosperity (Ipe, 2003). Companies now acknowledge human capital as the cornerstone of success. They are investing in knowledge management systems (KMSs) that promote the creation and sharing of both individual and collective knowledge (Becerra-Fernandez & Sabherwal, 2001).

An organization's knowledge resides primarily within individuals (Nonaka & Konno, 1998) and, more precisely, in the workers who acquire, access, archive, and apply knowledge in carrying out their tasks. Thus, the dissemination of knowledge across individual boundaries ultimately depends on employees' knowledge-sharing behaviors. Organizations can only exploit knowledge-based resources when information or know-how are actively shared within and across teams. Research suggests that knowledge sharing has a direct positive effect on both team and organizational performance (Wang & Noe, 2010). This effect is explained, in part, by better decision making (Moye & Langfred, 2004). Yet, extensive knowledge sharing appears to be the exception rather than the rule in organizations (Bock et al., 2005). It is an entrenched habit to hoard knowledge and look guardedly at the information provided by others (Davenport & Prusak, 1998). For a long time, companies were feeling threatened by transparency because of industrial espionage. They maintained economic supremacy by keeping material and processes secret. Once established, such strategies are difficult to change (Ruggles, 1998). To this day, organizational incentive structures tend to undermine knowledge sharing. Performance-related pay, for instance, leads employees to believe that passing on knowledge will impede their efforts to make themselves stand out (Huber, 2001).

In the internet age, however, it is no longer feasible to prevent competitors from copying new products and production methods somewhat quickly. A global marketplace for ideas has emerged, with the half-life of innovation getting shorter and shorter. While it is difficult to maintain the market power of new products or services, knowledge can provide a sustainable advantage for businesses. “Unlike material assets, which decrease as they are used, knowledge assets increase with use: Ideas breed new ideas, and shared knowledge stays with the giver while it enriches the receiver” (Davenport & Prusak, 1998, pp. 16-17). In the end, competitors will almost always catch up with the quality and price of a market leader's current product or service. But by then, a knowledge-driven, knowledge-managing company will have pivoted or moved on to the next level of quality and efficiency. In short, the need to capitalize on organizational knowledge, to get as much value as possible out of it, has never been greater. Thus, organizations are pressured to abandon old habits that served to discourage knowledge sharing.

A variety of tools and methodologies have been recommended to support knowledge-related activities (Becerra-Fernandez & Sabherwal, 2001), ranging from training measures to state-of-the-art technologies. On a structural level, the implementation of knowledge worker teams, which use the expertise and experience of multiple people to solve complex problems, can also be regarded as a knowledge management initiative (Lewis, 2003). Organizations are hoping to foster knowledge exchange and creative thinking by bringing experts of different domains together. Indeed, higher task-related diversity of team members appears to be associated with better decision outcomes (e.g., Rink & Ellemers, 2010; Schulz-Hardt, Brodbeck, Mojzisch, Kerschreiter, & Frey, 2006). While setting up diverse teams is an initial step towards overcoming cross-functional barriers, it bears additional challenges. Diversity in expertise, skills, and background demands a higher degree of coordination. It is rather easy to understand what colleagues know and what they are doing as long as they have similar tasks, skills, information, and views. Coordinating with each other becomes much more complicated, however, when everyone has their own role, specialized knowledge, and unique perspective.

In order to benefit from and manage their distributed knowledge, interdisciplinary teams need to develop a mental map of this distributed knowledge, that is, they need *meta-knowledge*. Meta-knowledge refers to a person's knowledge about what other people know. Going beyond the individual level, Wegner (1986) introduced the idea that social groups can acquire a *collective* meta-knowledge. He coined the term *transactive memory*, which describes the sum of knowledge possessed by members of a group in combination with their shared awareness of who knows what. It can be conceived as cognitive architecture that interconnects the knowledge held by each individual (DeChurch & Mesmer-Magnus, 2010) and "develops as a function of a person's beliefs about the knowledge possessed by another person and about the accessibility of that knowledge" (Lewis, 2003, p. 588). Regarding knowledge worker teams, transactive memory consists of each member's domain of expertise coupled with a meta-knowledge of the member-expertise associations.

According to Wegner (1986, 1995), a *transactive memory system* (TMS) is cultivated over time, including a set of processes that occur among members. These processes are (a) learning and updating who knows what, (b) allocating memory items to specific group members, and (c) planning how to retrieve information in a way that takes advantage of the distributed knowledge. Thus, a TMS denotes the active use of transactive memory by two or more people. It gives rise to an *interactive knowledge structure* with group members dividing cognitive labor. Everyone specializes in a different domain and relies on the others to complement their knowledge. By collectively encoding, storing, and retrieving information, groups gain access to a body of knowledge that no one member could hope to remember (Austin, 2003).

Transactive memory systems are predicted to boost group performance because they help members to cultivate specialized expertise and coordinate the exchange of knowledge. That way, more task-relevant information can be incorporated. Despite being an emerging area of psychological research that has only grown considerably since the 2000s, transactive memory systems have already proven to be linked to higher team performance and satisfaction (for a brief review, see Lewis & Herndon, 2011). Early studies by Liang, Moreland, and Argote (1995) and Moreland, Argote, and Krishnan (1996) demonstrated that student groups whose members were trained together were more apt to jointly remember and apply task-relevant knowledge than were teams whose members were trained individually. As a consequence, groups trained as groups performed better than groups trained individually. This effect was attributed to the development of a TMS. Subsequently, other researchers have provided first evidence for the positive influence of a highly developed TMS on team learning (e.g., Lewis, Lange, & Gillis, 2005) and team performance (e.g., Austin, 2003; Kanawattanachai & Yoo, 2007; Lewis, 2003).

When making decisions under conditions of asymmetrically distributed knowledge, teams must appreciate who knows what, coordinate who will contribute what, pool information systematically, and reconcile differences. Transactive memory, which enables quick and coordinated access to specialized expertise, should therefore prove beneficial to decision quality. Previous findings on expertise recognition suggest that groups make better decisions when their members know who is good at what (Libby, Trotman, & Zimmer, 1987; Littlepage & Silbiger, 1992). Recognizing expertise is certainly a fundamental component of TMS development, since it directs group members to those individuals who have the most reliable information and helps them to evaluate the information they obtain. However, the concept of transactive memory goes beyond simple expertise recognition. It also involves a coordinated process of storing and disseminating information. Thus, it is not enough to merely examine participants' meta-knowledge about who is an expert on what. In order to assess transactive memory, multiple dimensions should be considered (Austin, 2003; Lewis, 2003). In addition to testing shared meta-knowledge, researchers must also determine whether group members deliberately specialize in a knowledge domain and explicitly combine their expertise to accomplish a task.

Unfortunately, research on TMSs is generally scarce and "most of that research involves couples rather than groups […], and tasks that are not much like those faced by most workers"

(Moreland, 2006, p. 329). To my knowledge, Stasser, Stewart, and Wittenbaum (1995) and later Stasser, Vaughan, and Stewart (2000) conducted the only studies that intended to test the effect of transactive memory on group decision making. Employing a hidden profile paradigm, Stasser et al. (1995) designed a task that is representative of the modern workplace. It necessitated the exchange and integration of distributed information to reach a common goal (i.e., an optimal decision). Transactive memory was manipulated by introducing expert roles. Each group member was an expert on one of the suspects in a homicide investigation in that they received more information on the respective suspect than the others did. Before reviewing the materials, participants were forewarned in one condition that they had received information about a specific suspect the other members did not have. This means, each group member was aware of their own expert role by this point. In another condition, expert roles were explicitly assigned in addition to forewarning. More precisely, prior to group discussion but after reading the materials, participants were informed about each other's expertise. Stasser et al. (1995) found that assigning explicit expert roles advanced the dissemination of unshared information and led to a higher rate of correct decisions. Forewarning of expertise, however, did not significantly affect the frequency of solved hidden profiles.

In a follow-up study, Stasser et al. (2000) further examined the existence of transactive memory by analyzing groups' recall patterns. Contrary to their hypothesis, the authors could not demonstrate the complementary division of labor in recalling information that is postulated by TMS theory. Regardless of the experimental condition, group members did not remember more items within their domain of expertise. Thus, both studies failed to prove the presence of a full transactive memory. While their results show that shared awareness of who knows what contributes to more knowledge sharing and better decision outcomes, they do not provide evidence for a deliberate coordination of encoding and retrieving information. This might have been due to some methodological shortcomings. Stasser and colleagues (Stasser et al., 1995; Stasser et al., 2000) manipulated transactive memory by either making participants aware of their own expertise at the beginning of the study or by publicly assigning expert roles at the onset of group discussion. One condition included both steps. This experimental setting implies that group members neither aware of their *mutual* expertise initially nor were they continuously reminded of the distributed knowledge structure during the experiment. Since newly formed groups cannot rely on previous experience and established trust, they need to spontaneously develop a collective meta-knowledge or transactive memory. This is of course much harder than gradually developing a TMS over a long period of time. The impact of an experimental manipulation should therefore be maximized. If everyone's expert role is announced at the very beginning and groups are continuously reminded of the distributed knowledge, they might actually exhibit more characteristics of a TMS than just the knowledge of who is an expert in which domain. Another proposal for improvement pertains to the way transactive memory is measured. To analyze both the coordinated encoding and retrieving of information, Stasser et al. (2000) counted how many items participants recalled inside their respective expert domains during group discussion (relative to the total number of items they mentioned). Yet, whether group members specialize when encoding information is best probed *prior* to group discussion, that is, before other group processes can interfere with it. The coordinated retrieval of information, on the other hand, should indeed find expression in a higher mentioning rate of items that belong to a participant's expert domain.

Despite these methodological problems of research, the potential benefits of transactive memory for decision making groups appear obvious. When established, a TMS enables a better use of the knowledge team members already possess. Tasks will be assigned to the people who will perform them best. Knowledge will be shared more efficiently because workers understand when to give advice and when to listen. Decisions will be made more accurately because workers can match questions with the people most likely to answer them (Moreland, 2006). Yet, the concept is relatively new and researchers have only started to explore its development, antecedents, and effects. As the world's knowledge stock is increasing exponentially, organizations feel compelled to structure this flood of knowledge proactively. Their eager demand for knowledge management strategies has sparked great interest in transactive memory. With teams being the most common way to structure and perform knowledge work, making them transfer, use, and extend their knowledge is seen as the key to companies' future success.

Although a TMS is assumed to generally boost knowledge sharing and ultimately improve team performance, it could have a differential impact depending on a team's internal structure. Traditionally, a manager has always been expected to know which skills are relevant to the team's tasks and how those skills are distributed among workers. Functioning as a hub where all necessary information converges, managers have been responsible for coordinating their workers activities. As mentioned before, this standard is increasingly difficult to live up to. Self-organized teams, on the other hand, lack the role of a well-informed coordinator who sets the agenda. Instead, responsibility for coordinating individual tasks is delegated to the employees (i.e., to everyone in the team). This basically means that learning more about one another, specifically about colleagues' task knowledge, becomes imperative in self-organized teams. Hence, a collective meta-knowledge structure might be especially conducive to their success, whereas it might be less critical in conventional, manager-led teams.

To address the research gaps outlined above, I experimentally investigated the effect of a TMS on group decision making by extending previous manipulations. Moreover, I explored potential interaction effects between TMS and group structure. To validate the findings from the experiment (see Research Paper I), I subsequently conducted a field study in an organizational context (see Research Paper II).

1.4 Contributions of the Present Dissertation

As self-organized teams become increasingly popular in modern organizations, there is a growing interest in research investigating how these teams function and what makes them successful (e.g., Stephens & Lyddy, 2016; Stewart, Courtright, & Barrick, 2012). However, the underlying assumptions put forward by those who advocate self-organization have not been rigorously tested yet. The rationale behind self-organized structures is that they increase group identification and members' feeling of responsibility, which, in turn, leads to higher intrinsic motivation, and ultimately improves job satisfaction, effort, and productivity (e.g., Manz, 1992; Seibert et al., 2011; Stewart et al., 2011). Accordingly, self-organized teams are hypothesized to fare better when making complex organizational decisions. Due to a heightened engagement and shared responsibility, their members are expected to exchange knowledge more willingly and integrate individual expertise more effectively than the members of conventional teams. Yet, this only has a favorable effect if task-relevant information and skills are distributed among multiple people. In other words, only if team members need to work interdependently, an autonomous structure might be superior to a hierarchical one.

At the same time, hierarchically structured teams with distributed expertise are still common in all kinds of organizations. Top management teams, product development teams, hospital emergency room teams, or research teams of graduate students led by a professor are just a few of the many examples that correspond to the model of a hierarchical team with distributed expertise making critical decisions (Hollenbeck et al., 1995). Although both kinds of knowledge worker teams – self-managing *and* manager-led, hierarchical teams – are found in present-day organizations, research has hitherto hardly ever investigated them in parallel. Self-organized teams are a product of applied research and hands-on experiences in industry. By contrast, hierarchical structures are part of fundamental research and have been explored by scientists of various disciplines. Self-organization is still new and uncommon as underlying structure of social systems, whereas social hierarchies are an ancient and ubiquitous phenomenon. Findings on the effectiveness of self-organized teams mainly come from field studies, whereas the dynamics of hierarchy have been examined experimentally for the most part.

This dissertation intends to provide much needed empirical data by *directly* comparing these two organizational structures while taking the level of interdependence (i.e., the distribution of task-relevant knowledge) into account. More precisely, it will investigate how the internal team structure influences decision making processes (e.g., knowledge sharing), and the quality of final decisions.

In addition to this, teams' knowledge structure will be assessed and manipulated to measure its impact on decision outcomes. Knowledge worker teams with distributed expertise depend on knowledge sharing to make the most informed choices. Being their key resource, each team member's idiosyncratic knowledge must be extracted, processed, and organized. Thus, supporting a knowledge structure that stimulates communication and sharing of information is a potential intervention to improve team effectiveness. The development of a TMS is assumed to expedite the access to and coordinated exchange of idiosyncratic knowledge by honing a collective meta-knowledge structure (Austin, 2003; Wegner, 1986).

As we have seen, there is already some evidence that TMSs are positively related to team performance (Lewis & Herndon, 2011). However, research that explicitly examines TMSs in decision situations under conditions of distributed knowledge is largely missing (see Sohrab et al., 2015, p. 520). This dissertation will therefore explore the difference a TMS can make in such situations, testing its effect on knowledge sharing and decision quality. Given the coordinating function of transactive memory in group discussions, another interesting question is whether a TMS is more effective in self-organized than in traditionally managed teams. The relevance of group transactive memory to different types of teams has not been studied so far and will be addressed here for the first time.

This dissertation aims at contributing to a growing body of research on team effectiveness with two individual studies presented in *Research Paper I* and *Research Paper II* (chapters 2 and 3). The first study was designed as a group experiment to shed light on the causal relationships between team structure, TMS, and decision quality. The second study employed a correlational survey design, collecting field data from a large corporation. It complements the experimental study by testing the central hypotheses in an organizational setting, and thereby improving the external validity of findings.

2 Research Paper I

The Effects of Group Structure and Transactive Memory System on Group Decision Making Under Conditions of Distributed Knowledge

2.1 Abstract

Organizations are increasingly utilizing work groups to gain access to a richer pool of knowledge and skills, as well as to enable adaptive, efficient decision making. However, research has repeatedly cast doubt on the claimed advantages of group decision making, prompting the question of how to structure teams in order to achieve the best results. Using a paradigm that reflects the asymmetrical distribution of knowledge in modern work groups (i.e., hidden profile paradigm), the present group experiment compares the decision quality of self-organized versus hierarchically structured groups, both in a condition with a transactive memory system (TMS) and in a condition without a TMS. Based on this two-by-two factorial design, two main effects are found in a sample of 80 groups. First, self-organized groups are shown to outperform hierarchical groups under conditions of distributed information. Second, groups with TMS make better decision than groups without TMS under these conditions. Both effects are found to be mediated by improved information sharing among group members. Specifically, groups' shared information bias is attenuated by both a self-organized group structure and the development of a TMS. Theoretical and practical implications of these findings are discussed.

Keywords: group decision making, distributed knowledge, self-organization, hierarchy, TMS, information sharing

2.2 Introduction

In today's fast-paced and complex economy, organizational success increasingly hinges upon the abilities to innovate, generate intellectual capital, and collaborate effectively. Given the ongoing shift from manual to knowledge work, the hierarchical distribution of responsibility and control that has dominated organizations for the past centuries does not seem to fulfill its purpose anymore. Knowledge used to be held by a select few who legitimately assumed leadership. The sea captain provides a timeless example – if only one person knows how to navigate a ship across the ocean, the most effective strategy to reach any destination is to put that person in charge and everyone else under their control. Instead of being narrowly concentrated, however, knowledge has become widely distributed in most organizations these days. With growing specialization, it is not uncommon that an employee possesses more expertise in a domain central to the team's or company's mission than their superior. Thus, the locus of control over how to accomplish tasks has partially moved away from the leader to the worker. This is touching one of the most fundamental concepts of social organization: hierarchy (Fiske, 1992; Gruenfeld & Tiedens, 2010; Magee & Galinsky, 2008).

People endorse hierarchical rankings based on a meritocratic belief. That is, differential levels of status and power are considered legitimate because individuals higher up in the organization are regarded as more competent and motivated to accomplish the organization's goals (e.g., Haines & Jost, 2000; Jost, Banaji, & Nosek, 2004). The perceived legitimacy of a hierarchical system has a strong influence on its stability. If people do not consider the ranking and opportunities in an organization as fair, they are more likely to leave or challenge the existing order (e.g., Martorana, Galinsky, & Rao, 2005; Wade, O'Reilly, & Pollock, 2006).

Hierarchical structures are prone to lose legitimacy in modern organizations where knowledge workers possess a complex skill set, take on more and more responsibility, and are often expected to work autonomously. Moreover, the pace of technological development, aggravated risks involved in decision making, and an intensified competition make it extremely difficult for leaders to act alone, lead effectively, and make the right decisions. In order to adapt organizational structures to the changing work environment, “new approaches to leadership are required that go beyond a hierarchical leader-focused view […] and involve more extensive interactions among multiple individuals” (Yammarino, Salas, Serban, Shirreffs, & Shuffler, 2012, p. 382).

As a consequence, the idea of establishing less hierarchical but more self-organized structures has gone viral. Superseding traditional leader-follower relationships that are based on demand and control, the use of teams with high levels of autonomy has risen dramatically since the 1990s (Cohen & Bailey, 1997; Gonzalez-Mulé, Courtright, DeGeest, Seong, & Hong, 2016; Stewart & Barrick, 2000; Tata & Prasad, 2004). In their most extreme form, these teams are called *self-organized*, *self-managed*, or *autonomous* teams. They are defined as a group of employees with interdependent tasks who share a common goal and have autonomy over decisions such as task assignments, work methods, hiring, or firing. In addition, they regulate their own performance by setting objectives, evaluating their own progress, giving feedback, and making corrections if necessary (Cohen et al., 1994).

Despite the rapid adoption of self-organized structures by businesses, there is little research – and even less *experimental* treatments – detailing their strengths and weaknesses compared to classic hierarchical management. In general, the question of how different management structures (e.g., self-organization vs. hierarchy) affect team performance is still understudied (see Tost et al., 2013, p. 1465). While their advocates claim that self-organized teams are more adaptable, motivated, and productive, previous research has revealed inconsistencies regarding their potential to enhance performance (for a review, see Magpili & Pazos, 2018). Similarly, findings on the functionality of hierarchical team structures are highly heterogeneous. Accumulating evidence suggests that steeper hierarchies have a diminishing effect on team performance and team learning (e.g., Bunderson, 2003; Ivancevich & Donnelly, 1975; Ouchi, 2006). On the other hand, structuring teams hierarchically can facilitate cooperation and coordination among their members (for a review, see Halevy et al., 2011).

According to contingency theories of organization (e.g., Hall & Tolbert, 2005), there is no form of organizational structure that fits *all* groups and situations. It is rather a question of *when* a more autonomous or a more hierarchical structure will benefit team functioning. In light of the current trend towards the attenuation of hierarchy, this study investigates under which conditions self-organized structures might actually outperform hierarchical ones.

2.2.1 Teamwork Under Conditions of Distributed Knowledge

The emergence of self-organized teams is closely linked to increasingly complex work processes and decision making. Given the acceleration of innovation and the abundance of available information, it has become vital to utilize *distributed knowledge*. Organizations are therefore delegating tasks and increased decision making responsibility to teams of multiple experts who possess complementary skills and expertise. In doing so, they intend to gain improved access to knowledge for making effective organizational decisions (e.g., Brodbeck et al., 2007, Kellermanns et al., 2008, Mesmer-Magnus & DeChurch, 2009). At the same time, the shift in job design from individual work to teamwork entails a higher level of interdependence among coworkers. The wide distribution of knowledge increases the extent to which team members depend on each other to accomplish their tasks.

In theory, groups of multiple experts should benefit from a greater pool of informational resources, reaching better solutions than individuals could. Contrary to these expectations, however, numerous studies have demonstrated that team members frequently fail to leverage distributed expertise (for reviews, see Kerr & Tindale, 2004; Sohrab et al., 2015; Wittenbaum et al., 2004). Not only do they tend to omit relevant information and coordinate poorly, they are also detrimentally affected by various biases. For instance, studies employing the *hidden profile* paradigm (Stasser & Titus, 1985) have found a bias towards shared information in decision making groups. The hidden profile paradigm implies that “part of the information is shared among group members (i.e., all members possess this information prior to discussion), whereas other pieces of information are unshared (i.e., information known to only one member prior to discussion)” (Schulz-Hardt et al., 2006, p. 1080). In addition, task-relevant information is distributed such that groups can only come to the right conclusion if they exchange and gather the initially *unshared* pieces of information. Yet, groups’ efforts to solve the hidden profile have repeatedly proven to be unsuccessful due to their bias in favor of shared information (Wittenbaum et al., 2004). Although researchers have addressed many factors that could mitigate this problem, it is still unclear whether a self-organized group structure helps or hurts decision making under conditions of distributed knowledge as implied by the hidden profile paradigm.

On the one hand, the proliferation of self-organized teams is symptomatic of an organizational change underway. As illustrated above, the traditional approach of organizing work by granting both authority and responsibility to individual leaders seems obsolete. Hierarchical structures have come under criticism because bureaucratic pyramids are slow, and managers rarely have enough knowledge these days to make informed decisions on their own. On the other hand, teams without a leader have not always proven beneficial. Many of the shortcomings of group decision making hold regardless of a group’s internal structure. As a recent study by Tarakci et al. (2016) demonstrates that self-organized groups can even be outperformed by groups with a highly competent leader.

In this paper, I argue that teams perform better on decision making tasks in a self-organized setting than in a formally introduced hierarchy when task-relevant knowledge is asymmetrically[3] distributed among their members, such that task interdependence is high. Two field

[3] Knowledge is asymmetrically distributed when the individual knowledge sets of group members do not perfectly overlap, such that no single member possesses all relevant knowledge in a given situation.

studies by Langfred (2005) and Wageman (2001) provide first evidence that self-organized teams are more successful when working under conditions of high compared to low task interdependence. Moreover, Stewart and Barrick (2000) found that the degree of self-organization was only positively related to team performance for conceptual tasks, but not behavioral tasks. Yet, these findings remain purely correlative. Not only have previous studies on self-organized teams largely neglected the role of distributed knowledge, they have also failed to examine the causal connection between the internal structure of teams and their effectiveness. The present study therefore sets out to experimentally test the influence of a self-organized *versus* a hierarchical group structure on decision quality under conditions of asymmetrically distributed information.

2.2.2 Systems for Managing Distributed Knowledge

Since organizations are increasingly employing teams with distributed expertise, the exchange of knowledge among their employees is as important as never before. How can teams better coordinate and use their collective knowledge to create intellective products and make complex decisions? This question has spawned the development of multiple theoretical frameworks of group knowledge processes. One of these frameworks, which is especially relevant for understanding how knowledge worker teams share, integrate, and leverage distributed expertise, is Wegner's (1986) TMS theory.

A TMS describes the collective processes of encoding, storing, and retrieving information in groups. It has two major components: (1) a structure which involves a shared, organized store of knowledge, and (2) knowledge-relevant processes (Wegner, 1986; Wegner, 1995). More precisely, "the TMS structure is a knowledge representation of members' unique and shared knowledge (including members' shared understanding of who knows what). TMS processes are the mechanisms by which the group coordinates members' learning and retrieval of knowledge, so that the knowledge can be applied to group tasks" (Lewis & Herndon, 2011, p. 1256).

TMS theory has attracted a great deal of attention in recent years due to the growing need for strategies or systems that help teams leverage their members' complementary skills and knowledge. Theoretically, a highly developed TMS does not only provide teams with access to a larger pool of information, it also enables them to plan their work more sensibly and coordinate individual efforts more efficiently (e.g., Lewis & Herndon, 2011; Moreland, 2006). Even problems should be solved more quickly in teams with a well-developed TMS because their members know exactly who is most likely to solve them.

Indeed, previous findings indicate that TMSs can serve as a facilitator of team performance (e.g., Austin, 2003; Kanawattanachai & Yoo, 2007; Zhang, Hempel, Han, & Tjosvold, 2007). Especially when confronted with tasks that require the exchange and coordination of idiosyncratic knowledge, groups are expected to benefit from a TMS. Yet, studies explicitly examining the causal effect of a TMS under conditions of asymmetrically distributed information are scarce (Sohrab et al., 2015). To the best of my knowledge, Stasser and his colleagues (Stasser et al., 1995; Stasser et al., 2000) were the only ones to experimentally manipulate both transactive memory and the distribution of information among group members. Employing a hidden profile task, they assigned expert roles to induce a TMS. While their studies demonstrated that the awareness of expertise leads to more information sharing and higher decision quality, they did not succeed in establishing a full TMS. Participants had indeed acquired meta-knowledge of each other's expert roles, but they did not exhibit a deliberate coordination of encoding or retrieving information.

In the past, researchers have often simplified the operationalization of a TMS, defining it as shared understanding of who knows what. According to Lewis and Herndon (2011), this notion ignores integral components of a TMS, such as *differentiated group knowledge*. Differentiated group knowledge arises from a division of knowledge responsibilities with each member being responsible for unique knowledge. The authors strongly advocate to take this aspect of TMS knowledge into account "because the available conceptual and empirical evidence suggests that the usefulness of a TMS depends not only on a shared understanding of who knows what but also on the degree to which a group's knowledge is differentiated" (p. 1256).

Extending the work of Stasser and his colleagues (Stasser et al., 1995; Stasser et al., 2000), I addressed this issue by developing a modified manipulation of transactive memory. First, my goal was to infer an active TMS from multiple indicators, measuring both participants' shared understanding of who knows what *and* their division of knowledge responsibilities based on the expertise structure (i.e., differentiated group knowledge). Based on a successful manipulation of transactive memory, my second goal was to demonstrate its positive influence on decision quality through enhanced information sharing. As previous findings on expertise recognition indicate, groups make better decisions when their members know who the expert on which topic is (Libby et al., 1987; Littlepage & Silbiger, 1992). Identifying others' expertise is undoubtedly a fundamental component of TMS development but the concept of transactive memory goes beyond the scope of mere expertise recognition. The causal effect of a full TMS on the decision making processes under conditions of distributed knowledge has hitherto not been analyzed. It is possible that a TMS reduces the bias towards shared information – so often found in group decision making – because members explicitly rely on each other to remember and know different things.

Moreover, by crossing manipulations (TMS × group structure), this study examined the differential effect of a TMS depending on the internal group structure. Traditionally, a team's leader is assumed to coordinate members' individual knowledge and contributions. Perhaps helping members learn more about one another therefore improves performance to a larger extent in the absence of a leader (i.e., when groups operate in a self-organized way).

2.2.3 Overview of the Present Study and Hypotheses

The first objective of the present study was to compare the performance of self-organized and hierarchically structured groups while manipulating the distribution of knowledge – both shared information and the idiosyncratic knowledge of group members. Simulating a real-life decision case, a group experiment was conducted. The distribution of information among group members thereby constituted a hidden profile (i.e., the correct solution was not identifiable on the basis of members' individual information and could only be detected by pooling and integrating each member's unique information). As a consequence, group members were highly dependent on each other in order to perform well and make the best decision. It was hypothesized that decision quality would be higher in self-organized groups than in hierarchically structured groups. This difference was expected to be explained by the pattern of groups' information sharing. That is, members of self-organized groups were assumed to share more information and, thus, reduce the bias in favor of *shared* information during group discussions.

The second objective was to test the influence of different knowledge structures on groups' decision quality by manipulating the development of a TMS. It was hypothesized that groups who exhibit both a meta-knowledge structure of who knows what and a division of cognitive labor (i.e., a TMS) would perform better than groups who only knew about the asymmetric distribution of information (i.e., they merely knew that group members had different sets of information). Again, this effect was expected to be mediated by information sharing, in that groups with a TMS were assumed to be less biased towards shared information. Additionally, members of groups with a TMS were hypothesized to learn more from each other than members of groups without a TMS.

Finally, this study also examined potential interaction effects by combining the manipulations of knowledge structure (with TMS vs. without TMS) and group structure (hierarchical vs. self-organized) in a two-by-two factorial design. Self-organized groups were assumed to benefit to larger extent from a TMS than hierarchical groups.

2.3 Method

2.3.1 Participants and Design

Data were collected at Regensburg University and Heidelberg University in Germany. Forming three-person groups, a total of 267 students (154 women, 113 men) with an average age of 23.64 years (*SD* = 3.65) participated in the experiment. They were recruited from various faculties through university-internal mailing lists and postings. Familiarity among participants was an exclusion criterion. Table 1 summarizes the sample composition by academic discipline. Each student was paid €20 for participation. The experiment employed a two-by-two between-subjects design based on the manipulation of group structure (self-organized vs. hierarchical) and TMS (with TMS vs. without TMS). Participants were randomly assigned to one of the four experimental conditions (self-organized without TMS, self-organized with TMS, hierarchical without TMS, and hierarchical with TMS).

Table 1
Sample Composition by Academic Discipline

Discipline	Percentage
Psychology	36.3%
Educational Science	13.3%
Teacher's Training	8.3%
Business & Economics	7.9%
Law	5.0%
Medicine	4.2%
Computer Science	3.3%
Engineering	2.9%
Others	
Humanities	8.8%
Applied Social Sciences	5.0%
Natural Sciences	5.0%

Note. $n = 267$

2.3.2 Material

For the purpose of this experiment, I adapted a hidden profile task that was originally developed by Schulz-Hardt et al. (2006). In their decision scenario, an airline company wants to hire a new pilot for long-distance flights. Each study participant is asked to play the role of a member of the airline's selection committee. Their task involves two stages. In the first stage, participants have to read and memorize descriptions of the final candidates who have passed all preselection tests. The descriptions include a summary of positive and negative attributes. In the second stage, participants hold a committee meeting to discuss the presented information and to choose the best candidate.

Although the original version of the task includes profiles of four pilots, one of them was dropped in this experiment for reasons of simplification. Each of the remaining three candidates – named A, B, and C – was characterized by a total of 10 attributes. Given the full set of information, pilot C was unequivocally the best choice. This candidate was portrayed by seven positive and merely three negative attributes, whereas the ratio for candidates A and B was four positive attributes to six negative attributes. A pretest by Schulz-Hardt et al. (2006) had confirmed that the presented attributes did not vary substantially in strength or importance. Hence, the number of positive compared to negative characteristics should determine the ranking of alternatives. This assumption was also confirmed by the authors. 87% of people who had been given the full set of information chose candidate C. I ran an additional pretest to ascertain that alterations made to the original task did not affect this ranking. A sample of 100 people were asked to select the best candidate based on the complete list of attributes. In this sample, 94% decided in favor of candidate C. The decision making task therefore involved an empirically correct solution.

However, in the actual experiment, information was distributed among participants. The documents provided to them included merely 6 items per candidate. Each participant received a different set of information, such that some items were available to only one participant (unshared information), while others were handed to at least two participants (shared information). Table 2 details the distribution of information about the three candidates, which reflects a hidden profile situation. That is, the preferable alternative (in this case, candidate C) was not evident to participants unless they exchanged their individual information.

Table 2
Distribution of Information in the Hidden Profile Scenario

	Candidate		
Information type and valence	A	B	C
Shared information			
Positive	3	3	2
Negative	2	2	3
Unshared information			
Positive	1	1	5
Negative	4	4	0
Information available to each individual			
Positive	3	3	3
Negative	3	3	3
Full information available to the group			
Positive	4	4	7
Negative	6	6	3

In most hidden profile studies, researchers intentionally influence participants' preferences prior to discussion. They provide subsets of information, in which the advantages of inferior alternatives outweigh the advantages of the correct choice. As a result, participants are usually biased towards a suboptimal alternative. Previous studies have explicitly investigated how variations in these pre-discussion preferences affect subsequent information processing (e.g., Kelly & Karau, 1999; Schulz-Hardt, Frey, Lüthgens, & Moscovici, 2000). Yet, the present study was designed to avoid the development of initial preferences for the following reasons.

First, its main objective was to compare different team settings under conditions of asymmetrically distributed information, whereas the impact of pre-discussion preferences was not of further interest. Second, the experimental task was supposed to be as close to reality as possible. Willfully biasing team members' judgment was not in line with a realistic scenario. Finally, strong pre-discussion preferences could have interfered with the manipulation of TMS. In two conditions, participants were assigned expert roles, receiving more unshared information on one of the job applicants. These expert roles were expected to guide their information processing (i.e., remembering and retrieving more information within their domain of expertise). However, it has been shown that people allocate more cognitive resources to information that supports their pre-discussion bias (Faulmüller, Kerschreiter, Mojzisch, & Schulz-Hardt, 2010). This would have confounded the effect of expertise if initial preferences had not been prevented or at least attenuated.

Prior to discussion, each participant learned about three negative and three positive attributes of candidate A, B, and C, respectively. As the importance of attributes was balanced out empirically, potential preferences for one of the candidates should be random (i.e., based on participants' idiosyncratic interpretations of the perceived valence or significance of information). As depicted in table 2, more negative than positive attributes of candidate C were shared among participants. The opposite was true for the other two candidates: the majority of their negative attributes was initially unshared.

In addition, unshared items were distributed such that all participants implicitly became experts. That is, each participant received three items on one of the candidates (A, B, or C, respectively) that nobody else had access two. In other words, half of the information an expert had about their candidate was only known to them. For the remaining two candidates, they shared all but one item with other participants. Since a test group had three members, there was always one expert for each pilot. Appendix A describes the distribution of information in more detail.

2.3.3 Procedure

The experimenter scheduled two-hour sessions with three people at a time. They were invited to a breakout room at the university. If someone failed to appear, the session had to be cancelled and attendees were compensated with 5 Euros. At the beginning of each session, the experimenter welcomed participants and briefly informed them about the procedure of the experiment. They would be part of a committee that should fill a vacant position. After reading and memorizing information about the job applicants, they would have to discuss and make a decision about which of them should be hired. Specifically, it was pointed out that the group discussion would be recorded for research purposes. Having signed a consent form, each participant was given an alphanumeric code that was used to identify all further documents. This code included the group number and a letter that indicated whether someone was committee member X, Y, or Z. The member name or letter was randomly assigned to participants as it determined the leadership position and expert roles in some of the experimental conditions.[4] It was further highlighted by a name tag each participant had to wear.

Following this, participants received a cover letter introducing the decision case and providing some background information. They were further asked to provide basic demographic data (sex, age, field of study, and number of semesters). The experimenter then handed out a fact sheet on the candidates in question. On this sheet, candidates A, B, and C were described by six attributes each. However, there were three versions that differed between committee members. While the number of items remained the same, the list of attributes on the sheet varied. When combined, the versions of committee members X, Y, and Z covered the full information on all three candidates. If a group had been assigned to a condition with TMS, an additional sheet was provided to manipulate the development of a TMS. This supplementary

[4] A random computer-generated order determined prior to each experimental session which condition a group was assigned to and, in case it was a hierarchical condition, which committee member (i.e., X, Y, or Z) was selected as leader.

sheet illustrated how information was distributed among committee members (see Appendix B). Without revealing any informational content, it showed that each member possessed more unique knowledge on one of the job applicants than the others did. By demonstrating the asymmetric distribution of information, expert roles became apparent and were further highlighted on the sheet. Participants were allowed to hold on to this information during the committee meeting. In the two conditions without TMS, it was also pointed out to participants that they had not received identical sheets of information. However, they did not learn about each other's expertise.

Next, participants were told to familiarize themselves with the material and memorize the candidates' attributes because they would not have access to them later on. To stress the importance of memorizing all information, they were forewarned of a recall test. After a period of 12 minutes, everyone's fact sheet was taken away. As announced before, a recall test was administered, having participants write down as many attributes per candidate as they could remember. After a maximum time of 10 minutes, their notes were collected by the experimenter.

Before proceeding to the committee meeting, group structure was manipulated. The experimenter announced to analyze the results of the recall test but was only pretending to do so. In the meantime, each participant had to fill out a short questionnaire, asking whether or not they had a preference for any of the candidates. The subsequent procedure differed depending on the condition. In a hierarchical condition, one participant was formally appointed as leader of the committee. The experimenter explained that this person had scored the most points on the recall test, and for that reason was chosen as leader.[5] While the role assignment was in fact based on *random* selection, participants were supposed to believe that the hierarchical ranking

[5] In the TMS conditions, one member was necessarily, though unknowingly, the expert on the best candidate. To control for a possible interaction effect between expert role and leadership position (i.e., the leader knowing more about the correct choice), half of the selected leaders were experts on the right candidate. The remaining 50% were evenly distributed between the other two expert roles.

was substantiated to some degree. This study did not aim to investigate the effectiveness of certain leadership characteristics or leadership styles but rather to compare two fundamental group structures. Assigning leadership roles on the basis of any characteristic would have limited the results to a specific type of leader. Instead, leaders were chosen randomly to average out differences between individuals. However, people typically display deference to authority when working in hierarchical organizations because they assume that it is (at least somewhat) justified. Specifically, they do not think of leaders or managers as randomly assigned. To reflect this, the experimenter concealed the actual selection process from participants by giving them an understandable justification for a hierarchical group structure.

The designated leader of the committee was first offered to sit at the head of a big table in an executive armchair. A glass of water, the audio recording device, and a sign that said "Kommissionsleiter/in" (leader of the committee) were put in front of them. Blank sheets of paper and a few pens had already been placed on the table. The other two participants were then seated on two wooden chairs. In their presence, the experimenter gave the following instructions, which were addressed to the leader of the committee:

> *You will now preside over the committee meeting. It is important for you to know that you are appointed to this committee to make the final decision. You alone are ultimately accountable for hiring the best candidate. You are expected to chair this meeting and determine when it is over. Please do not inform the committee members about your final decision. You will have some time to consider before handing it in.*

Participants in the self-organized conditions had no leadership position assigned. The experimenter nevertheless pretended to analyze the results of their recall test, while they were filling out the same questionnaire as participants in the hierarchical conditions. Afterwards, they were instructed as follows:

> *Please take a seat at this table wherever you want. You will now hold the committee meeting. It is important for you to know that you are appointed to this committee as*

equal members who are all entitled to vote. You are equally accountable for your committee's final decision. It is up to you to structure this meeting and adopt a strategy for hiring the best candidate. You have as much time as you need.

All participants were seated on three chairs of the same kind. A few blank sheets of paper, three pens, and the audio recording device were sitting on the table in front of them. Regardless of the condition, the experimenter now handed out a sheet with general instructions for the committee meeting. In accordance with previous hidden profile studies (Schulz-Hardt et al., 2006), the instructions emphasized that committee members' individual information did not perfectly overlap, such that each member also had some unique pieces of information. It was further emphasized that one of the candidates was clearly the best choice given the full set of information held by the committee as a whole. This, again, is part of the instructions that have been used in most hidden profile studies. To be able to identify participants in the audio recordings, they were also requested to open the committee meeting with a formal introduction of members.

Only after making sure that everyone had understood the instructions, the experimenter started the recording and the meeting was opened. Although no time limit was set for the discussion, a group would have been urged to make a decision if it had taken more than 45 minutes. With the longest group discussion taking 43.2 minutes, this was never the case, however. The experimenter always stopped the audio recording when the group was ready to make a decision. In a self-organized condition, groups were given a form to register their final choice after they indicated that they had come to a conclusion. If a group was structured hierarchically, the leader of the committee ended the meeting by giving the experimenter a sign. Both committee members were asked to leave the room for a moment, while their leader wrote down his or her final decision on a form.

Afterwards, the three participants were seated at separate tables again. A second recall test followed. Each of them had to write down all attributes they could remember for each candidate (i.e., both the attributes they had known prior to group discussion and those they had just learned from others). Lastly, participants had to fill in a questionnaire that included manipulation checks and some additional variables. After the experiment was completed, participants were thoroughly debriefed, paid, and thanked for their participation. On average, one experimental session took approximately 105 minutes.

2.3.4 Dependent Measures

Decision quality was the main dependent variable and could be derived from the form on which the final choice was recorded in writing. It was coded as a dichotomous variable, with 0 = incorrect choice (i.e., choice of one of the suboptimal candidates) and 1 = correct choice (i.e., choice of the optimal candidate). A number of measures that were hypothesized to mediate the effects of group structure and TMS on decision quality were extracted from the audio data. *Discussion time* was directly available from the recordings as it corresponded to their duration. To analyze information sharing, two coders blind to the hypotheses were trained in coding the group discussions. Using a form specifically designed for this purpose, they noted which items were mentioned and how often they were repeated. For the mention of an item to be counted as correct, group members had to link it to the corresponding candidate either explicitly or by context. Moreover, only minor deviations from the original wording were tolerated. Once an item had been introduced, all further times it was bought up were coded as a repetition. Items that were repeated by the same group member only counted as repetition, if at least one other item had been quoted in between.

One coder first coded the recordings of all groups that were included in the analysis. For each condition, five recordings were then randomly selected to be coded independently by the second coder. Based on these 20 analyzed discussions, the two coders agreed on 91% of coded statements (i.e., both the introduction and the repetition of information). In the remaining cases, where the second coder differed from the first coder, no bias or systematic pattern could be detected. Hence, the first coder's data were used for all subsequent analyses.

Based on these data, the proportion of mentioned information and the repetition rate for shared and unshared information could be calculated. To compute proportions of mentioned information, the number of items that were mentioned at least once in a discussion was counted for each category (e.g., unshared information) and divided by the total number of items available in the respective category. Repetition rates resulted from counting the number of all repetitions within a category (e.g., unshared information) and dividing it by the number of items that were mentioned at least once in the respective category. By combining these separate measures, the *bias in favor of shared information* was obtained (see results section).

Participants' recall tests were used to measure *information gain*. The items each participant recalled after the group discussion were matched against the items they had recalled prior to discussion. All items a participant had correctly quoted in the second but not in the first recall test counted as information gain. In other words, a participant's information gain describes how much unshared information he or she learned from the others during their group session.

2.3.5 Additional Variables

The final questionnaire assessed some additional variables that were used for the manipulation checks and to explore other dependent measures or mediators. To check whether group structure had been successfully manipulated, multiple variables were measured. First, participants had to indicate whether their committee had a formal leader and, if so, whether the leader was member X, Y, or Z. Second, the level of hierarchical stratification was assessed based on team members' ratings of perceived influence. Following other researchers (Anderson, Spataro, & Flynn, 2008; Greer, Caruso, & Jehn, 2011; Tarakci et al., 2016; Venkataramani & Tangirala, 2010), each participant was asked to rate on a 7-point Likert scale how much influence each member had within the committee. The average score of team members' ratings was defined as perceived power of a participant. Similarly, another question asked how much responsibility each member had for the committee meeting. Again, the average of members' ratings indicated the perceived responsibility of each participant. Finally, to quantify the degree of disparity in influence and responsibility within a group, the coefficient of variation in individuals' scores was calculated (Harrison & Klein, 2007).

The manipulation check for TMS was based on data from both the questionnaire and the first recall test. To ascertain that participants had acquired meta-knowledge, they had to specify at the end of a session which candidate each committee member was the expert on. This was not sufficient, however, to attest the presence of a TMS. Additionally, there had to be proof of a division of labor among group members. Recall tests were analyzed to check whether participants had memorized more information about the candidate they were an expert on relative to the other candidates.

The final questionnaire further assessed *intrinsic motivation* using an adapted, time-economic version of Deci and Ryan's "Intrinsic Motivation Inventory" (*Kurzskala Intrinischer Motivation* [KIM], Wilde, Bätz, Kovaleva, & Urhahne, 2009; for the original version see, e.g., Deci, Eghrari, Patrick, & Leone, 1994; Ryan, 1982). Finally, participants' *overall motivation* and *confidence in the decision* was measured by one item each ("Being completely honest, how important was it to you to make the right decision?" and "How confident are you that the committee has hired the best candidate?").

2.4 Results

Of the total sample of 89 three-person groups, four groups failed pre-defined attentional checks and were excluded prior to the analysis. The data of five groups had to be discarded due to technical problems or interruptions. The remaining 80 groups were evenly distributed across conditions. There were no significant differences between conditions with regards to participants' gender, $\chi^2(3, N = 80) = 4.60$, $p = .204$, age, $F(3, 236) = 1.24$, $p = .297$, $\eta_p^2 = .01$, or previous academic training (i.e., number of semesters), $F(3, 236) = 1.72$, $p = .164$, $\eta_p^2 = .02$. As intended, the vast majority of participants reported not having a preference for one of the job applicants prior to discussion (91.25%). For the 8.75% of participants who indicated a preference, no systematic bias for one of the candidates and no significant difference between conditions was found.

After presenting the results of both manipulation checks, I first report analyses of the decision quality measure to test the central hypotheses of this study. Next, I report analyses of discussion time and information sharing to determine whether these variables qualify for mediation analysis. I then describe the results of testing mediation models for all identified potential mediators. In the final section, additional findings are summarized. All statistical analyses were performed using *R*, version 3.6.2, (R Core Team, 2018).

2.4.1 Manipulation Checks

The effective manipulation of group structure was defined by three criteria. First, all members of a group had to agree with their experimental condition by correctly indicating whether one of them had been assigned as leader or not. This criterion was met by all test groups. Second, the coefficient of variation in perceived power was compared between conditions. A t-test confirmed that groups in a hierarchical condition experienced a greater power disparity than groups in a self-organized condition, $t(64) = 8.70$, $p < .001$, one-tailed, $d = 1.94$. Third, the coefficient of variation in members' perceived responsibility was analyzed. Groups in a hierarchical condition again perceived more disparity than groups in a self-organized condition, $t(43) = 10.60$, $p < .001$, one-tailed, $d = 2.36$.

To check whether the manipulation of TMS was successful, participants were asked to match each candidate (pilot A, B, and C) to the committee member who was an expert on this candidate (committee member X, Y, or Z, respectively). In the TMS conditions, all participants, without exception, correctly identified the assigned expert roles. By contrast, only 2.5% of participants indicated correct matches between experts and candidates in the other conditions.[6] Thus, the experimental manipulation was successful in establishing a meta-knowledge structure as the first major component of a TMS.

To further determine whether groups in the TMS conditions exhibited a division of labor, the first recall test was analyzed. Results showed that, indeed, participants remembered significantly more information about the candidate they were an expert on than about the other candidates, $F(1, 358) = 57.64$, $p < .001$, $\eta_p^2 = .14$. They had deliberately concentrated on memorizing information about one candidate. This was not the case for participants in the other conditions, $F(1, 358) = 0.63$, $p = .429$, $\eta_p^2 < .01$. TMS was effectively manipulated since group members did not only exhibit a shared meta-knowledge but also divided and coordinated their efforts according to this meta-knowledge.

2.4.2 Decision Quality

Overall, 45 of 80 groups (56.25%) made the right decision. To predict the solution rate, group structure (self-organized vs. hierarchical) and TMS (with TMS vs. without TMS) were entered into a binary logistic regression model (0 = unsolved hidden profile, 1 = solved hidden profile). In line with the hypothesis, results revealed a main effect of group structure on decision quality, $b = 2.09$, $p < .001$, 95% CI [1.05, 3.26], $OR = 8.05$. Specifically, self-organized groups had a significantly higher solution rate than hierarchical groups. In addition, there was a main effect of TMS on decision quality, $b = 2.09$, $p = .008$, 95% CI [0.42, 2.62], $OR = 4.32$. As expected, groups with TMS were significantly more likely to make the correct decision than groups without TMS. Figure 1 shows the percentages of correct decisions across experimental conditions. Adding the interaction term of group structure and TMS to the additive regression

[6] A very small number of participants was able to infer expert roles from the exchange of information during the group discussion without having received additional information on the distribution of expertise.

model did not yield a significant predictor, $b = 0.19$, $p = .866$, 95% CI [-1.99, 2.68], $OR = 1.21$. When comparing both logistic regression models, the additive model performed as well as the full model with interaction, $\chi^2(1) = 0.03$, $p = .865$.

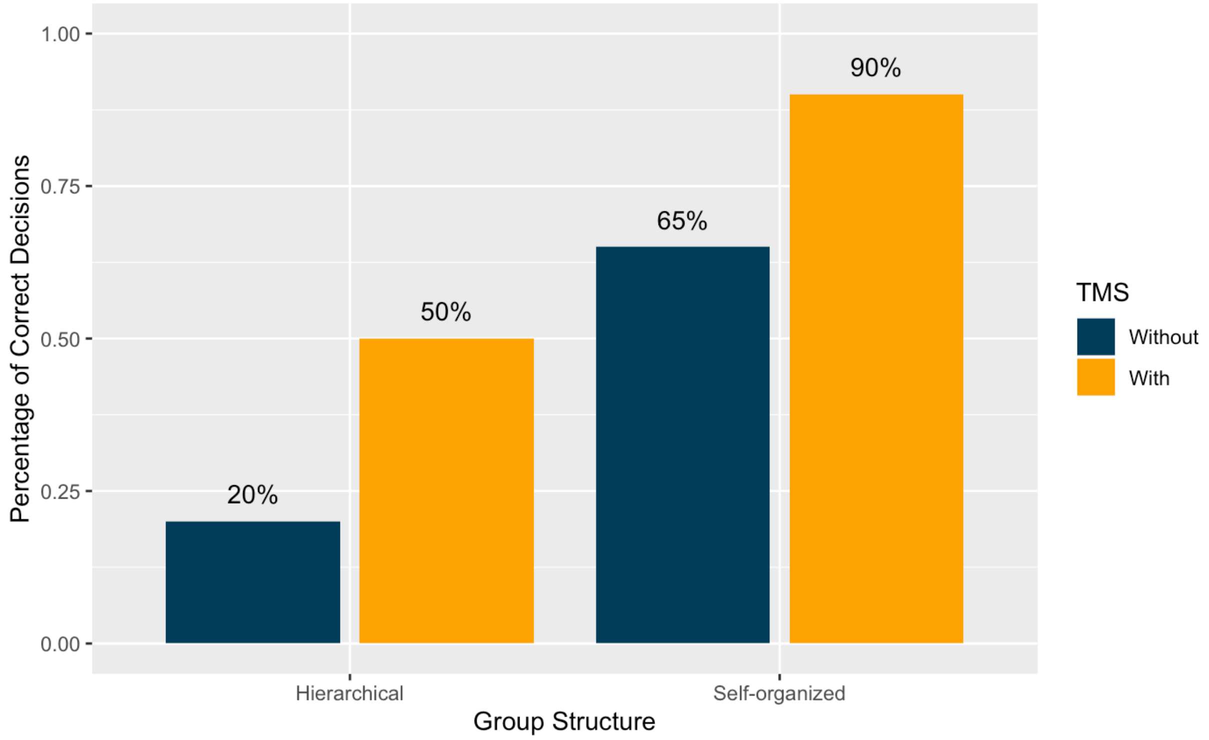


Figure 1. Percentage of correct group decisions by group structure and TMS. $N = 80$.

To explore potential differences in discussion time between conditions, a two-way ANOVA was conducted. Neither the main effect of TMS nor the interaction of TMS and group structure were significant, $F(1, 76) = 0.10$, $p = .755$, $\eta_p^2 < .01$ and $F(1, 76) = 0.72$, $p = .039$, $\eta_p^2 = .01$, respectively. Only the main effect of group structure turned out to be significant, $F(1, 76) = 8.00$, $p = .006$, $\eta_p^2 = .10$, with self-organized groups taking longer on average to make the final decision ($M = 19.5$ min, $SD = 7.3$) than hierarchical groups ($M = 15.3$ min, $SD = 5.8$). However, discussion time did not predict decision quality, $b = -0.002$, $p = .951$, 95% CI [-0.08, 0.08], $OR = 0.99$. Entering it as additional variable did not improve the regression model, $\chi^2(1)$

= 0.003, p = .951. Thus, discussion time was not suited as a mediator to explain the higher decision quality of self-organized groups.

2.4.3 Information Sharing

Groups' information sharing was evaluated based on the bias towards shared information. Two bias measures were derived from the proportion of mentioned information and the repetition rate for shared versus unshared information. As specified by Schulz-Hardt et al. (2006), *the mentioning bias in favor of shared information* was calculated by dividing the proportion of shared information mentioned by the sum of the proportions of shared and unshared information mentioned. Similarly, *the repetition bias in favor of shared information* was calculated by dividing the repetition rate of shared information by the sum of the repetition rates for shared and unshared information. These bias measures range between 0 and 1, with a value of .50 representing an unbiased exchange of information and larger values indicating a bias toward shared information.

Overall, a larger proportion of shared information (M = 89%, SD = 9%) than unshared information (M = 71%, SD = 16%) was mentioned during group discussions, $t(79) = 11.19$, $p < .001$, $d = 1.38$. Moreover, shared information was also repeated more frequently (M = 1.64, SD = 0.81) than unshared information (M = 1.10, SD = 0.72), once it had been introduced, $t(79) = 7.12$, $p < .001$, $d = 0.58$. The average mentioning bias in favor of shared information was .56, differing significantly from .50, $t(79) = 9.59$, $p < .001$, $d = 1.52$. An ANOVA revealed that groups with TMS exhibited a lower mentioning bias than groups without TMS, $F(1, 76) = 12.10$, $p < .001$, $\eta_p^2 = .14$. There was also a significant main effect of group structure, indicating that self-organized groups had a lower mentioning bias than hierarchical groups, $F(1, 76) = 5.14$, $p = .026$, $\eta_p^2 = .06$. No interaction effect was found, $F(1, 76) = 0.28$, $p = .595$, $\eta_p^2 < .01$. For each experimental condition, the means and standard deviations of all information sharing measures are listed in Table 3.

Table 3

Means for Information Sharing Measures by Experimental Condition

Measure	Experimental Condition							
	Hierarchical without TMS (n = 20)		Hierarchical with TMS (n = 20)		Self-organized without TMS (n = 20)		Self-organized with TMS (n = 20)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Proportion of shared information mentioned	.86	.09	.94	.06	.94	.06	.88	.11
Proportion of unshared information mentioned	.60	.15	.77	.10	.75	.21	.78	.10
Mentioning bias in favor of shared information	.61	.06	.55	.04	.56	.07	.53	.03
Repetition rate of shared information	1.43	0.71	1.43	0.58	1.58	0.86	2.1	0.94
Repetition rate of unshared information	0.80	0.72	1.21	0.69	1.17	0.63	1.57	0.67
Repetition bias in favor of shared information	.70	.14	.57	.10	.58	.13	.57	.07

The average repetition bias was .60, which was significantly different from .50, $t(79) = 7.32$, $p < .001$, $d = 1.16$. Again, differences between conditions were found. The repetition bias in favor of shared information was lower in conditions with TMS than in conditions without TMS, $F(1, 76) = 6.94$, $p = .010$, $\eta_p^2 = .08$. Similarly, groups in the self-organized conditions had a lower repetition bias compared to groups in the hierarchical conditions, $F(1, 76) = 5.31$, $p = .024$, $\eta_p^2 = .07$. This time, the interaction of group structure and TMS was also significant, $F(1, 76) = 5.78$, $p = .019$, $\eta_p^2 = .07$. Specifically, the difference in repetition bias between hierarchical groups with TMS and hierarchical groups without TMS was considerably greater than the difference in repetition bias between self-organized groups with and without TMS; for the corresponding means and standard deviations, see Table 3.

2.4.4 Mediation Analyses

Next, the mediating role of information sharing was analyzed. I used Imai, Keele, and Tingley's general approach to causal mediation analysis (2010) with Tingley, Yamamoto, Hirose, Keele, and Imai's R package (2014). The proportion of the indirect to the total effect is reported as a measure of effect size.

First, groups' mentioning bias in favor of shared information was analyzed as mediator of the effect of group structure on decision quality. As Figure 2 illustrates, not only the regression coefficient between group structure and decision quality was significant but also the regression coefficient between mentioning bias and decision quality. Using bootstrapping procedures (5,000 bootstrapped samples), the significance of the indirect effect was tested. The bootstrapped unstandardized indirect effect was 0.07, 95% CI [0.003,0.16], $p = .042$, suggesting that the effect of group structure on decision quality was mediated via the mentioning bias. The proportion mediated was 16%.

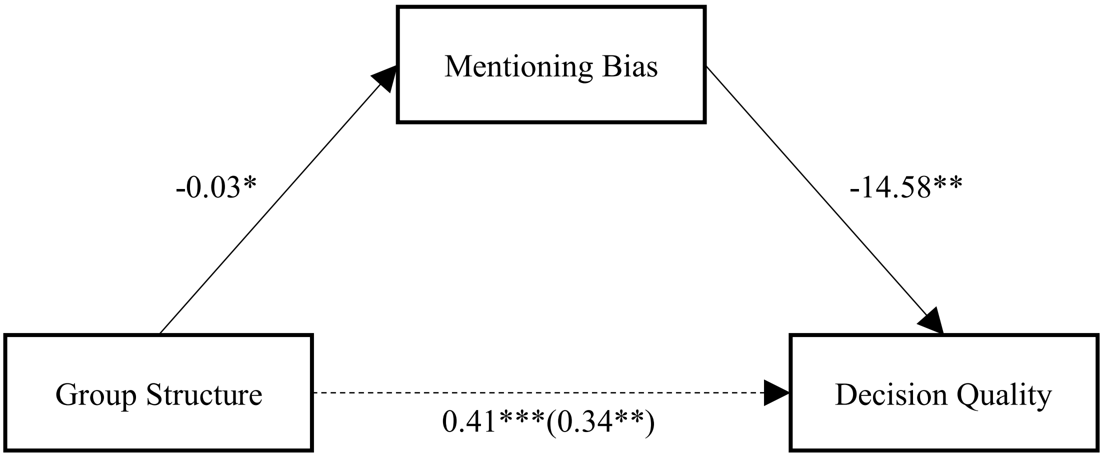


Figure 2. Path diagram with unstandardized regression coefficients, showing the mentioning bias in favor of shared information as a mediator of the effect of group structure on decision quality. The value in parentheses is the effect of group structure on decision quality after controlling for the mediating effect of the mentioning bias. $N = 80$. $p < .05$, ** $p < .01$, *** $p < .001$.

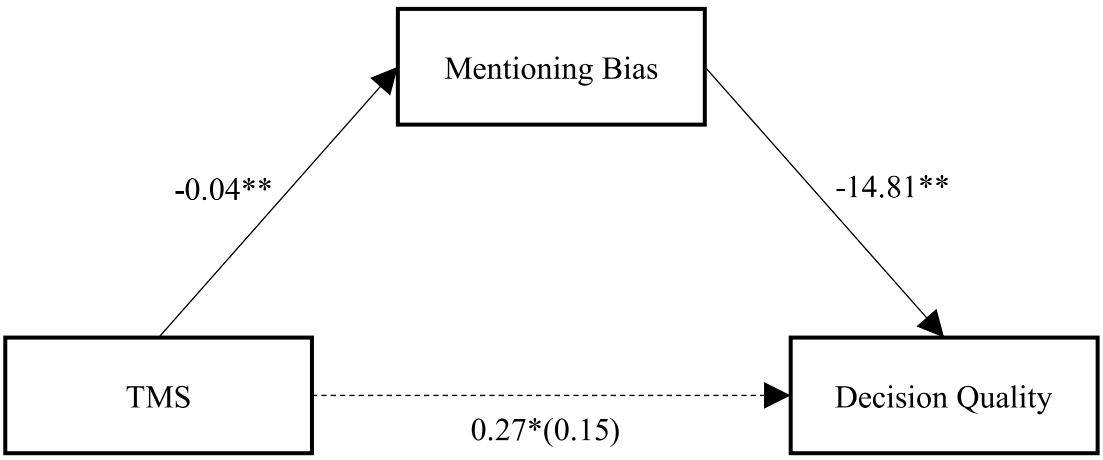


Figure 3. Path diagram with unstandardized regression coefficients, showing the mentioning bias in favor of shared information as a mediator of the effect of TMS on decision quality. The value in parentheses is the effect of group structure on decision quality after controlling for the mediating effect of the mentioning bias. $N = 80$. $p < .05$, ** $p < .01$, *** $p < .001$.

Second, I investigated the mediating role of groups' mentioning bias in the relationship between TMS and decision quality. Both the total effect of TMS and mentioning bias on decision quality and the effect of the mentioning bias on decision quality were significant. The corresponding regression coefficients are shown in Figure 3. Unstandardized indirect effects were again computed for each of 5,000 bootstrapped samples. The bootstrap confidence intervals indicated that the indirect effect coefficient was significant, $b = 0.12$, 95% CI [0.03, 0.24], $p = .006$, whereas the direct effect of TMS on decision quality became insignificant, $b = 0.15$, 95% CI [-0.06, 0.36], $p = .156$. Thus, the relationship between TMS and decision quality was mediated by the mentioning bias, with 45% of the effect of TMS on decision quality being attributed to groups' mentioning bias.

Third, I ran the same mediation analyses for the repetition bias in favor of shared information. Both the regression coefficient between group structure and decision quality and the regression coefficient between repetition bias and decision quality were significant, $b = 0.41$, 95% CI [0.20, 0.59], $p < .001$, and $b = -6.39$, 95% CI [-11.79, -1.90], $p = .010$, respectively. The bootstrapped unstandardized indirect effect was 0.07, and the 95% confidence interval ranged from 0.002 to 0.17. Thus, the indirect effect was statistically significant ($p < .05$), indicating that groups' repetition bias was a mediator of the relationship between group structure and decision quality. The proportion mediated amounted to 16.5%. With a bootstrapped unstandardized indirect effect of 0.09, the repetition bias also mediated the effect of TMS on decision quality, 95% CI [0.01, 0.19], $p = .016$. 33% of this effect could be attributed to the repetition bias.

In summary, the two main effects of group structure and TMS were partially explained by groups' information sharing. That is, the positive effect of a self-organized group structure on decision quality and the positive effect of an existing TMS on decision quality were mediated by attenuated biases towards shared information.

2.4.5 Additional Findings

Information gain (i.e., the number of pieces of information per group that participants had learned from each other, as evident from the comparison of their pre- and post-discussion recall tests) was analyzed by comparing all experimental conditions in a two-factorial ANOVA. In line with the results described so far, the information gain was higher in self-organized groups ($M = 5.77$, $SD = 2.67$) than in hierarchical groups ($M = 3.66$, $SD = 2.29$). This difference was significant, $F(1, 76) = 25.32$, $p < .001$, $\eta_p^2 = .25$. In addition, TMS significantly influenced how much participants learned from each other, $F(1, 76) = 7.21$, $p = .009$, $\eta_p^2 = .09$. As expected, groups with TMS had a higher information gain ($M = 5.28$, $SD = 2.83$) than groups without TMS ($M = 4.15$, $SD = 2.44$). There was no interaction effect between group structure and TMS, $F(1, 76) = 0.87$, $p = .353$, $\eta_p^2 = .01$.

I further explored differences in participants' KIM scores (i.e., intrinsic motivation). Based on another two-way ANOVA, only a main effect of group structure was revealed, $F(1, 76) = 50.23$, $p < .001$, $\eta_p^2 = .40$. Specifically, participants reported higher intrinsic motivation in the self-organized conditions ($M = 5.42$, $SD = 0.51$) than in the hierarchical conditions ($M = 4.58$, $SD = 0.53$). Neither the interaction term nor the effect of TMS were significant, $F(1, 76) = 0.33$, $p = .568$, $\eta_p^2 < .01$, and $F(1, 76) = 0.002$, $p = .969$, $\eta_p^2 < .01$, respectively.

Lastly, the single-item measure on participants' confidence in the final decision was examined. Again, only group structure predicted the reported confidence in the committee's choice, $F(1, 76) = 29.40$, $p < .001$, $\eta_p^2 = .28$. On average, members of self-organized groups were more confident that their committee had made the correct decision ($M = 5.59$, $SD = 1.00$) than members of hierarchical groups ($M = 4.41$, $SD = 0.95$). Groups with TMS did not differ from groups without TMS in their confidence, $F(1, 76) = 0.58$, $p = .447$, $\eta_p^2 < .01$, and no interaction effect was found, $F(1, 76) = 1.31$, $p = .256$, $\eta_p^2 = .01$.

2.5 Discussion

Based on a group experimental design, this study set out to examine the causal relationships between group structure, TMS, and decision quality. Participants were assigned to groups with either a self-organized or a hierarchical internal structure. Half of the self-organized and half of the hierarchical groups were further assigned to a condition with TMS as compared to a condition without TMS. All groups had to work on a decision making task that involved a hidden profile, such that task interdependence was high. Building on previous research, the goal was to provide an unequivocal test of the positive impact of both a self-organized group structure and an existing TMS on group decision quality. It was further hypothesized that both relationships would be mediated by the pattern of information sharing among group members. More precisely, reduced biases in favor of shared information were expected to partially explain the positive effects of a self-organized group structure and a TMS.

In line with the hypotheses, results revealed a main effect of group structure and a main effect of TMS on decision quality. Specifically, self-organized groups made better decisions on average than hierarchical groups (i.e., were more likely to solve the hidden profile). Regardless of their structure, groups with a TMS achieved better decision outcomes than groups without a TMS. The corresponding effect sizes can be considered medium to large. Contrary to my expectations, there was no interaction between TMS and group structure, implying that a TMS influenced the decision quality of self-organized groups and hierarchical groups equally. This resulted in the following ranking: Self-organized groups with TMS performed the best, followed by self-organized groups without TMS, hierarchical groups with TMS, and then hierarchical groups without TMS.

The experiment also shed light on *how* decision quality is improved by a self-organized structure and the existence of a TMS. As predicted, both main effects were mediated by groups' information sharing: Because self-organized groups and groups with a TMS conducted less biased discussions, they were more likely to solve the hidden profile. More precisely, when mentioning and repeating information, self-organized groups focused less on information that was already shared among members than hierarchical groups did. The same applied to groups with a TMS compared to groups without TMS. Thus, a TMS helps groups to make better decisions mostly by increasing members' exchange of information that is relevant to the decision at steak. Similarly, a self-organized structure also improves group decision making by fostering the exchange of unshared information among members.

Interestingly, the length of group discussions did not predict the rate of correct decisions. Although self-organized groups took longer on average than hierarchical groups to make a decision, discussion time did not explain the better results of self-organized groups. While the focus of this experiment was on decision quality, participants' information gain (i.e., the individual learning of new information that was not held prior to discussion) was also found to differ between conditions. Members of self-organized groups learned more from each other during discussion than members of hierarchical groups. Having a TMS independently facilitated members knowledge acquisition as well. This kind of team learning may, for instance, expedite the implementation phase of a decision by helping team members anticipate the consequences of their decision.

2.5.1 Theoretical and Practical Implications

This study contributes to research on the effectiveness of different organizational structures on team performance and learning. Previous findings have been inconclusive as to whether a hierarchical or a more autonomous, self-organized group structure leads to better outcomes. Advocates of a functional view of hierarchical differentiation propose that it motivates members through hierarchy-related rewards, supports a division of labor, facilitates coordination, and reduces conflict, among other things (Halevy et al., 2011). Socio-technical theorists, on the other hand, have brought forward the argument that self-organization instills a sense of ownership that is otherwise missing in work groups. Being in charge of their own internal matters, team members are more motivated and work more effectively (Pasmore et al., 1982). Hence, self-organized teams are claimed to strengthen members' commitment and improve productivity and product quality.

The results presented here provide causal evidence that a self-organized structure indeed benefits group performance. In particular, self-organized groups outperform hierarchically structured groups because their members share more task-relevant knowledge and, as a consequence, make more informed decisions. It should be noted, however, that this finding only applies to specific circumstances. I do not want to argue that a self-organized group structure is generally superior to a hierarchical one. The results of this study rather suggest that self-organization or a higher level of team autonomy is conducive to the effectiveness of a team when tasks are knowledge-intensive and require members to work interdependently because information and skills are asymmetrically distributed (i.e., everyone knows something that others do not know).

This is an important specification when comparing the findings by Tarakci et al. (2016). In a recent experimental study, they came to the seemingly conflicting conclusion that groups with high power disparity (i.e., hierarchical groups) gain the advantage over groups with low power disparity (i.e., self-organized groups) if the power holder has high task competence. Yet, they neither manipulated the distribution of information nor did they consider the level of task interdependence. Unlike in the present study, groups were not working on tasks that require cooperation and the integration of members' idiosyncratic knowledge. Therefore, my findings do not contradict Tarakci et al.'s observations but support the proposition that self-organized structures are particularly conducive to decision quality, along with other key determinants of team performance, under conditions of high interdependence (Alper, Tjosvold, & Law, 1998; Langfred, 2005; Wageman, 2001). Compared to hierarchically ranked members, the members of self-organized groups seem to integrate their individual knowledge more effectively, reducing biases towards commonly held information. Such enhanced knowledge sharing can be expected to have a positive impact on team performance even beyond an intellective decision making task (Mesmer-Magnus & DeChurch, 2009).

The fact that members of self-organized groups also had more confidence in their decision has further implications for the implementation process following any decision made. In order to implement a decision effectively, team members have to actively cooperate. Their cooperation is important because numerous complications can arise as the ramifications of a decision unfold and details have to be hammered out. Following through with a decision despite such obstacles, will be easier if team members commit to and back the decision at stake (Amason, 1996). Higher confidence in having made the right decision is irrefutably associated with higher commitment to the decision and will pave the way for its implementation.

To the best of my knowledge, the results of this experiment provide the first methodologically sound demonstration that the decision quality of a group is substantially improved by a TMS under conditions of asymmetrically distributed knowledge. Complementing previous studies (Engelmann & Hesse, 2011; Stasser et al., 1995; Stasser et al., 2000), the design of the present experiment allowed for a rigorous examination of the effect of a TMS in a hidden profile scenario. In line with Engelmann and Hesse’s findings (2011), I could show that groups who possess a meta-knowledge structure (i.e., knowing who knows what) and purposefully divide cognitive labor reduce the bias in favor of shared information. My results further reveal that this improvement in information sharing – brought about by TMS – leads to higher group decision quality and individual information gain. They represent an important advancement of prior research on the effectiveness of TMSs because they include the validation of multiple TMS components and demonstrate both an effect on the individual and on the group level. Although the impact of TMS was not tested for different levels of interdependence, the present work suggests that a TMS may be particularly helpful for teams when not all information is perfectly shared, and members need to rely on each other to accomplish their task (see Sohrab et al., 2015, p. 520).

The successful manipulation of a TMS in this experiment was not only the basis for testing its causal effect, it also has promising implications for organizational practice. It was possible to trigger the development of a TMS by doing no more than providing participants with an overview of the distribution of information and a clear task description. While the experimental setting certainly made this easier, it can be a starting point for interventions in the workplace. Expertise dashboards, for example, may give decentralized decision makers context for integrating opinions and information from their colleagues with different expertise and perspectives.

2.5.2 Limitations and Directions for Future Research

The contributions of this study should be qualified in light of several limitations that could guide future research. While this experiment was explicitly designed to examine the *causal* relationships among the variables of interest, I also note that the findings may be limited by its context. In particular, given that the results were generated in a laboratory, they may not hold true outside of this setting. Second, the sample consisted of students only, as is often the case in experimental group studies. Although university students cannot serve as a representative sample of the workforce, they actually represent the future knowledge workers in organizations. As such, they can nevertheless be considered a suitable sample population for the purpose of the present study. Third, individuals in an organizational context are usually aware of their accountability. That is, managers or team members know that they will be held accountable for a decision and that their performance can directly or indirectly affect compensation and career opportunities. The absence of such an awareness of accountability could have affected participants' (especially leaders') engagement with the task and the effort they were willing to put into it. Fourth, the decision making task used in this study did not perfectly mirror the kind of tasks typically found in organizations. Even though it was based on a realistic scenario, it still involved a simulation or role play, which undermines authenticity. Moreover, in real decision situations there is almost never a single correct solution identifiable and team members do not have to memorize all relevant information. These deficiencies notwithstanding, this specific hidden profile task permitted me to systematically compare groups under conditions of distributed knowledge while holding the task components constant.

Another limitation of the present study concerns the nature of the leader selection process. Although it was deliberately chosen, my manipulation of the leadership position is lacking in external validity. Henningsen, Henningsen, Jakobsen, and Borton (2004) argue that “leader selection can be considered on a continuum ranging from perceived random to systematic processes” (p.74). The selection process communicated to participants in this experiment clearly differed from a random selection but was likely still viewed by them as less systematic than the processes that occur in businesses or organizations. Thus, it remains an open question how different perceptions of the leader selection process influence group dynamics and decision outcomes.

The actual assignment of leadership positions was randomized in order to control for any characteristics or skills potentially influencing the effectiveness of a leader. While this was the best way to compare two basic group structures, further studies are needed to investigate whether selecting specific types of leaders changes the effects reported here. Past research on team leadership illustrates that a leader’s personality, competence, or leadership style can matter in predicting decision quality and other indicators of team effectiveness (e.g., Cruz, Henningsen, & Smith, 1999; Larson et al., 1996; Nevicka, Ten Velden, De Hoogh, & Van Vianen, 2011; Tarakci et al., 2016). For example, if leaders who adopt a participative leadership style had been selected for this experiment, hierarchical groups may very well have been as successful as self-organized teams.

The definition of a hierarchical and a self-organized structure applied in this research did not differentiate between the formal and the informal structure of a group. Yet, the formal structure is not always congruent with the informal structure of a group, team, or organization (Diefenbach & Sillince, 2011; McEvily, Soda, & Tortoriello, 2014). As groups were newly formed for the purpose of this experiment and only spent a limited amount of time together, their formally introduced structure largely determined, and thus reflected, their informal structure. This was revealed by the manipulation checks, which included both a criterion of the formal group structure (i.e., was a leader assigned or not) and a criterion of the informal group structure (i.e., members' perception of power disparity). In an organizational setting, however, where teams are working together over long periods of time, emergent dynamics come into play. A number of studies have demonstrated that individuals with certain traits often informally emerge as leaders over time (e.g., Eagly & Karau, 1991; Kalish & Luria, 2016; Lanaj & Hollenbeck, 2015). Future research should explore whether the emergence of different informal structures interferes with the effects found in the present study. In the long run, team members' perceived degree of equality and autonomy may be more predictive of their knowledge sharing behavior and their team's decision quality than official roles and titles.

In general, studying the effect of different time frames presents an interesting line of research. I did not set a time limit for the decision making task, since many of the challenging decision making scenarios organizations face (such as hiring or task prioritization) are not subject to a strict time pressure, which would recommend the curtailment of a fulsome discussion. In fact, the challenge in excelling at these decisions is in engendering a deep engagement by knowledgeable stakeholders (Brodbeck et al., 2007; Larson et al., 1996). Nevertheless, some decisions have to be made under time pressure. Given that self-organized groups seem to take longer on average to come to a conclusion, it could be hypothesized that they are less time-efficient and perform considerably worse if they have a tight deadline. By contrast, hierarchical groups might gain the advantage under conditions of high time pressure.

Another interesting line of inquiry would be to further examine the mediating effects that explain why a self-organized structure is conducive to group decision making. Exploring motivational factors, this study found that members of self-organized groups reported higher levels of intrinsic motivation than members of hierarchically structured groups. Future studies should follow-up on this finding and investigate whether differences in the motivation patterns of group members account for the causal relationship between group structure and decision quality.

Finally, the findings of this study suggest that a TMS improves groups' decision quality irrespective of their structure. However, by necessity, the study design makes it impossible to distinguish between two potential explanations for the effect of a TMS in hierarchical groups: either, 1) in the hierarchical condition with TMS, groups could have performed better because of the effect of the TMS, or, 2) they could have improved because their leader had access to additional information and the meta-knowledge of who knows what. Since the members of hierarchal groups learned more new information when a TMS was present, we can rule out the possibility that they benefited from a TMS only through their leader. However, future studies should try to disentangle which part of the improvement by a TMS is caused by giving (solely) leaders access to meta-knowledge and which part is caused by the whole group exhibiting a transactive memory. Furthermore, while I did not find an interaction effect between TMS and groups structure in this study, a different experimental design could still reveal interactive links between the two. If TMS is not manipulated, for instance, a self-organized group structure might expedite the development of a TMS compared to a hierarchical one because of members' increased knowledge sharing behavior. That is, members of self-organized groups can be expected to learn about each other faster as they tend to exchange information more thoroughly.

In conclusion, the present study makes the following contributions to the literature. First, it provides evidence for the positive impact of a self-organized group structure on the decision quality of groups under circumstances of distributed information and expertise. While prior research has pointed to improved performance in self-organized teams (e.g., Cohen & Ledford, 1994; De Dreu & West, 2001; de Jong et al., 2006; Fredendall & Emery, 2003), systematic comparisons of different team set-ups have been largely missing. By specifying some of the conditions under which a self-organized structure can be more advantageous, the present findings also yield valuable information on when to implement self-organized structures in an organization. Second, the study succeeded in experimentally manipulating and probing a TMS. It extends past findings by demonstrating that a TMS enhances group decision quality under conditions of distributed information and expertise. Although this association has been suggested by a number of researchers (e.g., Lewis & Herndon, 2011; Sohrab et al., 2015), it has rarely been tested empirically. Third, the study sheds light on the mechanisms underlying the positive relationships between a self-organized structure and group decision quality and between TMS and group decision quality. Although more studies are needed to scrutinize how these relationships can be explained, the present findings clearly indicate that both a TMS and a self-organized internal structure helps groups to share their knowledge more effectively, which ultimately leads to better decisions. In light of the vital importance of knowledge sharing for organizations today, this provides a promising starting point for interventions in the workplace. To stimulate intellectual cross-fertilizations, teams should be encouraged to work autonomously while enabling their members to learn about each other and keeping track of their broader network.

3 Research Paper II

Assessment of Decision Quality and Knowledge Sharing in Existing Knowledge Worker Teams: The Role of Team Structure and Transactive Memory Systems

3.1 Abstract

In this cross-sectional survey study of knowledge workers at a large-scale enterprise, the associations between team structure, transactive memory system (TMS), and team decision quality are analyzed. Building on previous research, a moderated mediation model is proposed and tested in a path analytic framework. Based on a total sample of 1129 employees, support for the hypothesized model is found, indicating that the degree of self-organization and the development of a TMS are positively related to the perceived decision quality of teams. Both relationships are shown to be mediated by members' knowledge sharing behavior. Results further reveal that task interdependence is a moderator of the indirect effects of TMS and team structure on decision quality through knowledge sharing. Specifically, the mediated relationships are stronger for higher levels of task interdependence compared to lower levels of task interdependence. The findings of the present study suggest that teams benefit from a high degree of self-organization and a well-developed TMS when knowledge is widely distributed among their members.

Keywords: knowledge worker teams, decision quality, team structure, TMS, knowledge sharing, task interdependence

3.2 Introduction

Hierarchy and power are important concepts in understanding human behavior from our ancestral tribes to the modern office. However, recent innovative technologies and organizational theories have provided interesting alternatives to the classic hierarchical organization. One alternative that is gaining increasing interest in corporate management is the self-organized team (e.g., Gonzalez-Mulé et al., 2016; Stewart & Barrick, 2000; Tata & Prasad, 2004). While it is defined on a continuum of autonomy, this type of team essentially implies that members have high levels of responsibility and control for making work-related decisions (Cohen et al., 1994; Stewart et al., 2011). Compared to hierarchically structured teams, self-organized teams are supposed to be more agile, more adaptive to environmental changes, and thus more productive (e.g., Campion et al., 1993; Goodman et al., 1988; Manz, 1992; Pearson, 1992).

In an economy that is characterized by growing complexity and uncertainty, self-organized teams have been raising in popularity. Despite their rapid adoption by businesses there is still a scarcity of studies detailing their strengths, weaknesses, and general efficacy compared to classic hierarchical teams. Additionally, those studies that actually examined the effectiveness of hierarchical and self-organized team structures have yielded contradictory findings (for reviews, see Halevy et al., 2011; Magpili & Pazos, 2018). As suggested by contingency theories of organization (e.g., Hall & Tolbert, 2005), no single organizational structure should be expected to fit all circumstances. Instead, different organizational structures may be suited depending on the specific situation, task, or people involved. This calls for research directly comparing hierarchical and self-organized team structures to start isolating the factors that determine *when* either of them is advantageous (see Guzzo & Dickson, 1996, p. 326).

One potential moderating factor that has been introduced by other researchers (e.g., Langfred, 2005; Wageman, 1995) is the *level of interdependence* among members of a team, unit, or whole organization. As more and more teams are set up to utilize the specialized knowledge of multiple experts, interdependence is necessarily increasing. As described above, the very idea behind modern-day teamwork is to benefit from a greater pool of knowledge and competencies (Brodbeck et al., 2007, Mesmer-Magnus & DeChurch, 2009). This requires teams to be composed of members from different disciplines and with complementary skill sets or knowledge. Consequently, these members then depend on each other's contributions and have to cooperate in order to accomplish their tasks or mission.

The question of how hierarchical and self-organized teams compare under conditions of such distributed knowledge and expertise has not been sufficiently considered in the literature so far. In particular, it is still unclear whether team structure has an impact on decision making under conditions of distributed knowledge. Decision making ranks among the most important and most frequently studied indicators of team performance (Guzzo & Dickson, 1996; Guzzo & Salas, 1995; Kerr & Tindale, 2004). It is especially relevant for investigating the effectiveness of self-organized teams: Since making decisions is the central function of management, the success of self-organized teams primarily hinges on their ability to make informed decisions in the absence of a leader.

Regardless of whether a team has a leader or not, decision making is further complicated by an asymmetrical distribution of knowledge. An extensive body of research documents the difficulties and shortcomings of groups when tackling complex decision making problems that demand the integration of members' idiosyncratic knowledge (for a review, see, e.g., Kerr & Tindale, 2004). For example, decision making groups are known to focus on *shared* information (i.e., it is available to all group members prior to discussion) at the expense of *unshared* information (i.e., it is merely available to individual members prior to discussion) during group discussions. First reported by Stasser and Titus (1985), this bias in favor of shared information ultimately leads to suboptimal decision outcomes (for reviews, see also Brodbeck et al., 2007; Sohrab et al., 2015; Wittenbaum et al., 2004).

In order to actually benefit from their distributed expertise and reach high quality decisions, teams must appreciate who knows what, coordinate who will contribute what, pool information systematically, and reconcile differences. In short, the *intellectual capital* of teams (Stewart, 1997) can only be unleashed if they effectively share information and integrate it into their decisions. An approach to improving how team members share and utilize task knowledge can be found in Wegner's TMS theory (see Wegner, 1987, 1995). Wegner was interested in how people use other people as memory aids to extend the scope of what they *can* remember. He suggested that groups are able to develop a TMS, which consists of the sum of knowledge possessed by each individual member plus their shared awareness of who knows what. A TMS also includes a set of processes that occur among members, such as (a) learning and updating who knows what, (b) allocating memory items to specific group members, and (c) planning how to retrieve information in a way that takes advantage of the distributed knowledge. Thus, a TMS gives rise to an *interactive knowledge structure* with group members dividing cognitive labor (DeChurch & Mesmer-Magnus, 2010). Each member specializes in a different domain and relies on the others to complement their knowledge.

As a TMS enables a quick and coordinated access to specialized expertise, it should prove beneficial to group decision making – particularly when knowledge is necessarily distributed. Although there is some evidence from studies on expertise recognition that groups make better decisions when members know who is good at what (Libby et al., 1987; Littlepage & Silbiger, 1992), research on TMSs is unfortunately rather scarce and their role in group decision making is far from being understood (Moreland, 2006; Sohrab et al., 2015). Having multiple components, a TMS is difficult to both manipulate and measure. Field studies have only become feasible since Lewis (2003) developed a self-report scale that constitutes an appropriate field measure for a TMS. Further research is clearly needed to determine whether TMS theory has practical relevance for group decision making.

Given the current trend towards utilizing teams of multiple experts to maximize the available pool of talent and knowledge, two major questions arise: First, which team structure is preferable under these circumstances of high interdependence? Second, can a TMS help to coordinate the distributed knowledge and navigate decision making situations more successfully? In a previous experimental study (see Research Paper I), I therefore compared the performance of hierarchical and self-organized groups under conditions of distributed knowledge. I further tested whether a TMS has a direct impact on decision quality under exactly these conditions. Using a customized version of the hidden profile paradigm, information was distributed such that each member possessed some task-relevant knowledge no one else had. That way, group members were highly interdependent. I then analyzed groups' information sharing behavior and decision quality.

Based on a sample of 80 groups, I found that those with a self-organized structure made better decisions on average than those with a hierarchical structure. In addition, decision quality was higher in groups with a TMS compared to groups without a TMS. These effects were mediated by groups' discussion bias. More precisely, while all groups revealed a bias in favor of shared information during discussions, this bias was reduced by a self-organized group structure and the presence of a TMS.

3.2.1 The present study

The objective of the present study was to validate the findings from the previous experiment in an organizational setting. While the laboratory made it possible to control for potentially confounding variables and examine causal relationships between the constructs of interest, its results cannot be generalized to actual work teams in organizations. To improve the external validity of findings, I therefore tested the hypotheses derived from the group experiment in a cross-sectional survey study at a large-scale enterprise. Based on the literature and my own findings, I made the following predictions:

Hypothesis 1a. A more self-organized team structure will be related to increased knowledge sharing.

Hypothesis 1b. A more self-organized team structure will result in better perceived decision quality.

Hypothesis 2a. TMS will lead to more knowledge sharing.

Hypothesis 2b. TMS will positively influence perceived decision quality.

Hypothesis 3. Increased knowledge sharing will predict higher decision quality.

Hypothesis 4a. Knowledge sharing will partially mediate the effect of team structure on decision quality.

Hypothesis 4b. Knowledge sharing will mediate the effect of TMS on decision quality.

An additional aim of this study was to explicitly investigate the moderating effect of task interdependence. In the previous experiment, a high degree of task interdependence among group members was implied by the decision making task, such that it was constant across conditions. In the present survey study, however, task interdependence could be explicitly measured. It can be assumed that the more team members depend on each other's contributions (i.e., the higher their interdependence), the more critical knowledge sharing, and cooperation in general, are to success. Hence, the following hypotheses were added:

Hypotheses 5a & 5b. Task interdependence will moderate the second stage of the indirect (positive) relationship of both team structure and TMS to decision quality through knowledge sharing, such that these relationships are stronger when task interdependence is high rather than low.

Figure 4 displays the moderated mediation model that results from the hypotheses listed above and was analyzed in the present study.

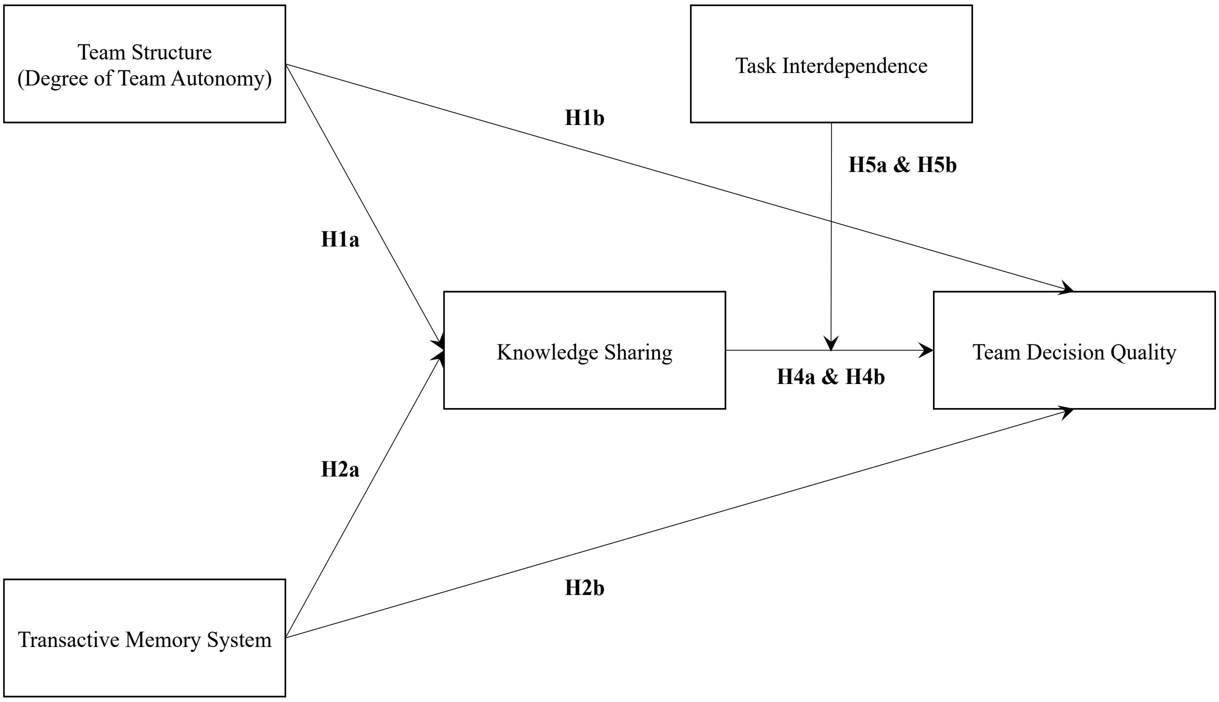


Figure 4. Moderated mediation model as hypothesized in this study.

3.3 Method

To test whether the findings from Study 1 can be generalized to an applied context, that is, employees who work in actual teams with distributed expertise, a cross-sectional survey study was conducted at a large corporation. The survey was intended to map as precisely as possible onto the variables used in a previous experiment (Research Paper I). However, the corporate context and the applied research method necessitated some alterations to the operationalization of constructs.

3.3.1 Participants and Procedure

Data were collected in Germany and the Unites States from a publicly traded IT company. Counting around 98,000 employees globally, the vast majority of the organization's workforce is highly skilled, working in service, product, or development teams to perform complex and knowledge-intensive tasks. Many of these teams have adopted *agile software development* (Cockburn, 2006; Schwaber & Beedle, 2002) that implies high levels of self-organization. Other teams exhibit a clearly hierarchical structure with more conventional management strategies. Being composed of knowledge workers, yet offering a diverse range of team settings, the company served as an ideal environment to test the central hypotheses in the field. Moreover, by comparing teams within the same organization, a number of potential confounding factors, such as sector, salary level, or work environment, could be excluded.

After consulting with the Human Recourses department and obtaining their approval, an online survey was sent out via e-mail to a representative sample of 10,000 employees. Participation was voluntary and anonymous. To guarantee both anonymity and a large sample size, data were collected solely on the individual level. An aggregation on the team level would have made it difficult or impossible to ensure a fully anonymous procedure which is considered key in avoiding socially desirable answers and reducing common method biases in self-report assessments (e.g., Dodou & de Winter, 2014; Fisher, 1993; Joinson, 1999; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Although there were no pre-defined exclusion criteria, the invitation e-mail instructed employees to only participate if they considered themselves as member of a *work team* which was defined as “the group of people you work with more or less on a daily basis and are connected to on the basis of a common goal or project”. Given that the formal structure of this company, as depicted in its organizational chart, is not on the same level of granularity as the content-related formation of teams, and therefore not always congruent with the perceived team affiliation, this definition allowed for an assessment of the most relevant classification of teams for the purpose of this research.

A total of 1148 employees replied, yielding a response rate of 11.5%. 10 subjects had to be excluded due to missing data. Based on a predetermined minimum size of 3 team members an additional 9 responses were dropped, resulting in a final sample of 1129 participants. 36%

of them were female, which reflects the overall percentage of women at this company (33%). The average work experience was 15 years and the reported team size ranged from 3 to 50 members with an average of 13 and a median of 10 members. The average team tenure (i.e., the amount of time a team has been working together) was 4.1 years.

3.3.2 Measures

Team Structure. The official structure of a team is not always indicative of its actual or perceived dynamics in the workplace. The degree of self-organization (versus hierarchy) can vary substantially even between teams with a designated manager. Besides, the labels describing specific team set-ups, e.g., *Scrum*, *agile*, *self-managing*, or *autonomous*, are neither standardized within nor across organizations. According to Stewart et al. (2011), self-organization should be generally conceived as a continuum in the work environment. Thus, a continuous scale developed by Janz, Colquitt, & Noe (1997) was employed. Being tailored to knowledge work settings – specifically information systems – their 12-item instrument was particularly suited in this context. It measures the *degree* of a team's self-organization in four domains: "planning", "products", "people", and "processes". Each domain is described by three items, e.g., "Schedule the team's work" (planning) or "Conduct peer evaluations" (people). Participants had to indicate on a 5-point Likert scale (1 = *absolutely no responsibility* to 5 = *complete responsibility*) how much responsibility non-managerial team members have for each of these aspects. The overall scale showed very good internal consistency (Cronbach's α = .89). To also get an idea of the official team structures, respondents had to indicate if their team was using an agile method and specify whether there was an internal or external team manager (i.e., she/he is also a team member and working within the team or she/he is not a member that is working together with the team on a daily basis).

Task Interdependence. The preceding experimental study examined a high interdependence setting in which the task was identical across conditions and required a high degree of interaction for successful outcomes. In contrast, the current study observes the effect of different levels of interdependence by assessing the naturally occurring variation inherent in the work environment. Knowledge-intensive organizations, like the one investigated here, are characterized by a high diversity of knowledge, expertise, and roles, which is generally associated with more task interdependence (Van der Vegt & Janssen, 2003; Zhang et al., 2007). However, the precise degree to which employees perceived their work as interdependent was assessed with a 5-item scale. Two items developed by Van der Vegt and Janssen (2003) ("I need to collaborate with my colleagues to perform my job well" and "My colleagues need information and advice from me to perform their jobs well") extended Campion et al.'s (1993) task interdependence. All items were scored on a 7-point scale from 1 (completely disagree) to 7 (completely agree). The Cronbach's alpha for these five items amounted to .79.

Transactive Memory System. A field measure developed by Lewis (2003) facilitated the self-report assessment of group transactive memory. According to Lewis, there are three observable manifestations of a TMS which are reflected in the subscales *specialization*, *credibility*, and *coordination*. Specialization denotes a differentiated structure of knowledge, that is, team members understand what others know and therefore develop specialized, complementary knowledge. In doing so, they need to trust in and rely on each other's memory and expertise which is the second manifestation, referred to as credibility. In addition, the TMS construct implies an "effective, orchestrated knowledge processing" (Lewis, 2003, p. 589) as measured by the coordination scale. However, this last subscale was dropped from the analysis for the following reasons. First, the construct of interest in this study was team members' transactive memory which is sufficiently described by specialization and credibility. Second, most items of the coordination subscale are closely linked to team effectiveness, thus going beyond the scope of the core construct and potentially confounding causality (e.g., "Our team works together in a well-coordinated fashion" or "We accomplish tasks smoothly and efficiently").

Third, there was no equivalent manipulation or assessment of coordination in the experimental study.

Team member specialization (e.g., “Each team member has specialized knowledge of some aspect of our project”) and credibility (e.g., “I am confident relying on the information that other team members bring to discussions”) were measured on a 5-point scale (1 = *strongly disagree* to 5 = *strongly agree*) by five items each which were ultimately aggregated to a total transactive memory score. As recommended by Lewis (2003), the originally reverse-coded item “I do *not* have much faith in other members’ expertise” was changed to “I have a lot of faith in other members’ expertise” (p. 601). Both subscales demonstrated good internal consistency (specialization: $\alpha = .79$; credibility: $\alpha = .83$). The Cronbach’s alpha for all ten items was .84.

Knowledge Sharing. To test the mediating role of knowledge sharing among team members, four items proposed by Faraj and Sproull (2000) on team members’ willingness to bring expertise to bear were combined with Sung and Choi’s (2012) 3-item scale on knowledge utilization. Sample items include “More knowledgeable team members freely provide other members with hard-to-find knowledge or specialized skills” and “Team members’ task-related expertise and skills are fully utilized in our team’s activities”. All items were rated on a scale ranging from 1 (*to a very small extent*) to 5 (*to a very large extent)*, yielding a high internal consistency of .91.

Decision Quality. As in previous studies (e.g., Carmeli, Tishler, & Edmondson, 2012; Lin & Rababah, 2014; Olson, Parayitam, & Bao, 2007), perceptual measures were employed to evaluate the quality of team decisions. In a real-world setting, it is nearly impossible to define an adequate objective measure. Not only would it be challenging to isolate single decisions and track their respective impact, a comparative assessment of such decisions seems also unwarranted. For instance, a decision that is sensible in one situation may quickly become maladaptive if that situation changes. Moreover, circumstances may sometimes coerce a team to choose the lesser of two evils. Comparing their decision outcomes with those of another team that had superior alternatives to decide between could lead to false conclusions about the relative quality of their decision making. An objective evaluation would therefore demand to consider all dependencies between a decision's outcome and its context. When corresponding data are not available, employees' perceptions provide a reliable substitute (Dess & Robinson, 1984). In fact, the best way to rate the quality of team decisions is to consult those who are involved in making them and can judge their effects while taking the context into account (Amason, 1996; Amason & Mooney, 2008).

A slightly modified version of Amason's (1996) 3-item scale covered the general quality of team decisions. Respondents had to rate (1) the effects of their team decisions on the department, (2) the results of their team decisions relative to their expectations, and (3) the overall quality, with answers ranging from 1, "very poor", to 5, "very good". Cronbach's Alpha amounted to .92.

In the previous experimental study, good results could only be obtained by integrating the individual viewpoints into a collective perspective. To also tap the quality of final team decisions in relation to members' individual input and competence, a second scale was added. Suggested and validated by Janssen, Van De Vliert, and Veenstra (1999), its items specifically address this kind of *relative* decision quality and improve comparability with the experimental study. Anchored by "strongly disagree" (1) to "strongly agree" (5), they read: "Final team decisions are generally of much higher quality than the initial proposals of individual members", "Final team decisions generally reflect the best that could be extracted from the team", and "Final team decisions usually extend the quality of members' individual input". The Cronbach's Alpha for this scale was .87.

I decided to merge both scales described above into a composite variable, representing the overall decision quality. A confirmatory factor analysis tested the assumption of a common factor underlying the six items. Using the lavaan package (Rosseel, 2012) in *R* version 3.5.1 (R

Core Team, 2018), the model was fit based on maximum likelihood estimation. With a Comparative Fit Index (CFI) of .996, a Root Mean Square Residual (SRMR) of .01, and a Root Mean Square Error of Approximation (RMSEA) of .055, 90% Confidence Interval (CI = .035, .078), the model fit was acceptable. As expected, all items showed significant positive factor loadings (> .60). Thus, the calculation of an overall decision quality score seemed justified.

3.3.3 Control Variables

Team size is commonly controlled for in organizational research as previous studies have shown that it may influence team effectiveness. For example, larger teams are prone to more conflict and face aggravated coordination problems (Ancona & Caldwell, 1992; Amason & Sapienza, 1997; for a meta-analysis see LePine, Piccolo, Jackson, Mathieu, & Saul, 2008). Another common control variable is *team tenure* which is assumed to promote TMS development and improve team performance (Humphrey, Morgeson, & Mannor, 2009). Participants were therefore asked how many members their work team has and how long its core group (new hires notwithstanding) has been working together. In addition to these team-level factors, respondents' gender, work experience, and career level were included as control variables.

3.3.4 Data Analysis

Based on the recommendations by Curran, West, and Finch (1996), data were screened for deviations from multivariate normality. Due to the large sample size (n = 1129) all study variables proved to be sufficiently normally distributed. Further, the eigenvalues of a correlation matrix of independent variables did not suggest multicollinearity. However, all independent variables were mean centered to facilitate moderation analysis by reducing multicollinearity among predictors and their interaction terms (Aiken & West, 1991). I then analyzed the proposed moderated mediation model employing a path analytic framework (Edwards & Lambert, 2007; Hayes, 2015; Preacher, Rucker, & Hayes, 2007). Team size, team tenure, work experience, and gender were entered as covariates. First, the hypothesized model was tested against alternative nested models and its overall fit was evaluated by the chi-square goodness-of-fit test as well as several alternative fit indices that are less affected by the sample size. Based on the recommendations by Hu and Bentler (1999), a model was only considered a good fit when it met multiple criteria, such as a more conservative comparative fit index (CFI) of .95 or higher, a root mean square error of approximation (RMSEA) of .06 or lower, and a standardized root mean square residual (SRMR) of .08 or lower.

Second, direction, significance, and magnitude of the estimated path coefficients were interpreted. To provide further support for the presence of partial and moderated mediation, (conditional) indirect effects were analyzed based on 95% bias-corrected confidence intervals derived from 10,000 bootstrap resamples (Hayes, 2015; Hayes & Scharkow, 2013; Preacher & Hayes, 2008). Finally, moderation effects were probed by computing simple paths and indirect effects at high (1 *SD* above the mean) and low (1 *SD* below the mean) levels of task interdependence (Preacher et al., 2007). All statistical analyses were performed in *R* version 3.6.2 (R Core Team, 2018), applying the lavaan package for structural equation modelling (SEM; Rosseel, 2012).

3.4 Results

Table 4 presents descriptive statistics and bivariate correlations of the study variables. Decision quality was positively associated with task interdependence ($r = .17$, $p < .001$), team structure ($r = .61$, $p < .001$), TMS ($r = .56$, $p < .001$), and knowledge sharing ($r = .75$, $p < .001$). Knowledge sharing, in turn, was positively correlated with task interdependence ($r = .18$, $p < .001$), team structure ($r = .59$, $p < .001$), TMS ($r = .56$, $p < .001$), and team tenure as control variable ($r = .06$, $p < .05$).

Table 4

Means, Standard Deviations, and Intercorrelations Among Study Variables

Variables	*M*	*SD*	1	2	3	4	5	6	7	8	9
1. Gender	0.36	0.48	—								
2. Work experience *(in years)*	14.66	8.71	-.08*	—							
3. Team size	13.05	8.43	-.01	-.03	—						
4. Team tenure *(in months)*	53.54	35.60	.01	.12***	.16***	—					
5. Task interdependence	4.40	1.10	.03	.06	.04	-.05	—				
6. Team structure	3.17	0.83	-.06	-.08*	-.02	-.05	.18***	—			
7. TMS	4.06	0.64	.00	.10***	.04	.12***	.28***	.43***	—		
8. Knowledge sharing	4.26	0.98	-.02	.04	-.03	.06*	.18***	.59***	.56***	—	
9. Decision quality	3.80	0.86	-.03	.00	-.03	.05	.17***	.61***	.56***	.75***	—

Note. N = 1229. Gender was coded: 1 = female, 0 = male.

* p < .05. ** p < .01. *** p < .001.

3.4.1 Model Estimation

I estimated the moderated mediation model depicted in Figure 5. All path coefficients are standardized for ease of interpretation of the magnitude of effects. In addition, paths from the four control variables (gender, individual work experience, team size, and team tenure) to the endogenous variables were estimated. Note, however, that these paths have been removed from Figure 5 for the sake of clarity. The proposed path model fit the data well, $\chi^2(2) = 4.36$, $p = .113$, CFI = .99, RMSEA = .03, 90% CI [.001, .075], SRMR = .01. Overall, the model explained 64.2 % of the variance in perceived decision quality. None of the control variable paths was significant. Specifying a model without the control variables resulted in a similar fit, $\chi^2(2) = 3.66$, $p = .161$, CFI = .99, RMSEA = .03, 90% CI [.000, .071], SRMR = .01.

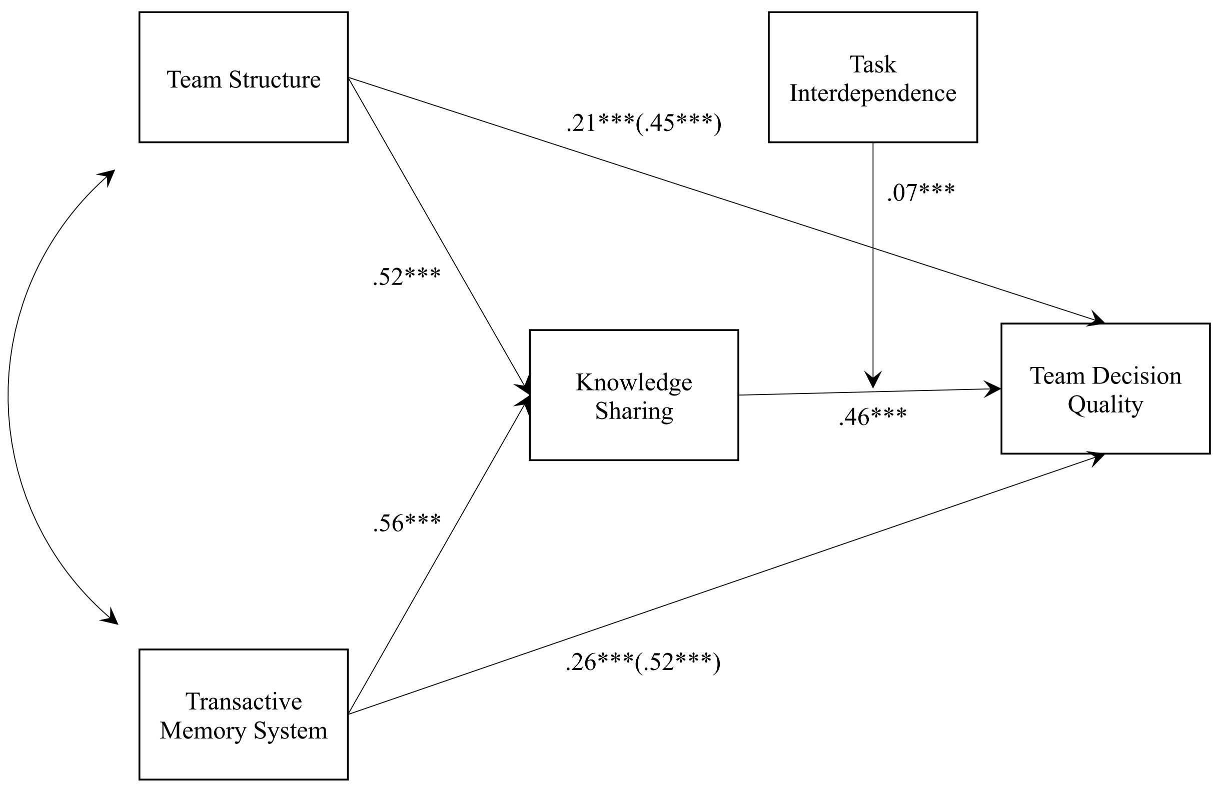


Figure 5. Path diagram of estimated moderated mediation model. Standardized path coefficients are presented (β). Numbers in parentheses are total effects. Control variables have been removed from this figure for clarity. Paths reflect the coefficients controlling for team size, team tenure, work experience, and gender. $N = 1129$. *** $p < .001$.

I compared two alternative models to examine whether knowledge sharing fully mediated the relation between the independent variables and decision quality. Removing the direct path from team structure to decision quality resulted in reduced fit indices, $\chi^2(3) = 80.51$, CFI = .96, RMSEA = .15, 90% [CI .124, .181], SRMR = .02. The Akaike Information Criterion (AIC) equaled 4345.9 as compared to 4191.2 for the partially mediated model. The chi-square test for model comparison indicated that the model with partial mediation of the relation between team structure and decision quality through knowledge sharing fit the data significantly better than the model with full mediation, $\Delta\chi^2(1, N = 1129) = 76.14$, $p < .001$. A third model was defined by removing the direct path from TMS to decision quality, while keeping the path from team structure to decision quality. This model also yielded a decrease in model fit, $\chi^2(3) = 73.85$, CFI = .96, RMSEA = .14, 90% CI [.117, .174], SRMR = .02. With a value of 4258.7, the AIC was bigger than the AIC of the partially mediated model. The difference between the proposed and the third model was significant, $\Delta\chi^2(1, N = 1129) = 69.49$, $p < .001$. Thus, the best fitting model assumed only partial mediation of the relationship between the two independent variables and decision quality through knowledge sharing. I therefore examined the path estimates of this model with regards to the postulated relationships.

3.4.2 Hypotheses Tests

Hypotheses 1a & 1b. A more autonomous or self-organized team structure was hypothesized to predict more knowledge sharing and better decision quality. In support of hypotheses 1a and 1b, team structure had both a direct effect on knowledge sharing and a direct effect on decision quality ($\beta = .52$, $p < .001$, and $\beta = .21$, $p < .001$, respectively). Since team structure was measured as the degree of team self-organization, the positive effects imply a positive relation between more self-organized team structures and the dependent variables.

Hypotheses 2a & 2b. It was further predicted that the more developed a team's TMS was, the more knowledge would be shared among members and the higher the quality of team decisions would be. A positive direct effect of TMS on knowledge sharing supported hypothesis 2a ($\beta = .56$, $p < .001$). Additionally, the direct path from TMS to decision quality was significant, confirming hypothesis 2b, ($\beta = .26$, $p < .001$).

Hypotheses 3. In line with hypothesis 3, knowledge sharing indeed predicted higher decision quality ($\beta = .46$, $p < .001$). Together with the direct effects of team structure and TMS on knowledge sharing, this already points to the mediating role of knowledge sharing in the effects of team structure and TMS on decision quality. To estimate the hypothesized indirect relationships, a parametric bootstrap procedure was used (Preacher & Hayes, 2004, Shrout & Bolger, 2002).

Hypotheses 4a & 4b. Calculating 95% bias-corrected confidence intervals with 10,000 bootstrap resamples, a significant indirect effect between team structure and team decision quality via knowledge sharing was revealed, indirect effect = .24, 95% CI [0.19, 0.29]. In other words, the more self-organized a team was, the better its decisions were rated, which was in part explained by an increased exchange of information and knowledge among team members. The proportion mediated amounted to 52.9%. Thus, hypothesis 4a was supported. Similarly, the indirect effect between TMS and team decision quality via knowledge sharing was .26, with the 95% bias-corrected bootstrap confidence interval ranging from 0.21 to 0.31. Congruent with hypothesis 4b, knowledge sharing therefore partially mediated the positive effect of a more developed TMS on decision quality. It accounted for 50.2% of the total effect.

Hypotheses 5a & 5b. Lastly, task interdependence was assumed to moderate the second stage of the indirect relationship between team structure and decision quality and the indirect relationship between TMS and decision quality through knowledge sharing, such that these relationships are stronger when task interdependence is high rather than low. As shown in Figure 5, the interaction effect of knowledge sharing and task interdependence on decision quality was significant, β = .07, 95% CI [0.04, 0.09]. To further test the hypotheses, I estimated the indirect relationships of team structure and TMS with decision quality via knowledge sharing at higher (+1 *SD*) and lower levels (−1 *SD*) of task interdependence.

3.4.3 Moderated Mediation Effects

The estimated conditional indirect effects are presented in Table 5. For team structure, the indirect effect was higher when task interdependence was higher than when task interdependence was lower. Corroborating hypothesis 5a, the difference between these two conditional indirect effects was .08, bias-corrected 95% CI [.050, .108]. Figure 6 plots the mediated effects of team structure on decision quality at ±1 *SD* around the mean of task interdependence.

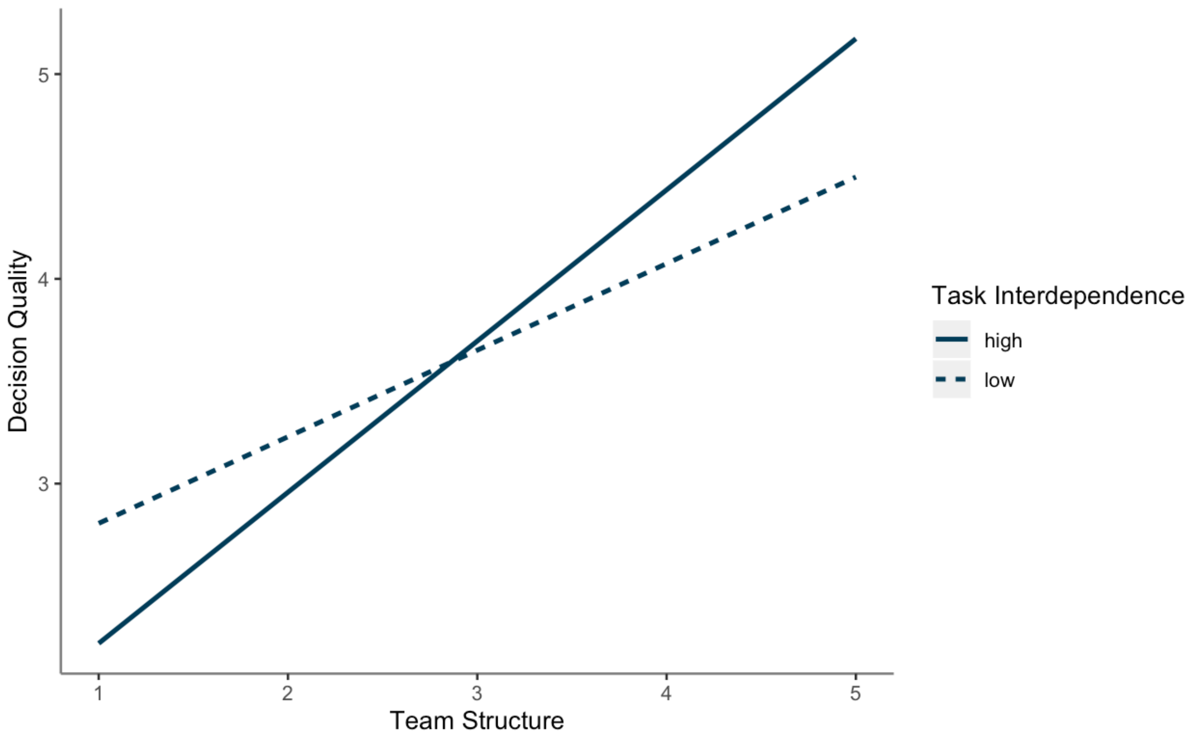


Figure 6. Interaction between the indirect (mediated) effect of team structure and task interdependence on teams' decision quality. High task interdependence = +1 *SD*; low task interdependence = −1 *SD*.

Table 5

Moderated Mediation Effects at Conditional Values of Task Interdependence

	Decision Quality			
Moderator Variable	Conditional indirect effect of team structure	Bias-corrected 95% CI	Conditional indirect effect of TMS	Bias-corrected 95% CI
Low Task Interdependence (−1 *SD*)	.20	[.166, .234]	.21	[.176, .256]
High Task Interdependence (+1 *SD*)	.28	[.240, .319]	.30	[.253, .349]
Difference between high versus low	.08	[.050 , .108]	.09	[.054, .117]

Note. N = 1129. The bias-corrected 95% confidence interval (CI) were bootstrapped with 10,000 replications. *SD* = Standard Deviation.

Furthermore, the relationship of TMS to decision quality through knowledge sharing was also stronger when task interdependence was higher than when task interdependence was lower, with a difference between the conditional indirect effects of .09, bias-corrected 95% CI [.054, .117]. As illustrated in Figure 7, the positive mediated effect of a more developed TMS on teams' decision quality via increased knowledge sharing was greater when teams were working on highly interdependent tasks. This was congruent with hypothesis 5b.

Finally, I investigated whether task interdependence also moderated the direct effects of team structure and TMS on decision quality. However, neither for team structure nor for TMS the conditional simple path was significant, β = .01, 95% bias-corrected CI [-0.001, 0.024], and β = -.01, 95% bias-corrected CI [-0.03, 0.01], respectively.

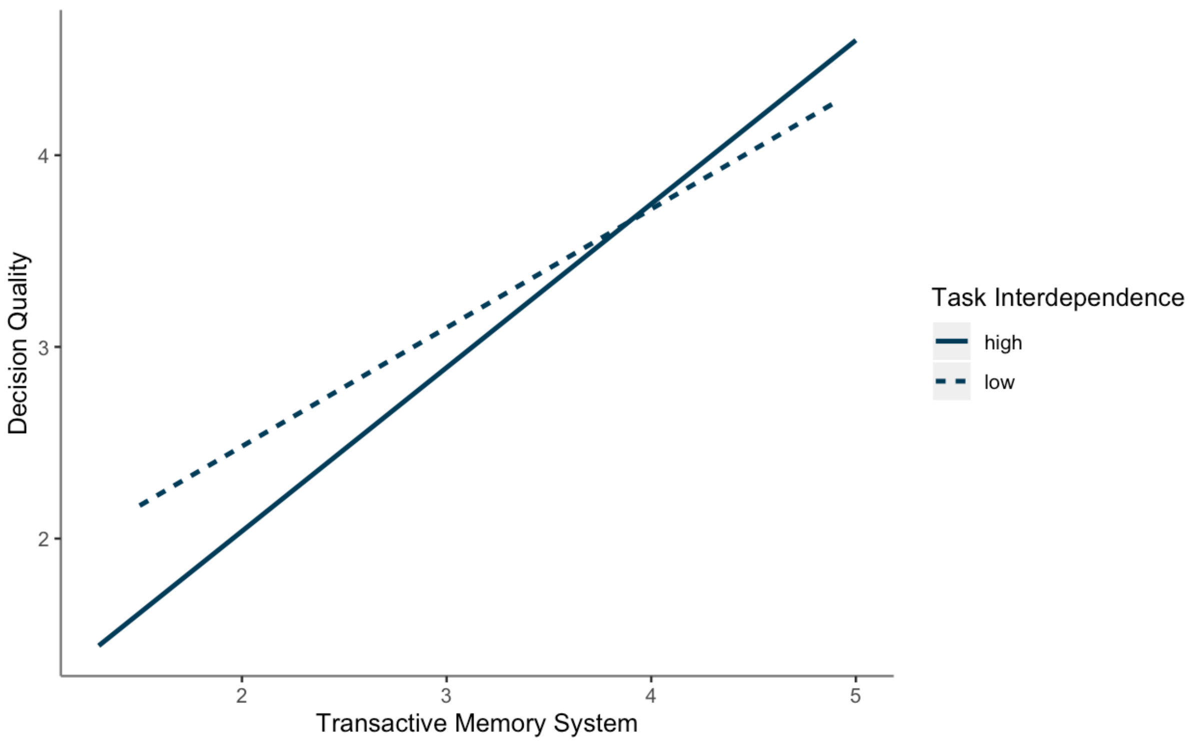


Figure 7. Interaction between the indirect (mediated) effect of transactive memory system and task interdependence on teams' decision quality. High task interdependence = +1 *SD*; low task interdependence = −1 *SD*.

3.5 Discussion

The goal of the present study was to corroborate the findings from a previous experiment by testing the same hypotheses outside the laboratory in an applied context. Based on cross-sectional survey data from 1129 employees at a publicly traded company the relationships between team structure, TMS, knowledge sharing, and team decision quality were analyzed at different levels of task interdependence. Using SEM, a positive direct effect of both team structure and TMS on team decision quality were revealed. This means that, first, the higher the degree of self-organization within a team was, the better was the team's decision quality. Second, the more developed a team's TMS was, the better was its decision quality. These effects were at least partially explained by teams' knowledge sharing. Both the degree of self-organization and the manifestation of a TMS were positively associated with knowledge sharing. Knowledge sharing, in turn, mediated the relationship between team structure and decision quality and the relationship between TMS and decision quality.

As hypothesized, the level of task interdependence reported by participants moderated these mediated relationships. That is, the effects of team structure and TMS on decision quality through knowledge sharing were significantly stronger when team members' interdependence was high compared to when it was low.

3.5.1 Theoretical and Practical Implications

Overall, the study reported here provides strong additional evidence for the hypotheses that were first tested in an experiment. Supporting those who advocate self-organized teams, it finds that, under conditions of distributed knowledge, a more self-organized team structure is associated with better decision quality not only in the laboratory but also in the field. While this finding does not imply the triumph of self-organized teams over hierarchically structured ones, it attests to the conduciveness of more autonomous structures in complex decision making situations that demand a high level of coordination. It is the success in exactly these situations that is of increasingly vital concern for organizations. In a more and more knowledge-driven economy (i.e., an era where people are generating value with their minds rather than their muscles), organizations are pressured to optimize the productivity of their knowledge workers (Drucker, 1973).

By delegating tasks to teams rather than individuals, they are hoping to improve productivity through higher motivation, cross-fertilization of ideas, and combined expertise (e.g., Brodbeck et al., 2007; Hollenbeck et al., 1995; Lawler et al., 1995; Mesmer-Magnus & DeChurch, 2009). While this can be considered a first step in the right direction, it is not enough to simply assemble a group of knowledge workers in order to capitalize on their skills and tacit knowledge. For a number of reasons, groups are easily overwhelmed by tasks that require them to coordinate and integrate individual knowledge. Especially when difficult decisions have to be made and expertise is distributed among workers, such that no single member possesses all relevant information, groups tend to succumb to detrimental patterns of information sharing (Kerr & Tindale, 2004; Sohrab et al., 2015). It is therefore crucial for organizations to understand how to mitigate these issues – now more than ever.

Although the present study does not provide a simple solution for overcoming the disadvantages of group decision making, it reveals two important ways in which teams can be supported in nurturing fruitful decision making processes. First, when tasks involve high interdependence, such that no single person (not even the leader) is able to master the task without consulting other members, it seems advisable to avoid a steep hierarchical ranking among team members and give them a high degree of autonomy. In addition, stimulating the development of a TMS constitutes a promising intervention for improving knowledge sharing and decision quality. TMSs have already been linked to improved team learning (Lewis et al., 2005) and a number of other performance measures (e.g., Austin, 2003; Kanawattanachai & Yoo, 2007;

Lewis, 2003). This study adds to the growing literature on the effectiveness of TMSs by demonstrating that they are also associated with better decision outcomes.

As the sheer amount of available information is growing (Price, 1965; Tabah, 1999), decision makers need to reduce complexity without overlooking valuable information. To reduce the quantity of input and to deal with the ever-growing knowledge, they have to specialize, but also to create teams or networks where distributed knowledge can be shared and leveraged (Drucker, 1992). Wegner's (1986) concept of group transactive memory describes how both can be achieved. A well-developed TMS enables employees to focus on sub-components of a task while benefitting from a large pool of information and effective knowledge sharing.

Having been suggested by several researchers (e.g., Lewis, 2003; Stasser et al., 1995; Wegner, 1986), it comes as no surprise that team members' awareness of each other's expertise and a collective division of cognitive labor leads to more knowledge sharing among them. Yet, to the best of my knowledge, the direct link between a TMS and member's knowledge sharing behavior has not been empirically demonstrated before. Knowledge sharing within and across teams is regarded as a key to success for organizations today (e.g., Bock et al., 2005; Cabrera & Cabrera, 2005; Davenport & Prusak, 1998). Research shows that it has a positive effect on both team *and* organizational performance (for an overview, see Wang & Noe, 2010). Although the present study only looked at the ultimate impact on perceived decision quality, it can therefore be assumed that increased knowledge sharing has positive implications beyond group decision making.

Despite the obvious significance of knowledge sharing for organizational success, the findings of this study also suggest that the level of interdependence among workers has a determining influence on *how much* knowledge sharing actually matters. Clearly, organizations should not blindly invest in KMSs in order to foster the exchange of knowledge. Following a targeted approach, they can first identify those teams, tasks, and workstreams that are based on or require interdisciplinary expertise and the distribution of knowledge. In a second step, they can then optimize for information and knowledge sharing by enabling agile, self-organized teamwork and promoting the development of TMSs. While the best interventions to support TMSs have yet to be established, the present research suggests that this strategy will pay off.

3.5.2 Strengths, Limitations, and Future Directions

To estimate the hypothesized model, this study followed a path analytic framework, implying that all hypothesized paths were estimated simultaneously. This reduced the problems associated with other approaches for testing mediation, such as piecemeal, subgroup, or causal step approaches (Bauer, Preacher, & Gil, 2006; Edwards & Lambert, 2007; Preacher, Zyphur, & Zhang, 2010). The overall fit of the model could be examined in addition to analyzing the parameter estimates for all structural paths. With a sample size of 1129 participants, even the stricter guidelines for SEM were met (Kline, 2016; Muthén & Muthén, 2002). Hence, the statistical procedure offered a rigorous empirical examination of the hypothesized relationships and can be considered a strength of this study.

Complementing the findings from an experiment, the present survey was theoretically motivated. The conceptual model was grounded in causal relationships that had been tested experimentally. Among naturalistic field studies, this is a rare advantage. While the cross-sectional data cannot prove causality, the assumptions of directionality in the hypothesized model are strengthened by previous evidence. Yet, this study is not free of limitations.

First, all data were derived exclusively from self-report measures. This includes a number of potential problems, such as common method bias or reduced reliability due to situational reactivity and memory limitations (Stone, Bachrach, Jobe, Kurtzman, & Cain, 1999). On the other hand, subjective measures of performance are commonly used in the study of work teams (e.g., Chang & Bordia, 2001, Cohen & Bailey, 1997, Cohen et al., 1994; Tarakci et al., 2016). Given that the relationships between the variables of interest had already been examined experimentally, it was generally less problematic to rely on employees' perception. Nevertheless, future studies should attempt to provide support for the theoretical model based on objective measures. Unfortunately, data could only be analyzed on the individual level and were not aggregated to the team level, which further reduces the comparability to the previous experimental findings. Again, this shortcoming should be addressed in future studies.

Second, while task interdependence turned out to be a moderator, it was only found to change the strength of the anyway significant effects of team structure and TMS on decision quality. It should be noted, however, that the variance of interdependence was limited in this study. The investigated company was deliberately chosen because it offered a comparatively wide range of team compositions and responsibilities. Nevertheless, the company’s profile is predominately that of a knowledge-driven organization in the IT sector. That means, employees tend to be experts from different fields who need work interdependently. Therefore, the collected data did not cover the full range of task interdependence. In line with previous findings (Langfred, 2005; Wageman, 2001), this study shows that self-organized teams are beneficial when members work highly interdependently. Yet, further studies are needed to also directly compare different team structures at very low levels of interdependence.

Third, it was not possible to control for the precise nature of tasks. Participants in this sample were recruited across organizational departments. Accordingly, their teams performed a variety of tasks, ranging from developing software to accounting or managing customer relationships. Prior research has revealed that a significant proportion of team effectiveness is explained by the characteristics of the tasks performed (e.g., Curral, Forrester, Dawson, & West, 2001; Kabanoff & O'Brien, 1979; Stewart & Barrick, 2000). In this study, only the degree of interdependence was assessed. It is still likely that predictive models of team performance systematically vary depending on additional task characteristics (e.g., task clarity).

Fourth, this study did not evaluate any organizational level variables such as the extent of change, corporate culture, or reward systems, which may also impact the examined relationships (Magpili & Pazos, 2018). Since the sample was collected from one large corporation, these contextual influences could not be examined. It is beyond the scope of this paper to define all task characteristics and situational factors that influence which team structure is the most advantageous, but these are fruitful avenues for future research.

Fifth, the study sample was biased in terms of participants' socioeconomic background. As already mentioned above, the company investigated here employs predominantly highly educated workers who earn above-average salaries. While the focus of this research is on knowledge work and therefore exactly on this part of the workforce, its findings should not be generalized to other types of organizations and industrial sectors. Additional studies could strengthen their validity by testing the proposed model in different contexts.

Finally, inconsistencies between the formally described structure and the implemented structure of teams made it impossible to rely on an objective criterion for assessing the degree of teams' self-organization. While the company labels some teams as agile, self-managing, or self-organized, the formal description of teams is not necessarily indicative of their actual internal structure. Thus, participants subjective rating of their team structure was used. Although this was still the best way to measure the degree of self-organization, it confounds the formal with the informal structure of teams. It should be included in the agenda for future research to dissect the effects of self-organization for formal and informal team structures.

Despite these limitations, the present study makes a number of important contributions to the literature on the effectiveness of teams in organizations. Given the popularity of teams as basic building block for organizations, on the one hand, and the complexities and problems involved in group dynamics, on the other hand (e.g., Brodbeck et al., 2007; De Dreu, 2007; Hollenbeck et al., 1995, Tost et al., 2013), questions revolving around how to utilize collective knowledge and to achieve effective decision making are capturing the attention of both researchers and practitioners. This study proposes a theory-driven model of team decision quality that provides actionable insights and answers to some of these questions. It complements and extends previous research by demonstrating the direct link between knowledge sharing and decision quality in an organizational setting (Wang & Noe, 2010). Based on large and diverse sample of employees, we see that team members share their knowledge more willingly and effectively when they can draw upon a well-developed TMS. Similarly, knowledge sharing is improved by establishing a self-organized internal team structure. This ultimately leads to better decisions made by teams – all the more if the interdependence among members is high.

4 General Discussion

4.1 Background

Over the last decades, we have been witnesses of a fundamental transformation:

> We grew up in the Industrial Age. It is gone, supplanted by the Information Age. The economic world we are leaving was one whose main sources of wealth were physical. The things we bought and sold were, well, *things;* you could touch them, smell them, kick their tires, slam their doors and hear a satisfying thud. Land, natural resources such as oil and ores and energy, and human and machine labor were the ingredients from which wealth was created. The business organizations of that era were designed to attract capital – financial capital – to develop and manage those sources of wealth, and they did it pretty well. (Stewart, 1997, p. XX)

Today, in the Information Age, knowledge and data have become the economy's primary resources. *They* are now the central ingredients of what we produce, buy, and sell (Bang, Cleemann, & Bramming, 2010; The Economist, 2017). While knowledge has always been important throughout history – bringing about change and progress –, only in this day and age is it at the heart of how wealth is created. The need to capitalize on knowledge assets, to get as much value as possible out of them, has never been greater. Traditional resources like capital, land, and physical labor have not vanished into thin air but become secondary.

"At the same time, however, specialized knowledge by itself produces nothing" (Drucker, 1992, para. 4). It has become the principal task for employees and organizations to extract value from knowledge or information by finding, storing, sharing, and growing it, as well as integrating it into tasks and products. One way organizations – especially businesses – have come to leverage their knowledge assets is with the use of *knowledge worker teams*. Composed of well-educated members with complementary expertise, these teams are increasingly employed to solve complex problems, create intellective products, and drive innovation (e.g., DeChurch & Mesmer-Magnus, 2010; Kozlowski & Ilgen, 2006; Lewis, 2003). The trend towards teamwork has generated great interest in researching whether this approach does, in fact, improve knowledge worker productivity (Lewis, 2003; Sanna & Parks, 1997).

Joining this line of research, the present dissertation aspires to rigorously evaluate factors that contribute to successful knowledge worker teams. Specifically, it examined how the distributed knowledge of such teams can be used more effectively. While much of the available evidence suggests that teams generally benefit organizational performance (Devine, Clayton, Philips, Dunford, & Melner, 1999; Katzenbach & Smith, 1993; Kozlowski & Bell, 2003), they still fall short of expectations when it comes to exploiting their informational resources. In particular, findings from decision making research have revealed a number of detrimental processes that prevent groups from sharing information effectively and reaching optimal decisions (for a review, see, e.g., Kerr & Tindale, 2004). Researchers are still in the process of finding out how teams should be structured and supported in order to mitigate these problems.

Based on an experimental and a field study, this dissertation investigated the impact of different group structures and knowledge structures on the information sharing behavior and decision quality of teams. The experimental study, described in Research Paper I, directly contrasted self-organized groups with hierarchically structured groups. In addition, it tested how groups *with* a TMS and groups *without* a TMS compare. In a subsequent survey study, described in Research Paper II, the natural distributions of these factors (i.e., TMS and self-organization) were assessed in real workspaces. Their associations with teams' knowledge sharing and decision quality were analyzed at different levels of task interdependence.

In what follows, I will first synthesize the findings of these two studies. Then, I will critically discuss the overall strengths and limitations of the present research. This section will conclude with an outlook on how the dissertation might enrich our theoretical understanding of knowledge worker teams and contribute to the development of practical interventions.

4.2 Summary of Findings

The indicators used by researchers to measure team effectiveness are manifold (Mathieu et al., 2008). In general, the criterion or outcome tends to be less systematically defined and addressed in team effectiveness research than the input variables (i.e., antecedents and mediators). This dissertation focused on decision quality as performance measure for the following reasons. First, successful decision making can be viewed as the pivotal point for tackling the challenges organizations are facing in a knowledge-driven economy. It allows for highly flexible and adaptive coping with environmental changes. Second, it is particularly relevant when investigating the effectiveness of self-organized team structures: Since making decisions is the central function of management, the success of self-organized teams primarily hinges on their ability to make informed decisions in the absence of a leader.

In Research Paper I, decision quality was defined by the rate of correct solutions based on a hidden profile task. As is usually the case in hidden profile studies (Sohrab et al., 2015), the task involved multiple decision alternatives, one of which was superior to the others. Such an evaluation of decision outcomes as either right or wrong was not possible outside the laboratory. As in previous studies (e.g., Carmeli et al., 2012; Lin & Rababah, 2014; Olson et al., 2007), Research Paper II therefore used perceptual measures of team decision quality. In the absence of suitable objective measures, employees' perceptions provide a reliable substitute (Dess & Robinson, 1984). In fact, the best way to rate the quality of team decisions can be to consult those who are involved in making them and are able to judge their effects while taking the context into account (e.g., Amason, 1996; Amason & Mooney, 2008). Using two scales with three items each, participants had to rate (1) their team's overall decision quality (Amason, 1996) and (2) their team's decision quality relative to its members' individual input and competence (Janssen et al., 1999).

4.2.1 The Relationship Between Team Structure and Decision Quality

Findings across the two papers are consistent, indicating that a team's internal structure has a direct effect on decision quality. Specifically, Research Paper I demonstrated that self-organized groups (i.e., groups whose members are not rank ordered) make better decisions than hierarchically structured groups (i.e., groups with an appointed leader) when task-relevant knowledge is asymmetrically distributed among their members. Assessing the internal team structure on a continuum from completely hierarchically managed to completely self-organized, Research Paper II provides additional evidence for this association in the context of knowledge work. A path analysis of the survey data revealed that the more self-organized a team was, the higher was its perceived decision quality.

4.2.2 The Relationship Between TMS and Decision Quality

The results of both papers provide consistent evidence in support of the positive impact of TMSs on team decision quality. In Research Paper I, the emergence of a TMS was successfully manipulated. Half of the groups in the sample had access to an overview of *how* information was distributed among members without revealing the actual content of information. As a consequence, group members acquired meta-knowledge of who was an expert on what. They also implicitly coordinated with each other by specializing on certain aspects of the task. Thus, they were able to develop a TMS. The other half of the groups was only informed that members had not received perfectly overlapping sets of information (i.e., that information was asymmetrically distributed). These groups did not develop a TMS. Results then showed that the rate of correct decisions was significantly higher in groups with a TMS than in groups without a TMS. Corroborating this finding, a positive correlation between TMS and decision quality was also found in the subsequent survey study (Research Paper II). The positive effect of TMSs was independent of a team's internal structure. That is, both self-organized and hierarchical teams benefited from a TMS equally.

4.2.3 Knowledge Sharing as a Mediator of the Effects of Team Structure and TMS on Decision Quality

Since the quality of group decisions hinges on the extent to which members share and integrate their individual information or knowledge (De Dreu, Nijstad, & Van Knippenberg, 2008; Hinsz, Tindale, & Vollrath, 1997), knowledge sharing was hypothesized to explain the positive effects of self-organized structures and TMSs on decision quality. Indeed, participants' knowledge sharing behavior was found to be a mediator in both papers. Research Paper I used an objective measure by analyzing the content and frequency of shared information during group discussions. As in previous studies (e.g., Schulz-Hardt et al., 2006; Stasser et al., 2000), the discussion bias in favor of shared information was derived from these data. Self-organized groups exhibited reduced discussion biases. That is, their members exchanged more initially unshared information than the members of hierarchical groups. Similarly, a TMS also attenuated the bias towards shared information, whereas groups without a TMS exhibited stronger discussion biases. The improved knowledge sharing (i.e., less biased discussions) explained between 16% and 45% of the effects of both team structure and TMS on decision quality.

Due to the applied context of Research Paper II, the assessment of knowledge sharing had to be modified. Instead of directly analyzing teams' information sampling bias, two subjective rating scales were employed. One of them assessed knowledge utilization, which was defined as "the extent to which the pool of available knowledge and expertise is activated and exploited within teams" (Sung & Choi, 2012, p. 5). The second scale measured team members' willingness to bring expertise to bear by sharing tacit knowledge (Faraj & Sproull, 2000). Thus, the pooling of unshared or tacit knowledge was a common element in the definitions of knowledge sharing across both papers. Based on 10.000 bootstrapped samples, Research Paper

II revealed significant indirect effects of team structure and TMS on decision quality through knowledge sharing, supporting the experimental findings.

4.2.4 Task Interdependence as Moderator of the Relationship between Knowledge Sharing and Decision Quality

Task interdependence was assumed to be a boundary condition of the positive impact of self-organization on knowledge sharing and decision quality. Based on previous research, it was hypothesized that a self-organized team structure is conducive to team performance if no single member is able to solve the task optimally (i.e., high task interdependence). A study by Tarakci et al. (2016) had shown before that hierarchical group structures can outperform more self-organized or autonomous group structures when the leader has high task competence and is theoretically able to accomplish the task single-handedly. There is also some evidence suggesting that self-organized teams fare better under conditions of high interdependence (Langfred, 2005; Wageman, 2001). Research Paper I therefore used an experimental task that involved a high level of interdependence. However, it did not manipulate and test different levels of task interdependence. In Research Paper II, on the other hand, task interdependence was assessed as an additional variable. Thus, it could be investigated as a moderating factor in the mediated relationship between team structure and decision quality and between TMS and decision quality. The conditional indirect effects were significant, showing that the associations were stronger for higher levels of task interdependence. Yet, the mediated effects remained significant even at the lower levels. In addition, only the *indirect* effects were moderated by task interdependence, whereas the direct effects of team structure and TMS on decision quality were not.

While these findings point to a moderating role of task interdependence in the hypothesized relationships, they do not confirm the assumption that the positive effect of a self-organized structure is clearly limited to high levels of task interdependence. Instead, self-organization was positively related to team decision quality across different levels of task interdependence. Similarly, a TMS seems to be generally conducive to team decision quality, although it is particularly helpful under conditions of high interdependence. Since task interdependence among employees was generally high at the investigated company, these findings could have been due to limited variation in the data.

4.3 Strengths, Limitations, and Directions for Future Research

The strengths and limitations specific to each paper are addressed in their respective discussion sections. To avoid reiterations, this section will focus on the overarching strengths and weaknesses of the present dissertation project.

4.3.1 Strengths

The major strength of this dissertation is its use of different research methods in a complementary manner. Research Paper I was based on an experimental design. Testing randomly assigned groups in a laboratory setting, it allowed for the rigorous examination of causal relationships between the variables of interest while controlling for confounding factors. After causal links had been established, a conceptual model was derived. Research Paper II then tested this model in an organizational context. Using field data from employees at a publicly traded company, the second study not only confirmed the hypothesized relationships but also improved the external validity of the present findings. As such, this dissertation offers a multimethod approach that attempts to decrease the methodological limitations of each individual study (Brewer & Hunter, 2006). Unfortunately, it was not feasible to use the same operationalizations of constructs across both papers. Yet, for each variable, it was carefully considered how to operationalize them in order to make the two papers as comparable as possible. For instance, instead of using a more general measure of team performance, as is common in field studies (Mathieu et al., 2008), Research Paper II explicitly assessed team decision quality. In particular, participants also rated the quality of final decisions in relation to members' individual input and competence in order to account for the fact that, in the experiment, good results could only be obtained by integrating individual viewpoints into a collective perspective.

Due to the extra effort and expense required for team studies or group studies, small sample sizes are often a problem for researchers. Yet, the sample sizes of Research Paper I and Research Paper II each provided sufficient statistical power to detect the hypothesized effects. This should not be taken for granted given the common issue of low statistical power in management and applied psychology research (Baroudi & Orlikowski, 1989; Mone, Mueller, & Mauland, 1996).

A further strength of this dissertation is the direct comparison of different team structures (i.e., hierarchical and self-organized) across papers. The literature tends to be divided: Studies either examine self-organized teams (for a review, see, Magpili & Pazos, 2018) or they look at hierarchy as influence factor of team performance (for a review, see Anderson & Brown, 2010). Generally, self-organized teams seem to be a product of hands-on experiences in industry and applied research. By contrast, hierarchical structures are part of fundamental research and have been explored by scientists of various disciplines. While many findings on the effectiveness of self-organized teams come from field studies, the dynamics of hierarchy have traditionally been studied in experimental settings. The present dissertation bridges these two research directions. Not only does it include the corresponding literature, it also studies self-organized and hierarchical structures in parallel.

Moreover, this dissertation involved an adaption of the widely used hidden profile paradigm that offers some methodological extensions. Based on the original hidden profile task by Schulz-Hardt et al. (2006), the distribution of information was changed such that no bias towards one decision alternative was intentionally instilled into participants. Instead, participants were either not at all or just randomly biased prior to group discussions. The best alternative was nevertheless hidden from each individual. Traditionally, pre-discussion biases have been a central line of inquiry in the context of the hidden profile studies (e.g., Kelly & Karau, 1999; Schulz-Hardt et al., 2000). On the other hand, researchers have criticized the narrow focus and specific assumptions of the hidden profile paradigm, calling for extensions that include a broader range of natural group decision making situations (Wittenbaum et al., 2004, p. 298). By removing systematic pre-discussion biases, the current version of the hidden profile task constitutes such an extension. In addition, the distribution of information implied the assignment of expert roles. Each participant received more unique (or unshared) information on one of the decision alternatives than the others. Yet, these expert roles were not transparent to participants since they were given the same amount of information for all alternatives. This experimental setup made it possible to manipulate the emergence of a TMS, comparing groups who knew about the distribution of expertise with groups who did not. Taken together, the alterations made to the hidden profile task in this research project broaden the range of questions that can be pursued with it experimentally.

Notwithstanding the strengths of this dissertation, the studies included in it have several weaknesses that should to be addressed in future research.

4.3.2 Limitations and Directions for Future Research

Although the survey study presented in Research Paper II was geared to corroborate the findings from the experimental study in Research Paper I, the comparability between the two studies was still limited in some ways.

First, the manipulation of group structure in Research Paper I determined both the formal and the informal structure. According to the manipulation checks, participants' subjective experience of power disparity was congruent with the formally assigned structure (i.e., equal members or hierarchically ranked members). In Research Paper II, on the other hand, only the informal or perceived internal structure was considered. As formal descriptions of organizational team settings are manifold and say very little about members' actual relations and responsibilities, it is difficult for researchers to define team structures consistently across organizational studies. The distinction between formal and informal structures should nevertheless be taken into account in future research.

Second, the experimental setting involved the assessment of many team-level variables, whereas the survey data were collected solely on the individual level. It would be desirable to reexamine the hypothesized relationships by collecting team-level data in the future.

Third, the operationalization of knowledge or information sharing in Research Paper I referred to a very specific phenomenon in group decision making, the so called shared information bias (Sohrab et al., 2015). As this bias can only be measured under controlled conditions where the distribution of information is known to the researcher, knowledge sharing had to be operationalized differently in Research Paper II. Participants were asked to rate team members' willingness to share information and their teams' general knowledge utilization. To complement the present findings, such measures of knowledge sharing should be additionally applied in replications or adaptions of the experimental study.

While this dissertation started to shed light on the pathways underlying the positive effects of both team structure and TMS on decision quality, these pathways are far from being understood. Comparing alternative models with fully mediated paths, the results of Research Paper II suggest that team structure and TMS have direct effects on team decision quality that cannot be explained by enhanced knowledge sharing.

Future studies could investigate, for instance, whether improvements in team coordination also account for the positive effect of TMS on decision quality. Inherently, TMSs involve a coordinated division of cognitive labor (Wegner, 1986; Lewis & Herndon, 2011). That is, team members who have developed a TMS rely on each other for memorizing and knowing specific things. However, a TMS is likely to further influence other aspects of team coordination such as making plans, assigning subtasks, or giving feedback. For example, there is first correlative evidence that TMSs are associated with better coordination of subtasks (Hsu, Shih, Chiang, & Liu, 2012). Research Paper I only measured how well members integrated their individual information by counting the mentioning and repetition rates of task-relevant information during group discussions. In addition to this, it would be possible to record and evaluate groups' strategizing about the task as an indicator of team coordination. It could be hypothesized that groups with a TMS are able to map out a better strategy in a shorter amount of time than groups without a TMS. The mediating role of team coordination in the relationship between TMSs and decision quality should also be tested in the field.

While knowledge sharing was treated as a mediator in this research, it is often regarded as an outcome itself (Wang & Noe, 2010). In that respect, it is still an open question *why* members of self-organized teams share knowledge more willingly and effectively. Explorative analyses revealed a significant difference in intrinsic motivation between members of self-organized groups and members of hierarchical groups in Research Paper I. In general, empowered or self-organized teams are claimed to be more motivating and rewarding for their members (e.g., Cohen & Ledford, 1994; Magpili & Pazos, 2018; Seibert et al., 2011). Such increased motivation could explain the improvement of knowledge sharing by self-organized team structures. The potential mediating effect of (intrinsic) motivation should therefore be explored in subsequent studies.

Other potential mediators of the relationship between team structure and knowledge sharing are trust and open communication. A study by Tost et al. (2013) found that leaders' verbal dominance can undermine open communication among team members. In general, hierarchies often reduce the trust of low-power individuals, which ultimately impairs team communication and coordination (for a review, see Anderson & Brown, 2010).

Theoretically, knowledge sharing is both supported by members' motivation and hindered by a lack of trust and openness such that both could be an explanation for the benefits of self-organization observed here. It would be an interesting line of inquiry to tease apart how these factors contribute to the aggregate observed effect.

Finally, future research should put the relationship between TMS and self-organization under the microscope. In Research Paper II, there was a significant correlation between these two variables. While I did not further investigate their relationship, it would be interesting to find out what is driving this correlation. It could be the case that teams with higher degrees of self-organization help develop TMSs because their members rely more on each other and interact more with each other. In this case, team structure would even be a predictor of TMS. Alternatively, organizations might intentionally give more autonomy to teams that are working highly interdependently. Maybe organizations have intuitively understood that team self-organization benefits performance when task interdependence is high. In this dissertation, task interdependence was only studied as a moderator. However, it might also function as an independent variable that influences the development of a TMS. More precisely, teams who work interdependently are likely to develop a TMS more efficiently because their members *need* to interact with each other. Supporting this assumption, Zhang et al. (2007) found that both task interdependence and cooperative goal interdependence are related to higher TMS in workgroups. In this alternative scenario, task interdependence then fosters the development of TMSs *and* determines whether an organization employs self-organized structures. It would be a common predictor, explaining why TMS and the degree of self-organization are correlated. Yet, team structure would not have a causal relationship with TMS.

4.4 Implications

The overall findings of this dissertation have a number of theoretical and practical implications that will be discussed in this concluding section.

4.4.1 Theoretical Implications

Together the papers of this dissertation contribute to research on the impact of different (social) team structures on team effectiveness (e.g., Tarakci et al., 2016; Tost et al., 2013). Researchers have called for a better understanding of when hierarchies or flatter structures will help or harm group success (Anderson & Brown, 2010). The present research indicates that, under conditions of distributed knowledge and expertise, a more egalitarian or self-organized structure is associated with better team decision quality in both the laboratory and the field. In particular, results demonstrate that the members of self-organized teams derive more benefit from their informational and intellectual resources than the members of hierarchically structured teams because they tend to share their distributed knowledge more efficiently. According to socio-technical theorists (Cummings, 1978; Manz & Stewart, 1997; Pasmore et al., 1982), self-organization or self-management instills a sense of ownership that is otherwise missing in organizations. The self-determination over one's work is expected to be intrinsically motivating and to elicit pride in one's job. This might explain why members' knowledge sharing behavior is improved by a self-organized team structure. Experiencing a strong sense of ownership for their work, team members could be more motivated to contribute individually.

Along these lines, some researchers have argued that teams benefit from cooperative outcome interdependence as it raises members' motivation to participate and work together (e.g., Alper et al., 1998; De Dreu, 2007). The *Theory of Cooperation and Competition* (e.g., Deutsch, 1949; Tjosvold, 1998) states that people in groups perceive their goals as either linked cooperatively or linked competitively to the other members' goals. "Under cooperative outcome interdependence, team members assume they swim or sink together and that they benefit from each other's performance. Under competitive outcome interdependence, in contrast, team members assume that when they swim, others sink, and vice versa." (De Dreu, 2007, p. 628). Studies have shown that the more team members perceive cooperative outcome interdependence, the more openly and constructively they discuss opposing views and the better they share information (Alper et al., 1998; De Dreu, 2007). However, this evidence is based on samples of self-organized teams only. It could be the case that a team's structure directly effects its members' perception of cooperative goal interdependence. More precisely, members of a self-organized team might in principal perceive higher goal interdependence than members of a hierarchical team because the self-organized structure strengthens their feeling of responsibility for the outcome. Maybe, the higher a team's autonomy, the more members exhibit a "sink or swim together"-attitude. This could then also explain the improvement in their knowledge sharing behavior.

While this dissertation did not elucidate the mechanisms underlying the relationship between team structure and knowledge sharing, it represents an important empirical advance by directly comparing the decision making performance of hierarchically structured and self-organized teams under conditions of distributed knowledge. As Anderson and Brown (2010) point out, "we have only scratched the surface in our understanding of hierarchy's effects on the group" (p. 80). The findings presented here enrich this understanding. They clearly show that, on average, a hierarchical ranking of team members impairs their exchange of knowledge, which becomes detrimental when high quality decisions depend on each members' expertise and idiosyncratic information. Similarly, Tost et al. (2013) found that leaders' subjective experience of power has a negative influence on teams' decision making performance when task interdependence is high.

A recent paper by Taracki et al. (2016) paints a more positive picture of hierarchical structures. Based on a series of studies, the authors come to the conclusion that groups can actually benefit from a leader if they are able to choose the most competent individual as the one who is in charge. It should be noted, however, that their findings rest on studies that implied low levels of task interdependence and did not consider distributed knowledge. Nevertheless, leaders' competence might play a moderating role even under the circumstances examined in this work. Other research in the context of the hidden profile paradigm suggests that the impact of a hierarchical structure can very well depend on the leaders' style or personality (e.g., Cruz et al., 1999; Nevicka et al., 2011; for a review, see Sohrab et al., 2015). To scrutinize the effects of leader characteristics and leadership behavior was not part of the objectives set by this dissertation project. Yet, in light of the evidence described above, the question arises how much the performance of hierarchically structured teams varies depending on the specific leader who is selected. For example, if leaders take on the role of a moderator more so than a manager (i.e., structuring team discussions to a greater or lesser degree), the detrimental effects of a hierarchical ranking could maybe be counteracted.

The research presented in this dissertation also has implications for TMS theory. In their review of studies on the hidden profile paradigm, Sohrab et al. (2015) pointed out that "research explicitly examining TMS in the hidden-profile literature is mostly missing" (p. 520). Due to its emergent nature (Wegner, 1986; 1995), a TMS seems to be difficult to define and manipulate in a laboratory setting. Building on previous work (Stasser et al., 1995; Stasser et al., 2000), *Research Paper I* nevertheless developed a new manipulation of TMS that made it possible to study its causal effect on decision quality in a hidden profile scenario. The results prove that a TMS is conducive to successful group decision making, attenuating the bias in favor of shared information. Researchers can leverage this evidence in further controlled studies of the development and impact of TMSs.

The totality of the evidence presented here further highlights the significance of the TMS construct for knowledge worker teams in general. These teams are purposefully formed by organizations to capitalize on the specialized knowledge and expertise of their individual members. Yet, their potential is not automatically realized. Team members must coordinate and integrate their differentiated views and complementary knowledge (e.g., Bock et al., 2005; Wang & Noe, 2010). TMSs promise exactly that: In line with previous research (e.g., Austin, 2003; Kanawattanachai & Yoo, 2007; Lewis, 2003; Lewis et al., 2005), the findings of this dissertation demonstrate that a TMS motivates members to cultivate specialized knowledge, facilitates access to a greater pool of information, and stimulates knowledge sharing. Extending the current state of research, the findings also provide direct evidence for the positive association between TMS and team decision quality.

As Lewis and Herndon (2011) argue, the actual benefits of TMSs can only be revealed if the construct is defined and measured correctly. In the past, researchers have often simplified the operationalization of a TMS, defining it as shared understanding of who knows what. While TMS theory is indeed related to team members' meta-knowledge about who is an expert on what, it not only explains a resulting cognitive structure but also the group processes that define how this structure emerges and operates (Lewis & Herndon, 2011, p. 1261). In the present research, not only structural but also process-related components of the TMS construct were taken into account. In doing so, TMS was clearly distinguished from other theories of team cognition that merely focus on shared cognition about expertise (DeChurch & Mesmer-Magnus, 2010; Lewis, 2003). The convergence of members' mental models has been only weakly related to team performance in previous studies (Lewis, 2003; Mohammed & Dumville, 2001). By contrast, this dissertation adds to the growing body of evidence that TMSs – if measured as such – are a powerful predictor of various dimensions of team performance.

4.4.2 Practical Implications

Today, many organizations – if not most – rely on knowledge assets to set their products or services apart. In order to leverage these assets, they have started to structure work around teams of employees who use experience and expertise to tackle complex problems, make informed decisions, and create innovative products (e.g., Lewis, 2003; Moreland, 2006; Sung & Choi, 2012). Due to the popularity of such knowledge worker teams, it has become a major focus of organizational research to find out what makes them successful and, in particular, how to optimize their knowledge processes. Despite these research efforts, our understanding of the effectiveness of teams in organizations is certainly still far from being exhaustive. More studies are needed to extend but also to replicate past findings, including the findings presented here. Nevertheless, this dissertation offers some practical advice on how organizations can facilitate effective team decision making.

First, it shows that steeper hierarchical structures are rather an impediment to the exchange of knowledge among team members. In comparison, more autonomous or self-organized team structures can be expected to foster knowledge sharing, resulting in better decision outcomes on average. This applies particularly to tasks that involve high interdependence, such that no single person (not even the leader) is able to master the task without consulting the other members. Yet, to conclude that knowledge-driven organizations should categorically abolish leadership positions, would be wrong. This dissertation defined hierarchical team structures based on the centralization of power and responsibility in one person. Additionally, it only investigated the structural effect of hierarchy, averaging over the personal characteristics of the leaders involved. Thus, the multifaceted role leaders can serve in naturalistic organizations falls largely outside of the scope of this dissertation. The data presented here do indeed suggest that organizations could benefit from flattening their decision making structures by directing more responsibility to teams without an internal rank order. However, we cannot advocate for the wholesale abolishment of management, a long-held cornerstone of organizations.

Instead, leadership has to follow the future of work. Researchers have already started to investigate different leadership styles and how they fit in with the new workplace of the Information Age (e.g., Cruz et al., 1999; Larson et al., 1996; Larson et al., 1998; Morgeson, 2005).

In addition, new approaches to leadership are being explored, going beyond the conventional leader-follower interactions. As Yammarino et al. (2012) point out, theories of leadership have been focusing on the impact of a single leader on their subordinates or other outcomes of interest. The authors explain:

> In contrast, in the newer approaches […], leadership is viewed as a collectivistic phenomenon that involves putting the ‘‘we’’ in leadership where multiple individuals interact, through a variety of formal and informal structures, broadly defined, and take on a variety of leadership roles, both formally and informally, over time. Also, in collectivistic leadership approaches, traditional power and authority structures are often ignored, downplayed, bypassed, or redefined. (p. 384)

For instance, the approach of *shared leadership* posits that team leadership is composed of several role functions that can be assumed by multiple individuals in various ways (e.g., Pearce & Conger, 2003). Thus, leadership may be distributed among team members and decisions made by the team are not the product of a sole leader driving it. In light of the present findings, such *collectivistic* approaches to leadership (Yammarino et al., 2012) become imperative, calling for more empirical research. If we move away from the hierarchical leader-focused view, we need to make other ways of steering the crowd available to organizations.

This dissertation further suggests that it should become an integral component of knowledge management to promote TMSs. “To know what they know” (Davenport & Prusak, 1998, p. 17) is not a given for organizations. Especially for larger organizations – being geographically and functionally siloed – it is a major challenge to localize, coordinate, and integrate the knowledge that they already hold. While this knowledge is potentially vast, its mere existence is of little value to them. Only if it is accessible and used by the organization’s members, can it turn into a competitive advantage. Unfortunately, “reinventing the wheel” is a common problem in (large) organizations. That is, different teams or units often run overlapping projects or tackle similar problems over and over again because they do not know what others in the organization know and have done (Davenport & Prusak, 1998). TMSs can minimize such inefficiencies. In fact, the more knowledge *is* or *needs to be* distributed within a team, unit, or whole organizations, the more members benefit from a highly developed TMS. It enables employees to specialize while benefitting from a large pool of information. Additionally, it encourages coordinated knowledge sharing and learning. In doing so, a TMS presents a powerful tool to meet the challenges of an increasingly knowledge-driven economy and society.

The findings of this dissertation lay a foundation for the development of workplace interventions. First, the TMS construct can help detect under-performing knowledge worker teams. Second, it has implications for staffing such teams. Clearly labeling and introducing a few experts from the beginning may promote TMS development. Specifically, the salience of expertise encourages other members to assume responsibility for different areas of expertise. It also creates trust in each other's competence.

Generally, high staff turnover should be avoided. Instead, a core of members could be kept together across projects. Also, onboarding procedures, which are typically tailored to one employee (or all new employees), should be designed in a way that involves more interactions between the new hires and already established team members. Third, the distribution and availability of knowledge among employees needs to be made easily accessible and updated regularly. Intranets could be one way to support this, serving as a platform where expertise is explicitly documented.

Interestingly, while some of the data questions the efficacy of traditional bosses in hierarchical decision making roles, it also suggests a vital role they could serve to facilitate an effective modern organization. Managers are a good candidate to ensure their team is empowered with the tools they need to be successful – such as instilling a robust TMS. Somewhat paradoxically, democratizing power and decentralizing decision making authority requires more structure *not less*, and therefore requires new integrated organizational structures. The creation and maintenance of which is a natural fit for the modern manager.

Such a recommendation for the role of modern management should come from both the experimentation with different organizational structures within industry *and* the rigorous empirical investigations of how effective these different structures are in addressing the myriad challenges organizations now face. There is an impressive degree of novel organizational structures currently being devised and employed across the modern economy – from Holacracy (Robertson, 2015) at Zappos to complete decentralization at Buurtzorg. Equally important to these one-off naturalistic experiments is serious and considered research to evaluate what of these organizations' performance can be attributed to these novel organizational approaches. Empowered and decentralized teams is one such organizational innovation, and the present research represents an important contribution to evaluating whether, and under which conditions, such an approach can be empirically recommended.

References

Aiken, L., & West, S. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park, CA: Sage.

Alper, S., Tjosvold, D., & Law, K. S. (1998). Interdependence and controversy in group decision making: Antecedents to effective self-managing teams. *Organizational Behavior and Human Decision Processes*, *74*(1), 33-52. doi:10.1006/obhd.1998.2748

Amason, A. C. (1996). Distinguishing the effects of functional and dysfunctional conflict on strategic decision making: Resolving a paradox for top management teams. *The Academy of Management Journal*, *39*(1), 123-148. doi:10.2307/256633

Amason, A. C., & Mooney, A. C. (2008). The Icarus paradox revisited: How strong performance sows the seeds of dysfunction in future strategic decision-making. *Strategic Organization*, *6*(4), 407-434. doi:10.1177/1476127008096364

Amason, A. C., & Sapienza, H. J. (1997). The effects of top management team size and interaction norms on cognitive and affective conflict. *Journal of Management*, *23*(4), 495-516. doi:10.1177/014920639702300401

Ancona, D. G., & Caldwell, D. F. (1992). Demography and design: Predictors of new product team performance. *Organization Science, 3*(3), 321-341. doi:10.1287/orsc.3.3.321

Anderson, C., & Brown, C. E. (2010). The functions and dysfunctions of hierarchy. *Research in Organizational Behavior*, *30*, 55-89. doi:10.1016/j.riob.2010.08.002

Anderson, C., John, O. P., Keltner, D., & Kring, A. M. (2001). Who attains social status? Effects of personality and physical attractiveness in social groups. *Journal of Personality and Social Psychology, 81*(1), 116-132. doi:10.1037/0022-3514.81.1.116

Anderson, C., Spataro, S. E., & Flynn, F. J. (2008). Personality and organizational culture as determinants of influence. *Journal of Applied Psychology*, *93*(3), 702-710. doi:10.1037/0021-9010.93.3.702

Anthony, S. D., Viguerie, S. P., Schwartz, E. I., & Van Landeghem, J. (2018, February). 2018 Corporate Longevity Forecast: Creative Destruction is Accelerating. *Innosight Strategy and Innovation at Huron*. Retrieved from https://www.innosight.com/insight/creative-destruction/

Ashby, W. R. (1947). Principles of the self-organizing dynamic system. *The Journal of General Psychology, 37*(2), 125-128. doi:10.1080/00221309.1947.9918144

Austin, J. R. (2003). Transactive memory in organizational groups: The effects of content, consensus, specialization, and accuracy on group performance. *Journal of Applied Psychology, 88*(5), 866-878. doi:10.1037/0021-9010.88.5.866

Autor, D. H. (2015). Why are there still so many jobs? The history and future of workplace automation. *Journal of Economic Perspectives*, *29*(3), 3-30. doi:10.1257/jep.29.3.3

Bang, A., Cleemann, C. M., & Bramming, P. (2010). How to create business value in the knowledge economy: Accelerating thoughts of Peter F. Drucker. *Management Decision*, *48*(4), 616-627. doi:10.1108/00251741011041382

Barker, J. (1993). Tightening the iron cage: Concertive control in self-managing teams. *Administrative Science Quarterly, 38*(3), 408-437. doi:10.2307/2393374

Baron, R. S., Kerr, N. L., & Miller, N. (1992). G*roup process, group decision, group action.* Buckingham, UK: Open University Press.

Baroudi, J. J., & Orlikowski, W. J. (1989). The problem of statistical power in MIS research. *MIS Quarterly*, *13*(1), 87-106. doi:10.2307/248704

Bauer, D. J., Preacher, K. J., & Gil, K. M. (2006). Conceptualizing and testing random indirect effects and moderated mediation in multilevel models: New procedures and recommendations. *Psychological Methods, 11*(2), 142-163. doi:10.1037/1082-989X.11.2.142

Becerra-Fernandez, I., & Sabherwal, R. (2001). Organizational knowledge management: A contingency perspective. *Journal of Management Information Systems, 18*(1), 23-55. doi:10.1080/07421222.2001.11045676

Bell, S. T. (2007). Deep-level composition variables as predictors of team performance: A meta-analysis. *Journal of Applied Psychology, 92*(3), 595-615. doi:10.1037/0021-9010.92.3.595

Berger, J., Rosenholtz, S. J., & Zelditch Jr., M. (1980). Status organizing processes. *Annual Review of Sociology, 6*(1), 479-508. doi:10.1146/annurev.so.06.080180.002403

Blau, P. M., & Scott, W. R. (1962). *Formal organizations: A comparative approach*. San Francisco, CA: Chandler.

Bock, G. W., Zmud, R. W., Kim, Y. G., & Lee, J. N. (2005). Behavioral intention formation in knowledge sharing: Examining the roles of extrinsic motivators, social-psychological factors, and organizational climate. *MIS Quarterly*, *29*(1), 87-111. doi:10.2307/25148669

Bornmann, L., & Mutz, R. (2015). Growth rates of modern science: A bibliometric analysis based on the number of publications and cited references. *Journal of the Association for Information Science and Technology*, *66*(11), 2215-2222. doi:10.1002/asi.23329

Brewer, J., & Hunter, A. (2006). *Foundations of multimethod research: Synthesizing styles.* Thousand Oaks, CA: Sage.

Brodbeck, F. C., Kerschreiter, R., Mojzisch, A., & Schulz-Hardt, S. (2007). Group decision making under conditions of distributed knowledge: The information asymmetries model. *Academy of Management Review*, *32*(2), 459-479. doi:10.5465/amr.2007.24351441

Bunderson, J. S. (2003). Team member functional background and involvement in management teams: Direct effects and the moderating role of power centralization. *Academy of Management journal*, *46*(4), 458-474. doi:10.5465/30040638

Bunderson, J. S., & Boumgarden, P. (2010). Structure and learning in self-managed teams: Why "bureaucratic" teams can be better learners. *Organization Science*, *21*(3), 609-624. doi:10.1287/orsc.1090.0483

Bunderson, J. S., & Sutcliffe, K. M. (2002). Comparing alternative conceptualizations of functional diversity in management teams: Process and performance effects. *Academy of Management Journal*, *45*(5), 875-893. doi:10.5465/3069319

Cabrera, E. F., & Cabrera, A. (2005). Fostering knowledge sharing through people management practices. *The International Journal of Human Resource Management*, *16*(5), 720-735. doi:10.1080/09585190500083020

Campion, M. A., Medsker, G. J., & Higgs, A. C. (1993). Relations between work group characteristics and effectiveness: Implications for designing effective work groups. *Personnel Psychology*, *46*(4), 823-847. doi:10.1111/j.1744-6570.1993.tb01571.x

Carmeli, A., Tishler, A., & Edmondson, A. C. (2012). CEO relational leadership and strategic decision quality in top management teams: The role of team trust and learning from failure. *Strategic Organization*, *10*(1), 31-54. doi:10.1177/1476127011434797

Chang, A., & Bordia, P. (2001). A multidimensional approach to the group cohesion-group performance relationship. *Small Group Research*, *32*(4), 379-405. doi:10.1177/104649640103200401

Chui, M., Manyika, J., & Miremadi, M. (2016, July). Where machines could replace humans – and where they can't (yet). *McKinsey Quarterly*. Retrieved from https://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/where-machines-could-replace-humans-and-where-they-cant-yet

Cockburn, A. (2006). *Agile software development: The cooperative game* (2nd ed.). Upper Saddle River, N.J.: Addison Wesley Professional.

Cohen, S. G., & Bailey, D. E. (1997). What makes teams work: Group effectiveness research from the shop floor to the executive suite. *Journal of Management*, *23*(3), 239-290. doi:10.1177/014920639702300303

Cohen, S. G., & Ledford Jr., G. E. (1994). The effectiveness of self-managing teams: A quasi-experiment. *Human Relations*, *47*(1), 13-43. doi:10.1177/001872679404700102

Cohen, S. G., Ledford Jr., G. E., & Spreitzer, G. M. (1996). A predictive model of self-managing work team effectiveness. *Human Relations*, *49*(5), 643-676. doi:10.1177/001872679604900506

Cruz, M. G., Henningsen, D. D., & Smith, B. A. (1999). The impact of directive leadership on group information sampling, decisions, and perceptions of the leader. *Communication Research*, *26*(3), 349-369. doi:10.1177/009365099026003004

Cummings, T. G. (1978). Self-regulating work groups: A socio-technical synthesis. *Academy of Management Review, 3*(3), 625-634. doi:10.5465/amr.1978.4305900

Curral, L. A., Forrester, R. H., Dawson, J. F., & West, M. A. (2001). It's what you do and the way that you do it: Team task, team size, and innovation-related group processes. *European Journal of Work and Organizational Psychology*, *10*(2), 187-204. doi:10.1080/13594320143000627

Curran, P. J., West, S. G., & Finch, J. F. (1996). The robustness of test statistics to nonnormality and specification error in confirmatory factor analysis. *Psychological Methods, 1*(1), 16-29. doi:10.1037/1082-989X.1.1.16

Davenport, T. H., & Prusak, L. (1998). *Working knowledge: How organizations manage what they know*. Boston, MA: Harvard Business School Press.

DeChurch, L. A., & Mesmer-Magnus, J. R. (2010). The cognitive underpinnings of effective teamwork: A meta-analysis. *Journal of Applied Psychology, 95*(1), 32-53. doi:10.1037/a0017328

Deci, E. L., Eghrari, H., Patrick, B. C., & Leone, D. R. (1994). Facilitating internalization: The self-determination theory perspective. *Journal of personality*, *62*(1), 119-142. doi:10.1111/j.1467-6494.1994.tb00797.x

De Dreu, C. K. W. (2007). Cooperative outcome interdependence, task reflexivity, and team effectiveness: A motivated information processing perspective. *Journal of Applied Psychology, 92*(3), 628-638. doi:10.1037/0021-9010.92.3.628

De Dreu, C. K. W., Nijstad, B. A., & Van Knippenberg, D. (2008). Motivated information processing in group judgment and decision making. *Personality and Social Psychology Review*, *12*(1), 22-49. doi:10.1177/1088868307304092

De Dreu, C. K. W., & West, M. A. (2001). Minority dissent and team innovation: The importance of participation in decision making. *Journal of Applied Psychology, 86*(6), 1191-1201. doi:10.1037/0021-9010.86.6.1191

de Jong, A., de Ruyter, K., & Wetzels, M. (2006). Linking Employee Confidence to Performance: A Study of Self-Managing Service Teams. *Journal of the Academy of Marketing Science*, *34*(4), 576–587. doi:10.1177/0092070306287126

Delarue, A., Van Hootegem, G., Procter, S., & Burridge, M. (2008). Teamworking and organizational performance: A review of survey-based research. *International Journal of Management Reviews*, *10*(2), 127-148. doi:10.1111/j.1468-2370.2007.00227.x

Dess, G. G., & Robinson Jr., R. B. (1984). Measuring organizational performance in the absence of objective measures: The case of the privately-held firm and conglomerate business unit. *Strategic Management Journal*, *5*(3), 265-273. doi:10.1002/smj.4250050306

Deutsch, M. (1949). A theory of cooperation and competition. *Human Relations*, *2*(2), 129-152. doi:10.1177/001872674900200204

DeVaro, J. (2006). Teams, autonomy, and the financial performance of firms. *Industrial Relations*, *45*(2), 217-269. doi:10.1111/j.1468-232X.2006.00425.x

Devine, D. J., Clayton, L. D., Philips, J. L., Dunford, B. B., & Melner, S. B. (1999). Teams in organizations: Prevalence, characteristics, and effectiveness. *Small Group Research*, *30*(6), 678-711. doi:10.1177/104649649903000602

Diefenbach, T., & Sillince, J. A. (2011). Formal and informal hierarchy in different types of organization. *Organization Studies, 32*(11), 1515-1537. doi:10.1177/0170840611421254

Dodou, D., & de Winter, J. C. (2014). Social desirability is the same in offline, online, and paper surveys: A meta-analysis. *Computers in Human Behavior*, *36*, 487-495. doi:10.1016/j.chb.2014.04.005

Douglas, C., & Gardner, W. L. (2004). Transition to self-directed work teams: Implications of transition time and self-monitoring for managers' use of influence tactics. *Journal of Organizational Behavior, 25*(1), 47-65. doi:10.1002/job.244

Drucker, P. F. (1973). *Management: Tasks, responsibilities, practices*. New York, NY: Harper & Row.

Drucker, P. F. (1980). *Managing in turbulent times*. London: Heinemann.

Drucker, P. F. (1992, September - October). The new society of organizations. *Harvard Business Review*. Retrieved from https://hbr.org/1992/09/the-new-society-of-organizations

Druskat, V. U., & Wheeler, J. V. (2003). Managing from the boundary: The effective leadership of self-managing work teams. *Academy of Management Journal, 46*(4), 435-457. doi:10.5465/30040637

Eagly, A. H., & Karau, S. J. (1991). Gender and the emergence of leaders: A meta-analysis. *Journal of Personality and Social Psychology, 60*(5), 685-710. doi:10.1037/0022-3514.60.5.685

Edmunds, A., & Morris, A. (2000). The problem of information overload in business organisations: A review of the literature. *International Journal of Information Management, 20*(1), 17-28. doi:10.1016/S0268-4012(99)00051-1

Edwards, J. R., & Lambert, L. S. (2007). Methods for integrating moderation and mediation: A general analytical framework using moderated path analysis. *Psychological Methods,* 12*(1)*, 1-22. doi:10.1037/1082-989X.12.1.1

Engelmann, T., & Hesse, F. W. (2011). Fostering sharing of unshared knowledge by having access to the collaborators' meta-knowledge structures. *Computers in Human Behavior*, *27*(6), 2078-2087. doi:10.1016/j.chb.2011.06.002

Eppler, M. J., & Mengis, J. (2004). The concept of information overload: A review of literature from organization science, accounting, marketing, MIS, and related disciplines. *The Information Society*, *20*(5), 325-344. doi:10.1080/01972240490507974

Esser, J. K. (1998). Alive and well after 25 years: A review of groupthink research. *Organizational Behavior and Human Decision Processes*, *73*(2-3), 116-141. doi:10.1006/obhd.1998.2758

Faraj, S., & Sproull, L. (2000). Coordinating expertise in software development teams. *Management Science*, *46*(12), 1554-1568. doi:10.1287/mnsc.46.12.1554.12072

Faulmüller, N., Kerschreiter, R., Mojzisch, A., & Schulz-Hardt, S. (2010). Beyond group-level explanations for the failure of groups to solve hidden profiles: The individual preference effect revisited. *Group Processes & Intergroup Relations*, *13*(5), 653-671. doi:10.1177/1368430210369143

Fischer, P., Greitemeyer, T., & Frey, D. (2008). Self-regulation and selective exposure: The impact of depleted self-regulation resources on confirmatory information processing. *Journal of Personality and Social Psychology*, *94*(3), 382-395. doi:10.1037/0022-3514.94.3.382

Fisher, R. J. (1993). Social desirability bias and the validity of indirect questioning. *Journal of Consumer Research*, *20*(2), 303-315. doi:10.1086/209351

Fiske, A. P. (1992). The four elementary forms of sociality: Framework for a unified theory of social relations. *Psychological Review, 99*(4), 689-723. doi:10.1037/0033-295X.99.4.689

Foster, R., & Kaplan, S. (2001). *Creative destruction: Why companies that are built to last underperform the market – and how to successfully transform them.* New York, NY: Currency/Doubleday.

Fredendall, L., & Emery, C. (2003). Productivity increases due to the use of teams in service garages. *Journal of Managerial Issues, 15*(2), 221-242. Retrieved from http://www.jstor.org/stable/40604427

Friesen, J. P., Kay, A. C., Eibach, R. P., & Galinsky, A. D. (2014). Seeking structure in social organization: Compensatory control and the psychological advantages of hierarchy. *Journal of Personality and Social Psychology, 106*(4), 590-609. doi:10.1037/a0035620

Gonzalez-Mulé, E., Courtright, S. H., DeGeest, D., Seong, J.-Y., & Hong, D.-S. (2016). Channeled autonomy: The joint effects of autonomy and feedback on team performance through organizational goal clarity. *Journal of Management*, *42*(7), 2018-2033. doi:10.1177/0149206314535443

Goodman, P. S., Devadas, R., & Hughson, T. L. (1988). Groups and productivity: Analyzing the effectiveness of self-managing teams. In J. P. Campbell & R. J. Campbell (Eds.), *Productivity in organizations* (pp. 295-327). San Francisco, CA: Jossey-Bass.

Greer, L. L., Caruso, H. M., & Jehn, K. A. (2011). The bigger they are, the harder they fall: Linking team power, team conflict, and performance. *Organizational Behavior and Human Decision Processes*, *116*(1), 116-128. doi:10.1016/j.obhdp.2011.03.005

Greer, L. L., & van Kleef, G. A. (2010). Equality versus differentiation: The effects of power dispersion on group interaction. *Journal of Applied Psychology, 95*(6), 1032-1044. doi:10.1037/a0020373

Gruenfeld, D. H., & Tiedens, L. (2010). Organizational preferences and their consequences. In S. T. Fiske, D. T. Gilbert, & G. Lindzey (Eds.), *Handbook of social psychology* (5th ed., Vol. 2, pp. 1252-1287). Hoboken, NJ: John Wiley & Sons.

Guzzo, R. A., & Dickson, M. W. (1996). Teams in organizations: Recent research on performance and effectiveness. *Annual Review of Psychology*, *47*(1), 307-338. doi:10.1146/annurev.psych.47.1.307

Guzzo, R. A., & Salas, E. (Eds.). (1995). *Team effectiveness and decision making in organizations* (1st ed.). San Francisco, CA: Jossey-Bass.

Hackman, J. R. (1987). The design of work teams. In J. W. Lorsch (Ed.), *Handbook of Organizational Behavior* (pp. 315-342). Englewood Cliffs, NJ: Prentice-Hall.

Hackman, J. R., & Oldham, G.R. (1980). Work redesign. Reading, MA: Addison-Wesley.

Haines, E. L., & Jost, J. T. (2000). Placating the powerless: Effects of legitimate and illegitimate explanation on affect, memory, and stereotyping. *Social Justice Research, 13*(3), 219-236. doi:10.1023/A:1026481205719

Halevy, N., Y. Chou, E., & D. Galinsky, A. (2011). A functional model of hierarchy: Why, how, and when vertical differentiation enhances group performance. *Organizational Psychology Review*, *1*(1), 32-52. doi:10.1177/2041386610380991

Hall, R. H., & Tolbert, P. S. (2005). Organizations: Structures, processes, and outcomes (8th ed.). Upper Saddle River, NJ: Prentice Hall.

Hammerstein, P., & Stevens, J. R. (Eds.). (2012). *Evolution and the mechanisms of decision making*. Cambridge, MA: MIT Press.

Harrison, D. A., & Klein, K. J. (2007). What's the difference? Diversity constructs as separation, variety, or disparity in organizations. *The Academy of Management Review, 32*(4), 1199-1228. doi:10.5465/amr.2007.26586096

Hayes, A. F. (2015). An index and test of linear moderated mediation. *Multivariate Behavioral Research, 50(1)*, 1-22. doi:10.1080/00273171.2014.962683

Hayes, A. F., & Scharkow, M. (2013). The relative trustworthiness of inferential tests of the indirect effect in statistical mediation analysis: Does method really matter? *Psychological Science*, *24*(10), 1918-1927. doi:10.1177/0956797613480187

Henningsen, D. D., Henningsen, M. L. M., Jakobsen, L., & Borton, I. (2004). It's good to be leader: The influence of randomly and systematically selected leaders on decision-making groups. *Group Dynamics: Theory, Research, and Practice*, *8*(1), 62-76. doi:10.1037/1089-2699.8.1.62

Heylighen, F. (2001). The science of self-organization and adaptivity. *The Encyclopedia of Life Support Systems, EOLSS*. Retrieved from http://books.google.com

Hinsz, V. B., Tindale, R. S., & Vollrath, D. A. (1997). The emerging conceptualization of groups as information processors. *Psychological Bulletin*, *121*(1), 43-64. doi:10.1037/0033-2909.121.1.43

Hollenbeck, J. R., Ilgen, D. R., Sego, D. J., Hedlund, J., Major, D. A., & Phillips, J. (1995). Multilevel theory of team decision making: Decision performance in teams incorporating distributed expertise. *Journal of Applied Psychology*, *80*(2), 292-316. doi:10.1037/0021-9010.80.2.292

Hsu, J. S. C., Shih, S. P., Chiang, J. C., & Liu, J. Y. C. (2012). The impact of transactive memory systems on IS development teams' coordination, communication, and performance. *International Journal of Project Management*, *30*(3), 329-340. doi:10.1016/j.ijproman.2011.08.003

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1)*,* 1-55. doi:10.1080/10705519909540118

Huber, G. P. (2001). Transfer of knowledge in knowledge management systems: Unexplored issues and suggested studies. *European Journal of Information Systems*, *10*(2), 72-79. doi:10.1057/palgrave.ejis.3000399

Humphrey, S. E., Morgeson, F. P., & Mannor, M. J. (2009). Developing a theory of the strategic core of teams: A role composition model of team performance. *Journal of Applied Psychology, 94*(1), 48-61. doi:10.1037/a0012997

Ilgen, D. R., Hollenbeck, J. R., Johnson, M., & Jundt, D. (2005). Teams in organizations: From input-process-output models to IMOI models. *Annual Review of Psychology*, *56*, 517-543. doi:10.1146/annurev.psych.56.091103.070250

Imai, K., Keele, L., & Tingley, D. (2010). A general approach to causal mediation analysis. *Psychological Methods*, *15*(4), 309-334. doi:10.1037/a0020761

Ipe, M. (2003). Knowledge sharing in organizations: A conceptual framework. *Human Resource Development Review*, *2*(4), 337-359. doi:10.1177/1534484303257985

Ivancevich, J. M., & Donnelly, J. H., Jr. (1975). Relation of organizational structure to job satisfaction, anxiety-stress, and performance. *Administrative Science Quarterly, 20*(2), 272-280. doi:10.2307/2391699

Jackson, S. E., Chuang, C. -H., Harden, E. E., Jiang, Y., & Joseph, J. M. (2006). Toward developing human resource management systems for knowledge-intensive teamwork. In J. M. Joseph (Series Ed.), *Research in Personnel and Human Resources Management:* Vol. 25. (pp. 27-70). Bingley, UK: Emerald Group Publishing Limited. doi:10.1016/S0742-7301(06)25002-3

Janis, I. L. (1972). *Victims of groupthink.* Boston, MA: Houghton Mifflin.

Janis, I. L. (1982). *Groupthink: Psychological studies of policy decisions and fiascos.* Boston, MA: Houghton Mifflin.

Janssen, O., Van De Vliert, E., & Veenstra, C. (1999). How task and person conflict shape the role of positive interdependence in management teams. *Journal of Management*, *25*(2), 117-141. doi:10.1177/014920639902500201

Janz, B. D., Colquitt, J. A., & Noe, R. A. 1997. Knowledge worker team effectiveness: The role of autonomy, interdependence, team development, and contextual support variables. *Personnel Psychology*, *50*(4), 877-904. doi:10.1111/j.1744-6570.1997.tb01486.x

Johnson, M. D., Hollenbeck, J. R., DeRue, D. S., Barnes, C. M., & Jundt, D. (2013). Functional versus dysfunctional team change: Problem diagnosis and structural feedback for self-managed teams. *Organizational Behavior and Human Decision Processes*, *122*(1), 1-11. doi:10.1016/j.obhdp.2013.03.006

Joinson, A. (1999). Social desirability, anonymity, and Internet-based questionnaires. *Behavior Research Methods, Instruments, & Computers*, *31*(3), 433-438. doi:10.3758/BF03200723

Jost, J. T., Banaji, M. R., & Nosek, B. A. (2004). A decade of system justification theory: Accumulated evidence of conscious and unconscious bolstering of the status quo. *Political Psychology*, *25*(6), 881-920. doi:10.1111/j.1467-9221.2004.00402.x

Kabanoff, B., & O'Brien, G. E. (1979). The effects of task type and cooperation upon group products and performance. *Organizational Behavior and Human Performance*, *23*(2), 163-181. doi:10.1016/0030-5073(79)90054-0

Kalish, Y., & Luria, G. (2016). Leadership emergence over time in short-lived groups: Integrating expectations states theory with temporal person-perception and self-serving bias. *Journal of Applied Psychology, 101*(10), 1474-1486. doi:10.1037/apl0000126

Kanawattanachai, P., & Yoo, Y. (2007). The impact of knowledge coordination on virtual team performance over time. *MIS Quarterly*, *31*(4). doi:10.2307/25148820

Katzenbach, J. R., & Smith, D. K. (1993). *The wisdom of teams: Creating the high-performance organization.* Cambridge, MA: Harvard Business School Press.

Kauffman, S. A. (1993). *The origins of order: Self-organization and selection in evolution*. New York, NY: Oxford University Press.

Kellermanns, F. W., Floyd, S. W., Pearson, A. W., & Spencer, B. (2008). The contingent effect of constructive confrontation on the relationship between shared mental models and decision quality. *Journal of Organizational Behavior, 29*(1), 119-137. doi:10.1002/job.497

Kelly, J. R., & Karau, S. J. (1999). Group decision making: The effects of initial preferences and time pressure. *Personality and Social Psychology Bulletin*, *25*(11), 1342-1354. doi:10.1177/0146167299259002

Kerr, N. L., & Tindale, R. S. (2004). Group performance and decision making. *Annual Review of Psychology, 55,* 623-655. doi:10.1146/annurev.psych.55.090902.142009

Kim, K. Y., Atwater, L., Patel, P. C., & Smither, J. W. (2016). Multisource feedback, human capital, and the financial performance of organizations. *Journal of Applied Psychology*, *101*(11), 1569-1584. doi:10.1037/apl0000125

Kirkman, B. L., & Shapiro, D. L. (2001). The impact of team members' cultural values on productivity, cooperation, and empowerment in self-managing work teams. *Journal of Cross-Cultural Psychology*, *32*(5), 597-617. doi:10.1177/0022022101032005005

Kline, R. B. (2016). *Principles and practice of structural equation modeling* (4th ed.). New York, NY: The Guilford Press.

Kohlhoff, J. (2017). Smart machines. *Europäische Sicherheit & Technik*, *66*(2), 45. Retrieved from http://publica.fraunhofer.de/documents/N-435144.html

Komlosy, A. (2014). *Arbeit. Eine globalhistorische Perspektive. 13. bis 21. Jahrhundert.* Wien: Promedia.

Kozlowski, S. W. J., & Bell, B. S. (2003). Work groups and teams in organizations. In W. C. Borman, D. R. Ilgen, & R. J. Klimoski (Eds.), *Handbook of psychology: Vol. 12. Industrial and organizational psychology* (pp. 333-375). London: Wiley.

Kozlowski, S. W. J., & Ilgen, D. R. (2006). Enhancing the effectiveness of work groups and teams. *Psychological Science in the Public Interest*, *7*(3), 77-124. doi:10.1111/j.1529-1006.2006.00030.x

Kray, L. J., & Galinsky, A. D. (2003). The debiasing effect of counterfactual mind-sets: Increasing the search for disconfirmatory information in group decisions. *Organizational Behavior and Human Decision Processes*, *91*(1), 69-81. doi:10.1016/S0749-5978(02)00534-4

Kriz, J. (1999). *Systemtheorie für Psychotherapeuten, Psychologen und Mediziner: Eine Einführung*. Wien: Facultas Universitätsverlag.

Lammers, J., & Galinsky, A. D. (2009). The conceptualization of power and the nature of interdependency: The role of legitimacy and culture. In D. Tjosvold & B. Wisse (Eds.), *Power and interdependence in organizations* (pp. 67-82). Cambridge, UK: Cambridge University Press.

Lanaj, K., & Hollenbeck, J. R. (2015). Leadership over-emergence in self-managing teams: The role of gender and countervailing biases. *Academy of Management Journal*, *58*(5), 1476-1494. doi:10.5465/amj.2013.0303

Langfred, C. W. (2005). Autonomy and performance in teams: The multilevel moderating effect of task interdependence. *Journal of Management*, *31*(4), 513-529. doi:10.1177/0149206304272190

Larson, J. R., Christensen, C., Abbott, A. S., & Franz, T. M. (1996). Diagnosing groups: Charting the flow of information in medical decision-making teams. *Journal of Personality and Social Psychology*, *71*(2), 315-330. doi:10.1037//0022-3514.71.2.315

Larson, J. R., Christensen, C., Franz, T. M., & Abbott, A. S. (1998). Diagnosing groups: The pooling, management, and impact of shared and unshared case information in team-based medical decision making. *Journal of Personality and Social Psychology*, *75*(1), 93-108. doi:10.1037/0022-3514.75.1.93

Lawler, E. E., III, Mohrman, S. A., & Ledford, G. E. (1995). *Creating high performance organizations: Practices and results of employee involvement and total quality management in Fortune 1000 companies*. San Francisco, CA: Jossey-Bass.

Lee, C., Huang, G. H., & Ashford, S. J. (2018). Job insecurity and the changing workplace: Recent developments and the future trends in job insecurity research. *Annual Review of Organizational Psychology and Organizational Behavior*, *5*, 335-359. doi:10.1146/annurev-orgpsych-032117-104651

Lee, P., Gillespie, N., Mann, L., & Wearing, A. (2010). Leadership and trust: Their effect on knowledge sharing and team performance. *Management Learning*, *41*(4), 473-491. doi:10.1177/1350507610362036k

LePine, J. A., Piccolo, R. F., Jackson, C. L., Mathieu, J. E., & Saul, J. R. (2008). A meta-analysis of teamwork processes: Tests of a multidimensional model and relationships with team effectiveness criteria. *Personnel Psychology*, *61*(2), 273-307. doi:10.1111/j.1744-6570.2008.00114.x

Lewis, K. (2003). Measuring transactive memory systems in the field: Scale development and validation. *Journal of Applied Psychology*, *88*(4), 587-603. doi:10.1037/0021-9010.88.4.587

Lewis, K., & Herndon, B. (2011). Transactive memory systems: Current issues and future research directions. *Organization Science*, *22*(5), 1254-1265. doi:10.1287/orsc.1110.0647

Lewis, K., Lange, D., & Gillis, L. (2005). Transactive memory systems, learning, and learning transfer. *Organization Science*, *16*(6), 581-598. doi:10.1287/orsc.1050.0143

Liang, D. W., Moreland, R., & Argote, L. (1995). Group versus individual training and group performance: The mediating role of transactive memory. *Personality and Social Psychology Bulletin*, *21*(4), 384-393. doi:10.1177/0146167295214009

Libby, R., Trotman, K. T., & Zimmer, I. (1987). Member variation, recognition of expertise, and group performance. *Journal of Applied Psychology, 72*(1), 81-87. doi:10.1037/0021-9010.72.1.81

Lin, H. C., & Rababah, N. (2014). CEO–TMT exchange, TMT personality composition, and decision quality: The mediating role of TMT psychological empowerment. *The Leadership Quarterly*, *25*(5), 943-957. doi:10.1016/j.leaqua.2014.06.005

Littlepage, G. E., & Silbiger, H. (1992). Recognition of expertise in decision-making groups: Effects of group size and participation patterns. *Small Group Research*, *23*(3), 344-355. doi:10.1177/1046496492233005

Magee, J. C., & Galinsky, A. D. (2008). Social hierarchy: The self-reinforcing nature of power and status. *Academy of Management Annals*, *2*(1), 351-398. doi:10.5465/19416520802211628

Magpili, N. C., & Pazos, P. (2018). Self-managing team performance: A systematic review of multilevel input factors. *Small Group Research*, *49*(1), 3-33. doi:10.1177/1046496417710500

Manz, C. C. (1992). Self-leading work teams: Moving beyond self-management myths. *Human Relations, 45*(11), 1119-1140. doi:10.1177/001872679204501101

Manz, C. C., & Sims, H. (2001). *The new superleadership: Leading others to lead themselves.* San Francisco, CA: Berrett-Koehler Publishers.

Manz, C. C., & Stewart, G. L. (1997). Attaining flexible stability by integrating total quality management and socio-technical systems theory. *Organization Science*, *8*(1), 59-70. doi:10.1287/orsc.8.1.59

Martorana, P. V., Galinsky, A. D., & Rao, H. (2005). From system justification to system condemnation: Antecedents of attempts to change status hierarchies. In M. A. Neale, E. A., Mannix, & M. Thomas-Hunt (Eds.), *Research on Managing Groups and Teams: Status* (Vol. 7, pp. 283-313). Greenwich, CT: JAI Press.

Mathieu, J. E., Heffner, T. S., Goodwin, G. F., Salas, E., & Cannon-Bowers, J. A. (2000). The influence of shared mental models on team process and performance. *Journal of Applied Psychology*, *85*(2), 273-283. doi:10.1037/0021-9010.85.2.273.

Mathieu, J., Maynard, M. T., Rapp, T., & Gilson, L. (2008). Team effectiveness 1997-2007: A review of recent advancements and a glimpse into the future. *Journal of Management*, *34*(3), 410-476. doi:10.1177/0149206308316061

McEvily, B., Soda, G., & Tortoriello, M. (2014). More formally: Rediscovering the missing link between formal organization and informal social structure. *Academy of Management Annals*, *8*(1), 299-345. doi:10.5465/19416520.2014.885252

McGrath, J. E. (1964). *Social psychology: A brief introduction*. New York, NY: Holt, Rinehart & Winston.

McGrath, J. E. (1984). *Groups: Interaction and performance*. Englewood Cliffs, NJ: Prentice-Hall.

McGrath, J. E., Arrow, H., & Berdahl, J. L. (2000). The study of groups: Past, present, and future. *Personality and Social Psychology Review*, *4*(1), 95-105. doi:10.1207/S15327957PSPR0401_8

Mesmer-Magnus, J. R., & DeChurch, L. A. (2009). Information sharing and team performance: A meta-analysis. *Journal of Applied Psychology, 94*(2), 535-546. doi:10.1037/a0013773

Mohammed, S., & Dumville, B. C. (2001). Team mental models in a team knowledge framework. *Journal of Organizational Behavior, 22*(2), 89-106. doi:10.1002/job.86

Mone, M. A., Mueller, G. C., & Mauland, W. (1996). The perceptions and usage of statistical power in applied psychology and management research. *Personnel Psychology*, *49*(1), 103-120. doi:10.1111/j.1744-6570.1996.tb01793.x

Moore, G. (1998). Cramming more components onto integrated circuits. *Proceedings of the IEEE*, *86*(1), 82-85. doi:10.1109/JPROC.1998.658762

Moreland, R. L. (2006). Transactive memory: Learning who knows what in work groups and organizations. In J. M. Levine & R. R. Moreland (Eds.), *Small groups: Key readings in social psychology* (pp. 327-346). New York, NY: Psychology Press.

Moreland, R. L., Argote, L., & Krishnan, R. (1996). Socially shared cognition at work: Transactive memory and group performance. In J. L. Nye & A. M. Brower (Eds.), *What's social about social cognition?* (pp. 57-85). Thousand Oaks, CA: Sage.

Morgeson, F. P. (2005). The external leadership of self-managing teams: Intervening in the context of novel and disruptive events. *Journal of Applied Psychology, 90*(3), 497-508. doi:10.1037/0021-9010.90.3.497

Moscovici, S., & Doise, W. (1994). *Conflict and consensus: A general theory of collective decisions.* London: Sage.

Moye, N. A., & Langfred, C. W. (2004). Information sharing and group conflict: Going beyond decision making to understand the effects of information sharing on group performance. *International Journal of Conflict Management*, *15*(4), 381-410. doi:10.1108/eb022919

Muthén, L. K., & Muthén, B. O. (2002). How to use a Monte Carlo study to decide on sample size and determine power. *Structural Equation Modeling*, *9*(4), 599-620. doi:10.1207/S15328007SEM0904_8

Muthusamy, S. K., Wheeler, J. V., & Simmons, B. L. (2005). Self-managing work teams: Enhancing organizational innovativeness. *Organization Development Journal*, *23*(3), 53-66. Retrieved from https://ssrn.com/abstract=687892

Nahapiet, J., & Ghoshal, S. (1998). Social capital, intellectual capital and the organizational advantage. *Academy of Management Review, 23*(2), 242-266. doi:10.5465/amr.1998.533225

Nevicka, B., Ten Velden, F. S., De Hoogh, A. H., & Van Vianen, A. E. (2011). Reality at odds with perceptions: Narcissistic leaders and group performance. *Psychological Science*, *22*(10), 1259-1264. doi:10.1177/0956797611417259

Nonaka, I., & Konno, N. (1998). The concept of "Ba": Building a foundation for knowledge creation. *California Management Review*, *40*(3), 40-54. doi:10.2307/41165942

Olson, B. J., Parayitam, S., & Bao, Y. (2007). Strategic decision making: The effects of cognitive diversity, conflict, and trust on decision outcomes. *Journal of Management*, *33*(2), 196-222. doi:10.1177/0149206306298657

Ouchi, W. G. (2006). Power to the principals: Decentralization in three large school districts. *Organization Science, 17*(2), 298-307. doi:10.1287/orsc.1050.0172

Park, W. W. (1990). A review of research on groupthink. *Journal of Behavioral Decision Making*, *3*(4), 229-245. doi:10.1002/bdm.3960030402

Parker, S. K., Morgeson, F. P., & Johns, G. (2017). One hundred years of work design research: Looking back and looking forward. *Journal of Applied Psychology, 102*(3), 403-420. doi:10.1037/apl0000106

Pasmore, W., Francis, C., Haldeman, J., & Shani, A. (1982). Sociotechnical systems: A North American reflection on empirical studies of the seventies. *Human Relations, 35*(12), 1179-1204. doi:10.1177/001872678203501207

Pearce, C. L., & Conger, J. A. (2003). *Shared leadership: Reframing the hows and whys of leadership.* Thousand Oaks, CA: Sage.

Pearson, C. A. L. (1992). Autonomous workgroups: An evaluation at an industrial site. *Human Relations*, *45*(9), 905-936. doi:10.1177/001872679204500903

Podsakoff, P. M., MacKenzie, S. B., Lee, J.-Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879-903. doi:10.1037/0021-9010.88.5.879

Polanyi, M. (1958). *Personal knowledge: Towards a post-critical philosophy*. London: Routledge & Kegan Paul.

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers*, *36*(4), 717-731. doi:10.3758/BF03206553

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*(3), 879-891. doi:10.3758/BRM.40.3.879

Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral Research*, *42*(1), 185-227. doi:10.1080/00273170701341316

Preacher, K. J., Zyphur, M. J., & Zhang, Z. (2010). A general multilevel SEM framework for assessing multilevel mediation. *Psychological Methods, 15*(3), 209-233. doi:10.1037/a0020141

Price, D. J. D. (1965). Networks of scientific papers. *Science, 149*(3683), 510-515. Retrieved from http://www.jstor.org/stable/1716232

R Core Team. (2018). *R: A language and environment for statistical computing.* R Foundation for Statistical Computing, Vienna, Austria. Retrieved from https://www.R-project.org/

Rink, F., & Ellemers, N. (2010). Benefiting from deep-level diversity: How congruence between knowledge and decision rules improves team decision making and team perceptions. *Group Processes & Intergroup Relations*, *13*(3), 345-359. doi:10.1177/1368430209344866

Robertson, B. J. (2015). *Holacracy: The new management system for a rapidly changing world*. New York, NY: Henry Holt and Company.

Rosseel, Y. (2012). lavaan: An R package for structural equation modeling. *Journal of Statistical Software, 48*(2), 1-36. doi:10.18637/jss.v048.i02

Ruggles, R. (1998). The state of the notion: Knowledge management in practice. *California Management Review*, *40*(3), 80-89. doi:10.2307/41165944

Ryan, R. M. (1982). Control and information in the intrapersonal sphere: An extension of cognitive evaluation theory. *Journal of Personality and Social Psychology*, *43*, 450-461. doi:10.1037/0022-3514.43.3.450

Salas, E., Priest, H. A., Stagl, K. C., Sims, D., & Burke, S. (2007). Work teams in organizations: A historical reflection and lessons learned. In L. L. Koppes (Ed.), *Historical perspectives in industrial and organizational psychology* (pp. 407-438). Mahwah, NJ: Lawrence Erlbaum Associates.

Sanna, L. J., & Parks, C. D. (1997). Group research trends in social and organizational psychology: Whatever happened to intragroup research? *Psychological Science*, *8*(4), 261-267. doi:10.1111/j.1467-9280.1997.tb00436.x

Schulz-Hardt, S., Brodbeck, F. C., Mojzisch, A., Kerschreiter, R., & Frey, D. (2006). Group decision making in hidden profile situations: Dissent as a facilitator for decision quality. *Journal of Personality and Social Psychology*, *91*(6), 1080-1093. doi:10.1037/0022-3514.91.6.1080

Schulz-Hardt, S., Frey, D., Lüthgens, C., & Moscovici, S. (2000). Biased information search in group decision making. *Journal of Personality and Social Psychology, 78*(4), 655-669. doi:10.1037/0022-3514.78.4.655

Schwaber, K., & Beedle, M. (2002). *Agile software development with Scrum*. Upper Saddle River, N.J.: Prentice Hall.

Seibert, S. E., Wang, G., & Courtright, S. H. (2011). Antecedents and consequences of psychological and team empowerment in organizations: A meta-analytic review. *Journal of Applied Psychology, 96*(5), 981-1003. doi:10.1037/a0022676

Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods, 7*(4), 422-445. doi:10.1037/1082-989X.7.4.422

Sidanius, J., & Pratto, F. (2001). *Social dominance orientation: A theory of intergroup of hierarchy and oppression.* New York, NY: Cambridge University Press.

Siegel, J. J., & Schwartz, J. D. (2006). Long-term returns on the original S&P 500 companies. *Financial Analysts Journal*, *62*(1), 18-31. doi:10.2469/faj.v62.n1.4055v

Siegel, P. A., & Hambrick, D. C. (2005). Pay disparities within top management groups: Evidence of harmful effects on performance of high-technology firms. *Organization Science, 16*(3), 259-274. doi:10.1287/orsc.1050.0128

Sohrab, S. G., Waller, M. J., & Kaplan, S. (2015). Exploring the hidden-profile paradigm: A literature review and analysis. *Small Group Research*, *46*(5), 489-535. doi:10.1177/1046496415599068

Spender, J. C., & Grant, R. M. (1996). Knowledge and the firm: Overview. *Strategic Management Journal, 17*(S2), 5-9. doi:10.1002/smj.4250171103

Srivastava, A., Bartol, K. M., & Locke, E. A. (2006). Empowering leadership in management teams: Effects on knowledge sharing, efficacy, and performance. *Academy of Management Journal, 49*(6), 1239-1251. doi:10.5465/amj.2006.23478718

Stasser, G. (1992). Pooling of unshared information during group discussion. In S. Worchel, W. Wood, & J. Simpson (Eds.), *Group process and productivity* (pp. 48-57). Newbury Park, CA: Sage.

Stasser, G., Stewart, D. D., & Wittenbaum, G. M. (1995). Expert roles and information exchange during discussion: The importance of knowing who knows what. *Journal of experimental social psychology*, *31*(3), 244-265. doi:10.1006/jesp.1995.1012

Stasser, G., & Titus, W. (1985). Pooling of unshared information in group decision making: Biased information sampling during discussion. *Journal of Personality and Social Psychology, 48,* 1467-1478. doi:10.1037/0022-3514.48.6.1467

Stasser, G., Vaughan, S. I., & Stewart, D. D. (2000). Pooling unshared information: The benefits of knowing how access to information is distributed among group members. *Organizational Behavior and Human Decision Processes*, *82*(1), 102-116. doi:10.1006/obhd.2000.2890

Stephens, J. P., & Lyddy, C. J. (2016). Operationalizing heedful interrelating: How attending, responding, and feeling comprise coordinating and predict performance in self-managing teams. *Frontiers in Psychology*, *7*, 362. doi:10.3389/fpsyg.2016.00362

Stewart, G. L., & Barrick, M. R. (2000). Team structure and performance: Assessing the mediating role of intrateam process and the moderating role of task type. *Academy of Management Journal*, *43*(2), 135-148. doi:10.5465/1556372

Stewart, G. L., Courtright, S. H., & Barrick, M. R. (2012). Peer-based control in self-managing teams: Linking rational and normative influence with individual and group performance. *Journal of Applied Psychology, 97*(2), 435-447. doi:10.1037/a0025303

Stewart, G. L., Courtright, S. H., & Manz, C. C. (2011). Self-leadership: A multilevel review. *Journal of Management*, *37*(1), 185-222. doi:10.1177/0149206310383911

Stewart, T. A. (1997). *Intellectual capital: The new wealth of organizations.* New York, NY: Currency/Doubleday.

Stone, A. A., Bachrach, C. A., Jobe, J. B., Kurtzman, H. S., & Cain, V. S. (Eds.). (1999). *The science of self-report: Implications for research and practice*. Mahwah, NJ: Lawrence Erlbaum Associates.

Sung, S. Y., & Choi, J. N. (2012). Effects of team knowledge management on the creativity and financial performance of organizational teams. *Organizational Behavior and Human Decision Processes*, *118*(1), 4-13. doi:10.1016/j.obhdp.2012.01.001

Tabah, A. N. (1999). Literature dynamics: Studies on growth, diffusion, and epidemics. *Annual Review of Information Science and Technology (ARIST)*, *34*, 249-286.

Takahashi, D. (2005, April 18). Forty years of Moore's Law. *The Seattle Times*. Retrieved from https://www.seattletimes.com/business/forty-years-of-moores-law/

Tarakci, M., Greer, L. L., & Groenen, P. J. F. (2016). When does power disparity help or hurt group performance? *Journal of Applied Psychology, 101*(3), 415-429. doi:10.1037/apl0000056

Tata, J., & Prasad, S. (2004). Team self-management, organizational structure, and judgments of team effectiveness. *Journal of Managerial Issues, 16*(2), 248-265. Retrieved from https://www.jstor.org/stable/40604457

The Economist (2017, May 6). The world's most valuable resource is no longer oil, but data. *The Economist.* Retrieved from https://www.economist.com/leaders/2017/05/06/the-worlds-most-valuable-resource-is-no-longer-oil-but-data

The World Bank (2019). *World development indicators* [Data file]. Available from https://databank.worldbank.org/source/world-development-indicators/

Tingley, D., Yamamoto, T., Hirose, K., Keele, L., & Imai, K. (2014). Mediation: R package for causal mediation analysis. *Journal of Statistical Software, 59*(5), 1-39. Retrieved from http://hdl.handle.net/1721.1/91154

Tjosvold, D. (1998). Cooperative and competitive goal approach to conflict: Accomplishments and challenges. *Applied Psychology: An International Review*, *47*(3), 285-313. doi:10.1111/j.1464-0597.1998.tb00025.x

Tost, L. P., Gino, F., & Larrick, R. P. (2013). When power makes others speechless: The negative impact of leader power on team performance. *Academy of Management Journal*, *56*(5), 1465-1486. doi:10.5465/amj.2011.0180

van der Vegt, G. S., & Janssen, O. (2003). Joint impact of interdependence and group diversity on innovation. *Journal of Management*, *29*(5), 729-751. doi:10.1016/S0149-2063_03_00033-3

van Mierlo, H., Rutte, C. G., Seinen, B., & Kompier, M. (2001). Autonomous teamwork and psychological well-being. *European Journal of Work and Organizational Psychology*, *10*(3), 291-301. doi:10.1080/13594320143000681

Venkataramani, V., & Tangirala, S. (2010). When and why do central employees speak up? An examination of mediating and moderating variables. *Journal of Applied Psychology, 95*(3), 582-591. doi:10.1037/a0018315

Verdier, N. (2006). Hierarchy: A short history of a word in Western thought. In D. Pumain (Ed.), *Hierarchy in natural and social sciences* (pp. 13-37). Dordrecht: Springer.

von Bertalanffy, L. (1968). *General system theory.* New York, NY: Braziller.

Wade, J. B., O'Reilly III, C. A., & Pollock, T. G. (2006). Overpaid CEOs and underpaid managers: Fairness and executive compensation. *Organization Science*, *17*(5), 527-544. doi:10.1287/orsc.1060.0204

Wageman, R. (1995). Interdependence and group effectiveness. *Administrative Science Quarterly, 40*(1), 145-180. doi:10.2307/2393703

Wageman, R. (1997). Critical success factors for creating superb self-managing teams. *Organizational Dynamics, 26*(1), 49-61. doi:10.1016/S0090-2616(97)90027-9

Wageman, R. (2001). How leaders foster self-managing team effectiveness: Design choices versus hands-on coaching. *Organization Science*, *12*(5), 559-577. doi:10.1287/orsc.12.5.559.10094

Wall, T. D., Kemp, N. J., Jackson, P. R., & Clegg, C. W. (1986). Outcomes of autonomous workgroups: A long-term field experiment. *Academy of Management Journal*, *29*(2), 280-304. doi:10.5465/256189

Wang, S., & Noe, R. A. (2010). Knowledge sharing: A review and directions for future research. *Human Resource Management Review, 20*(2), 115-131. doi:10.1016/j.hrmr.2009.10.001

Webber, A. (1993). What's so new about the new economy? *Harvard Business Review, 71*(1), 24-42.

Wegner, D. M. (1986). Transactive memory: A contemporary analysis of the group mind. In B. Mullen & G. R. Goethals (Eds.), *Theories of group behavior* (pp. 185-208). New York, NY: Springer.

Wegner, D. M. (1995). A computer network model of human transactive memory. *Social Cognition, 13*(3), 319-339. doi:10.1521/soco.1995.13.3.319

Wilde, M., Bätz, K., Kovaleva, A., & Urhahne, D. (2009). Überprüfung einer Kurzskala intrinsischer Motivation (KIM). *Zeitschrift für Didaktik der Naturwissenschaften*, *15*, 31-45. Retrieved from http://www.archiv.ipn.uni-kiel.de/zfdn/pdf/15_Wilde.pdf

Wittenbaum, G. M., Hollingshead, A. B., & Botero, I. C. (2004). From cooperative to motivated information sharing in groups: Moving beyond the hidden profile paradigm. *Communication Monographs*, *71*(3), 286-310. doi:10.1080/0363452042000299894

Wittenbaum, G. M., & Park, E. S. (2001). The collective preference for shared information. *Current Directions in Psychological Science*, *10*(2), 70-73. doi:10.1111/1467-8721.00118

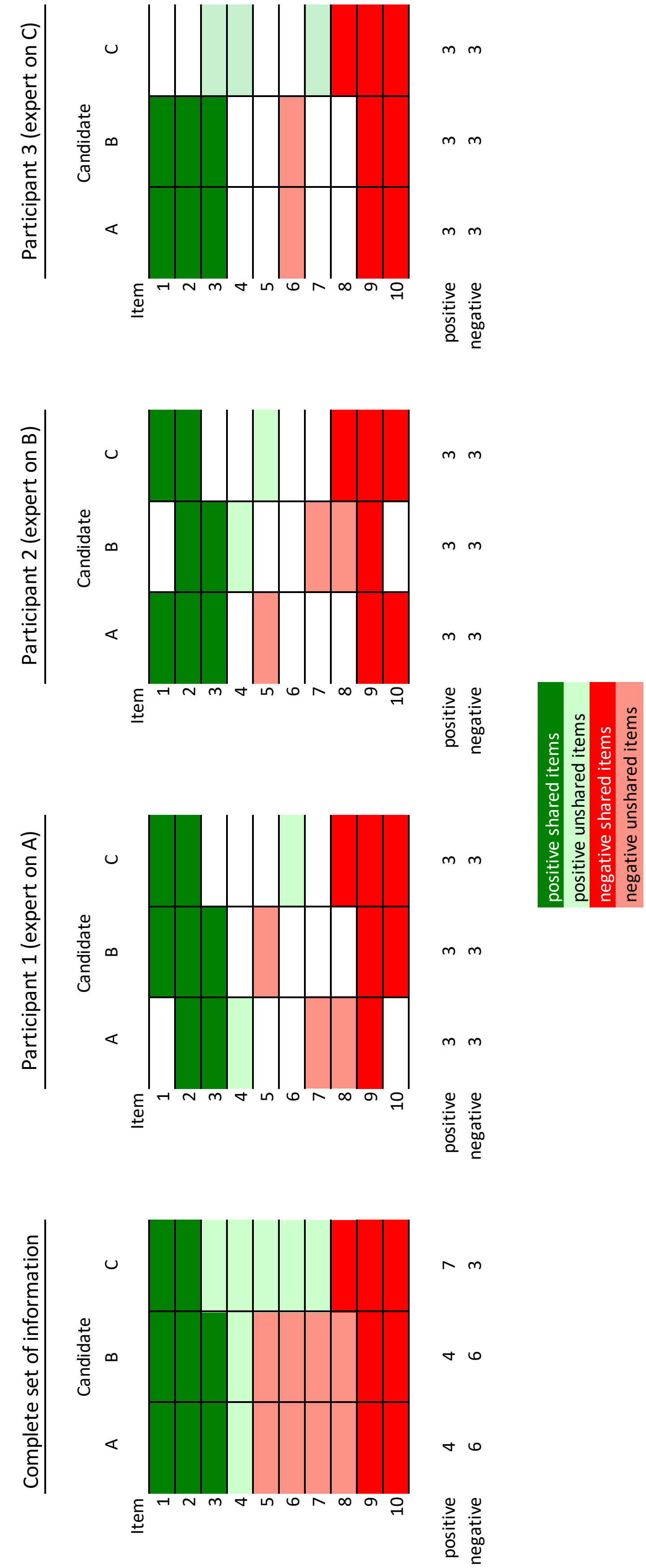
World Economic Forum (2018, September 17). *The future of jobs report 2018.* Retrieved from https://www.weforum.org/reports/the-future-of-jobs-report-2018

Yammarino, F., Salas, E., Serban, A., Shirreffs, K., & Shuffler, M. (2012). Collectivistic leadership approaches: Putting the "we" in leadership science and practice. *Industrial and Organizational Psychology, 5*(4), 382-402. doi:10.1111/j.1754-9434.2012.01467.x

Zand, D. E. (1981). *Information, organization, and power. Effective management in the knowledge society*. New York, NY: McGraw-Hill.

Zhang, Z.-X., Hempel, P. S., Han, Y.-L., & Tjosvold, D. (2007). Transactive memory system links work team characteristics and performance. *Journal of Applied Psychology*, *92*(6), 1722-1730. doi:10.1037/0021-9010.92.6.1722

Appendix A – Detailed Distribution of Information (Research Paper I)



Appendix B – Example of Supplementary Sheet for Participants in TMS Conditions (Research Paper I)