WORKING ALONE FROM HOME

The facilitation of spontaneous knowledge sharing between knowledge workers in an online environment

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Management summary

Due to the Covid-19 pandemic, many companies have had to shift to remote work. This trend continues as companies are currently taking steps to prepare for a future where remote work will increasingly become a part of working life. The shift to remote work has negatively impacted the relationship and connection between colleagues, in which knowledge sharing plays an important role. However, not much is known about the facilitation of knowledge sharing where companies were forced to shift to remote work on such a large scale, making it an interesting topic to study. Therefore, this study focused on the facilitation of knowledge sharing through spontaneous interaction in an online environment, specifically in a university department consisting of knowledge workers.

In total, 15 qualitative interviews, partially based on the grounded theory approach, were conducted with the theory of planned behavior and the self-determination theory forming the basis of the interview scheme. Both theories focus on the intention and motivation to perform a certain behavior, in this case, knowledge sharing. Additionally, literature specific to knowledge sharing was connected to the two theories leading to various factors that could influence the facilitation of knowledge sharing in an online environment. These factors were sorted into sorting tasks which participants were asked to complete by indicating the importance of each factor.

The results show that the relationship and connection with colleagues were ranked as the most important factor influencing knowledge sharing by the participants in the sorting tasks. Additionally, although ranked low on importance, the form with which knowledge is shared was mentioned most often by participants in the interviews. Interestingly, both factors were often mentioned together with the amount of interaction and the amount of spontaneity in knowledge sharing. With regards to the theory of planned behavior and the self-determination theory, all factors connected to relatedness were ranked as important with the factors connected to attitude, subjective norm, perceived behavioral control, and actual behavioral control being partially ranked as important by participants.

To facilitate the relationship and connection between colleagues, employees having an overview of the work activities and personal interests of their colleagues can have a positive influence. Additionally, for a hybrid form of remote work, it can be beneficial for organizations to create communal spaces in the office that not only facilitate work-related knowledge sharing but also facilitate non-work-related knowledge sharing. Next, there is no one-size-fits-all solution for the form with which knowledge can be shared. However, considering the social dynamics of an organization is important for choosing a form of knowledge sharing. Moreover, providing extra time and resources to create an equal level of technical confidence among employees can positively impact knowledge sharing as well.

This study shows that the change to working remotely in an online environment, due to the pandemic, has had an impact on the knowledge sharing of knowledge workers. Results show that the relationship and connection with colleagues is important in the facilitation of knowledge sharing through spontaneous interactions, with factors as overview of colleagues and communication online having an influence as well. In addition, it can be concluded that the form of knowledge influences the facilitation of knowledge sharing and that this facilitation can be optimized on the factors time available for knowledge sharing and technical confidence. To conclude, knowledge sharing through spontaneous interaction among knowledge workers can be facilitated online when the relationship and connection with colleagues and the form with which knowledge is shared are considered.

Contents

1. Introduction

Since the start of the Covid-19 pandemic, the number of employees working remotely has rapidly increased. At the beginning of March 2020, employees in the Netherlands worked 3.8 hours remotely per week on average (CPB, 2021). This number increased to 14.1 hours on average at the end of March that year, during the first lockdown in the Netherlands (CPB, 2021). However, it is expected that this change will not be temporary. In a report by the Dutch 'Centraal Planbureau' (CPB, 2021) it is stated that the average hours per week of working remotely are expected to double after the pandemic, when compared to the average before the pandemic. Similarly, big companies such as Facebook and Twitter have told their employees that they are allowed to work from home indefinitely (Forbes, 2020). Moreover, Forbes (2020, para. 1) states that "by 2025, an estimated 70% of the workforce will be working remotely at least five days a month". This sentiment is shared by 95 percent of Dutch employers, who believe that their employees will more often work from home after the pandemic, according to a member survey of the general employer's association in the Netherlands, in Dutch known as the 'algemene werkgeversvereniging Nederland' or AWVN (OR Rendement, 2020). These expectations for the future are influencing the current decisions of employers concerning their companies. According to a report by Microsoft (2021), "66 percent of business decision-makers are considering redesigning physical spaces to better accommodate hybrid work environments" (p. 4). Or more drastically, some start-ups, employing 50 to 100 people, have stopped using a physical building as an office entirely (Usborne, 2020). So, companies are taking steps to prepare for a future where remote working will increasingly become a part of working life.

Through the sudden and forced shift to remote working, various issues have been highlighted that affect the effectiveness with which one can work. Bolisani, Scarso, Ipsen, Kirchner, and Hansen (2020) state that "a continuous online connection can stress workers and reduce productivity and interpersonal relationships" (p.474). In contrast, Bloom, Liang, Roberts, and Ying (2015) argue that remote work increases productivity, however, they also found that working remotely increased the loneliness of employees. This is further emphasized by the fact that in a study by Microsoft (2021), 67 percent of workers indicated they were "craving more in-person time with their teams" (p. 4), and another study indicated that for 13 percent of the participants loneliness was a reason to start working in the office again (Esser, 2020). There is a trend of employees getting disconnected from their colleagues while working from home (Meester, 2021), as one only tends to discuss official business online which hinders the building of trust and motivation (NOS, 2020). The CEO of Unilever said that Unilever would like to see its employees working in the office again "after seeing a 'slow erosion of social capital', as working from home prevents colleagues from meeting in person" (Jolly, 2021, para. 8). Other companies have also been looking for solutions by offering virtual coffee moments where no work-related things are discussed, walk and talks where employees hold a meeting while walking outside and some companies even consider opening up the office for small groups of employees (Meester, 2021; NOS, 2020). Thus, the switch to remote work has negatively impacted the relationship and connection between colleagues.

The switch to remote work has not only impacted the relationship and connection between colleagues, but it has also influenced the knowledge sharing between colleagues. A lack of contact between employees negatively affects innovation and it also influences the training and integration of new employees (Jolly, 2021). Moreover, Bolisani et al. (2020) emphasize that it has become more difficult to share knowledge with co-workers while working in an online environment. It is important for organizations that knowledge is effectively shared among their employees as it allows organizations to stay flexible and competitive (Charband & Navimipour, 2016). Similarly, Dourish and

Bellotti (1992) state that knowledge sharing and knowing who knows and does what in an organization "are central to a successful collaboration" (p. 107). Child and Schumate (2007) elaborate on this by stating that knowing what colleagues know and do within an organization positively affects perceived team effectiveness. Furthermore, Majchrzak, Faraj, Kane, and Azad (2013) emphasize that the knowledge of employees should be seen as an important asset to organizations. With the shift to working in an online environment, knowledge sharing might have become more difficult, but there are people with a different opinion. Charband and Navimipour (2016) argue that online knowledge sharing is easier and faster in comparison to face-to-face conversations. Additionally, the authors argue that online knowledge sharing increases "productivity, performance, creativity, and quality of communication" (Charband & Navimipour, 2016, p.1140). Also, according to the scarce research into the relationship between remote work and productivity, remote work, within limits, can increase productivity (CPB, 2021). In short, knowledge sharing is important for organizations but has both struggles and advantages when practiced in an online environment.

Not every employee can work remotely or has knowledge sharing as a big part of their job description, however, there is a group of people that has both and was thus largely influenced by the pandemic, namely knowledge workers who are sharing knowledge in their daily working activities. According to research by Birkinshaw, Cohen, and Stach (2020), the lockdown helped knowledge workers prioritizing their work. Additionally, Birkinshaw et al. (2020) argue that an increase in freedom in their work activities increases the intrinsic motivation of knowledge workers. However, a challenge of remote working is the informal interaction with colleagues and Birkinshaw et al. emphasize the importance of bringing "back the informal and social elements of office life that are so vital to organizational and individual success" (para. 22). De Leede, De Jager, and Torka (2020) have conducted similar research among university employees, of which most can be considered knowledge workers. In the study, participants complained most about the remote contact with colleagues which has led to poor communication (De Leede et al., 2020). Next, participants indicated that the threshold for having informal contact with colleagues has gotten higher due to the pandemic as these contact moments now need to be scheduled (De Leede et al., 2020). This is important as participants expressed that they get much work done by spontaneously 'bumping into people', for example during "quick conversations at the coffee machine" (De Leede et al., 2020, p. 16). Therefore, De Leede et al. (2020) advise stimulating informal online group meetings and other measures to improve social contacts as informal contact enables employees to keep up to date with what is going on in the organization, which is important for the "embedding of people within an organization" (p. 17). Consequently, the facilitation of knowledge sharing among knowledge workers in an online context is an interesting topic of study.

The facilitation of online knowledge sharing has been studied before, however, no clear and up-to-date overview of the requirements for said facilitation exists yet. Specific factors that were studied individually concerning knowledge sharing are organizational culture (Kimble, 2020) and chat as a communication technology (McGregor, Bidwell, Sarangapani, Appavoo, & O'Neill, 2019). However, the effect of the pandemic on organizational culture and the closeness of employees in relation to knowledge sharing was not considered as the publication of Kimble (2020) predated the pandemic. Next, McGregor et al. (2019) focused on only one specific communication technology and did not consider all factors surrounding the technology that are related to knowledge sharing. A study that did create an overview with various factors related to online knowledge sharing was conducted by Charband and Navimipour (2016). The authors reviewed scientific articles on online

knowledge sharing that were published between 2000 and 2015, but they mostly focused on the advantages of online knowledge sharing. Charband and Navimipour (2016) advise that future studies focus on the barriers and not only the benefits of online knowledge sharing. Also, as the study focused on scientific articles up until 2015, likely, certain aspects of new, innovative communication technologies for knowledge sharing are not included. Lastly, Bolisani et al. (2020) studied the effect of the pandemic on knowledge workers but focused on the issues related to knowledge sharing and remote work that emerged during the pandemic. Therefore, it is important to study how knowledge sharing can be facilitated in an online environment, especially since the shift to remote work was forced and took place on a large scale.

One organization that was affected by the sudden and forced shift to remote work is a department at a university in the Netherlands that focuses on supporting teachers at said university in their teaching and personal development. The department consists of approximately 30 employees with mostly knowledge workers and a few supporting staff. Employees of this department experienced similar issues as mentioned by De Leede et al. (2020) and Birkinshaw et al. (2020) after switching to working from home. The number of spontaneous conversations with colleagues has decreased and the threshold to plan (informal) contact moments with colleagues has gotten higher. Additionally, due to the large variation in function between employees, there is no clear and detailed overview of what each employee is working on or knowledgeable about. This issue existed before the pandemic, as employees of the department work on different topics with some employees working in a specific faculty of the university a few days a week, so the issue is not new. However, the issue has become more important since the switch to remote work as informal contact between colleagues has decreased and the overview is now necessary to plan contact moments with the right colleagues in case one has a specific question. Therefore, this study will focus on the facilitation of knowledge sharing in this department consisting of knowledge workers. There will be a specific focus on the facilitation in an online context with knowledge sharing taking place through spontaneous interaction. This leads to the following research question:

"To what extent can knowledge sharing among knowledge workers through spontaneous interaction be facilitated in an online environment?"

To this end, an exploratory study, based on aspects of the grounded theory approach, will be conducted in which 15 knowledge workers will be interviewed. First, a literature overview will be given of relevant definitions and factors influencing knowledge sharing in an online context. Based on the factors, two sorting tasks will be developed for participants to complete in the interviews, in which they are asked to indicate which factors are most important for their own online knowledge sharing. The interviews will be analyzed based on open and selective coding, after which the results will be presented. Lastly, the results, theoretical implications, practical implications, limitations, and suggestions for further research will be discussed before a concluding answer to the research question is given.

2. Theoretical framework

To answer the research question, the various components of the question will first be defined in more detail. Next, the theory of planned behavior and the self-determination theory will be introduced to get insight into what influences the facilitation of knowledge sharing through spontaneous interaction in an online environment. Based on these two theories, more specific factors related to the topic of knowledge sharing will be stated and reflected upon to create a list of factors that will be used as input for data collection. Lastly, two sub-questions to the main research question will be introduced to further structure the consequent data collection and analysis.

2.1 Defining knowledge sharing and related concepts

Knowledge sharing can be defined in various ways on different levels of abstraction. Qun and Xiaocheng (2012) define knowledge sharing as "an individual, team and organization" sharing "knowledge with other members of the organization in the course of activities through various ways" (p. 1426). Similarly, Lee (2001) states that knowledge sharing can be done by and between an individual, a group of people, or the organization by "transferring or disseminating knowledge" (p. 324). Lee (2001) further elaborates on this by stating that effective knowledge management, "the process of capturing, storing, sharing, and using knowledge" (p. 324), is an integral part of effective knowledge sharing. An absence of knowledge management in an organization will thus influence the effectiveness of knowledge sharing between employees. Knowledge management can be defined as gaining knowledge about clients, improving this knowledge continuously, and sharing this knowledge with everyone in the organization so they can use the knowledge and increase the value of their work (Sulaiman, Ariffin, Esmaeilian, Faghihi, & Baharudin, 2011). Sulaiman et al. (2011) mention knowledge about clients specifically, but knowledge sharing can also include knowledge about everything that is happening within the organization. Dourish and Bellotti (1992) call this 'awareness information', knowledge about work activities, interests, and personal information of colleagues, and connect this to the transactive memory system developed by Wegner (1997). The transactive memory system, as explained by Wegner (1997), involves the creation of knowledge by a group in which the created knowledge cannot be traced back to a certain individual. The knowledge created within the transactive memory system can pertain to both knowledge about the organization and knowledge about clients. Important to note is that knowledge creation according to the transactive memory system is a joint effort and requires interaction between colleagues (Wegner, 1997). A transactive memory system might not always be as present in an organization, but its presence influences the effectivity with which knowledge is shared and created within an organization. Therefore, in this study, the focus will be on knowledge sharing done by individuals, groups, or the organization about clients and the ongoings in the organization itself, such as work activities but also interests and personal information of employees.

To share knowledge effectively, it is important to know which type of knowledge can be shared and which boundaries within knowledge sharing can emerge. Firstly, Eraut (1994) acknowledges that some knowledge can be shared with others through written text, also known as technical knowledge, whereas other knowledge can only be shared with others through practice and experience, also known as practical knowledge. Similarly, Lee (2001) states that knowledge sharing includes both explicit and tacit knowledge, which connect to the definition of technical knowledge and practical knowledge, respectively. However, Eraut (1994) states that the context of use is equally important and therefore uses four modes of knowledge use: replication, application,

interpretation, and association. Replicating knowledge is defined as using knowledge without altering it, applying knowledge is defined as using knowledge while altering it to fit a certain context, interpreting knowledge requires professional judgment and intuition in altering knowledge to fit a certain context, and associating knowledge is defined as using metaphors or images to understand knowledge (Eraut, 1994). Next to the modes of knowledge use, of which knowledge workers mainly use replication, application, and interpretation (Majchrzak et al., 2013), some boundaries impede effective knowledge sharing. According to Carlile (2004), there are three types of knowledge boundaries, namely syntactic boundaries, semantic boundaries, and pragmatic boundaries. Syntactic boundaries are a result of differences in languages, semantic boundaries are a result of differences in interpretation, and pragmatic boundaries are a result of differences in interest. In this study, the main focus will be on the replication, application, and interpretation of knowledge while keeping differences in language, interpretation, and interest in mind as a possible influence on effective knowledge sharing.

As knowledge workers are the research population it is important to know who can be defined as a knowledge worker. Surawski (2019) defines knowledge workers as people who "command a large body of knowledge equivalent to university education, understood and internalized, grounded in experience and consequently updated" (p. 125). Additionally, in their work knowledge workers "perform complex tasks, focus on problem-solving, creating knowledge, distributing it and applying to achieve results" for which a high level of autonomy is required (Surawski, 2019, p. 125). Spanellis, Dörfler, and MacBryde (2020) distinguish three types of knowledge workers, 'the knower', 'the seeker', and 'the broker'. 'The knower' shares the knowledge that they know, 'the seeker' is seeking for knowledge that they do not yet know, and 'the broker' is brokering knowledge by connecting 'knowers' and 'seekers' with each other through the overview they have of the knowledge within the organization (Spanellis et al., 2020). A knowledge worker can shift between these three roles and even take on more than one of these three roles at the same time. Next, knowledge workers use various tools such as documents and ICT (Surawski, 2019), but they transcend their role by not only using tools but also actively creating knowledge themselves (Majchrzak et al., 2013). In short, knowledge workers have a university education worth of knowledge that they use in their work to create, distribute and apply knowledge while being highly autonomously, using various tools, and sharing, seeking, or brokering knowledge with other colleagues.

The spontaneous interaction through which knowledge sharing occurs can be connected to informal learning. According to Eraut (2004), the main characteristics of informal learning are that it is implicit, unintended, opportunistic, unstructured, and without the presence of a teacher (p. 250). Spontaneous interactions with colleagues in themselves are unintended and unstructured in nature with no teacher or trainer present. Additionally, employees might not be aware of the learning resulting from the spontaneous interactions, which could mean also mean that employees are not aware of the opportunities for learning in the spontaneous interactions. As Eraut (2004) states, "informal learning is largely invisible because much of it is either taken for granted or not recognized as learning; thus, respondents lack awareness of their own learning" (p. 249). This invisibility of informal learning might make it difficult for participants to describe their own learning through spontaneous interaction. Therefore, types of learning do not need to include all aspects of informal learning to be included in this study. To provide further insights into the dynamics of informal learning, Tannenbaum, Beard, McNall, and Salas (2010) provide a model with four factors included in informal learning (see Figure 1). According to Tannenbaum et al. (2010), there should be an intent to

learn as a way to avoid missing potential learning opportunities. Next, the knowledge learned should be applied by learning through action or experience as a way to learn by doing (Tannenbaum et al., 2010). Additionally, receiving feedback will lead to valuable learning experiences with reflection allowing the learner to uncover insights from their own learning experiences (Tannenbaum et al., 2010). These four factors show the extent to which informal learning can take place, with intent to learn and feedback being a catalyst for learning. To summarize, this study will focus on sharing knowledge through spontaneous interactions concerning aspects of informal learning where the intention to learn and the feedback of others can influence one's learning process.

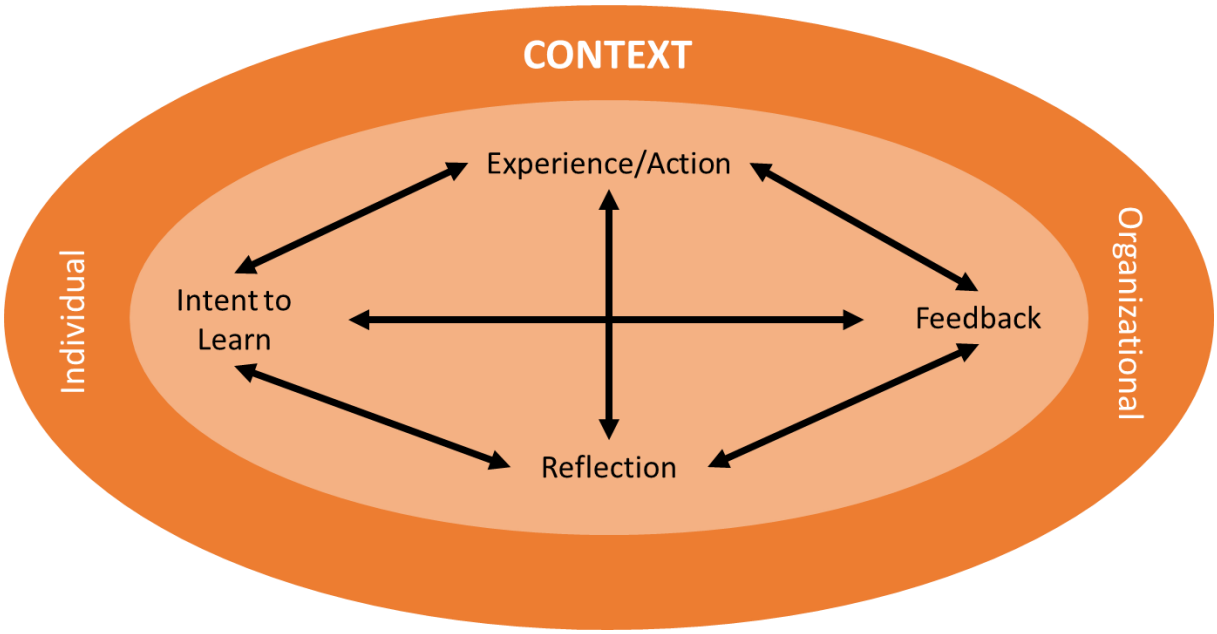

Figure 1. The dynamic model of informal learning adapted from Tannenbaum, Beard, McNall, and Salas (2010, p. 307)

The online environment is a broad term that should be defined in more detail to make clear which exact context, in which knowledge is shared, is being studied. Huan and DeSanctis (2005) studied knowledge sharing in the context of online networks which they defined as "social networks in which people engage in interactions, build relationships, share information, and request and extend assistance to each other using electronic communication technologies" (p. 207). Similarly, Majchrzak et al. (2013) focused on social media tools through which knowledge workers could not only share their knowledge with people they knew but also with people they did not know. In this study, the main focus will be on the knowledge sharing that takes place within the organization, although knowledge sharing with other departments of the university will not be excluded. As for the medium with which knowledge is shared, the main focus will be on all online applications that are used to share knowledge with colleagues within the department, which could potentially include social networks or social media. In short, knowledge sharing within the organization will be the focus with all online applications being used for knowledge sharing with colleagues being included.

2.1.1 Interpretation of research question

To summarize, the research question, “To what extent can knowledge sharing among knowledge workers through spontaneous interaction be facilitated in an online environment?”, can be interpreted in the following way. Knowledge sharing encompasses all knowledge shared about clients of the organization and the ongoings of the organization itself by either individuals, groups, or the organization. Within knowledge sharing, knowledge can be replicated, applied, and interpreted. In this study, the focus will be on the knowledge sharing of knowledge workers who have a university education worth of knowledge that they use in their work to create, distribute and apply knowledge while being highly autonomously, using various tools, and sharing, seeking, or brokering knowledge with other colleagues. The spontaneous interaction may pertain to one or several aspects of informal learning and mainly focuses on interactions with colleagues within the organization. Lastly, the online environment encompasses all online applications being used for knowledge sharing with colleagues.

2.2 Factors influencing knowledge sharing

2.2.1 Theory of planned behavior

As this study focuses on how a specific behavior, knowledge sharing, can be facilitated, the theory of planned behavior will be introduced to gain insights into what influences behavior. The theory of planned behavior is an extension of the theory of reasoned action and focuses on factors influencing the intention to display a certain behavior (Ajzen, 1991). Similar to the theory of reasoned action, the theory of planned behavior includes the attitude towards the behavior and the subjective norm as factors influencing behavioral intention (Ajzen, 1991). However, it extends on the theory of reasoned action by including factors pertaining to the behavioral control a person has (Ajzen, 1991). Ajzen (1991) states that behavioral control was added to the theory as the intention to display a certain behavior can only take place if a person has the choice to perform or not perform the specific behavior. A differentiation is made between perceived behavioral control and actual behavioral control with perceived behavioral control focusing on motivation and actual behavioral control focusing on non-motivational factors (Ajzen, 1991). Ajzen (1991) defines attitude towards the behavior as the way a certain behavior is evaluated or appraised by a person, which can be done favorably or unfavorably. Subjective norm refers to whether a person perceives pressure from others to display or not display a certain behavior and the perceived behavioral control refers to how easy or difficult a person expects the performance of a certain behavior to be (Ajzen, 1991). Lastly, actual behavioral control refers to all non-motivational factors necessary for a person to successfully perform a behavior if he or she has the intention of doing so, which can for example include “time, money, skills, and cooperation of others” (Ajzen, 1991, p. 182). The influence of attitude, subjective norm, and perceived behavioral control may vary depending on the specific behavior and situation (Ajzen, 1991). Therefore, all three factors will be included in this study as a possible influence on the effectiveness of knowledge sharing through spontaneous interaction in an online environment with non-motivational factors being included as well.

2.2.2 Self-determination theory

The self-determination theory, similar to the theory of planned behavior, focuses on factors influencing motivation. The theory includes three factors, autonomy, competence, and relatedness. Autonomy refers to the need for behavior to be self-directed and competence refers to the perceived ability to perform learning activities (Niemiec & Ryan, 2009). According to Niemiec and Ryan (2009), especially the fulfillment of autonomy and competence influences intrinsic motivation. However, as these factors have similar definitions to the subjective norm and perceived behavioral control respectively, they will not be included as separate factors in this study. Relatedness is not covered by the theory of planned behavior as it is defined by Deci and Ryan (2000) as "the need to feel belongingness and connectedness with others" (p. 73). This serves as an interesting additional factor as knowledge sharing takes place between individuals, groups, and organizations, as stated previously. Therefore, the relatedness to others will be included as an additional factor that could influence knowledge sharing next to the factors included in the theory of planned behavior, as displayed in Figure 2.

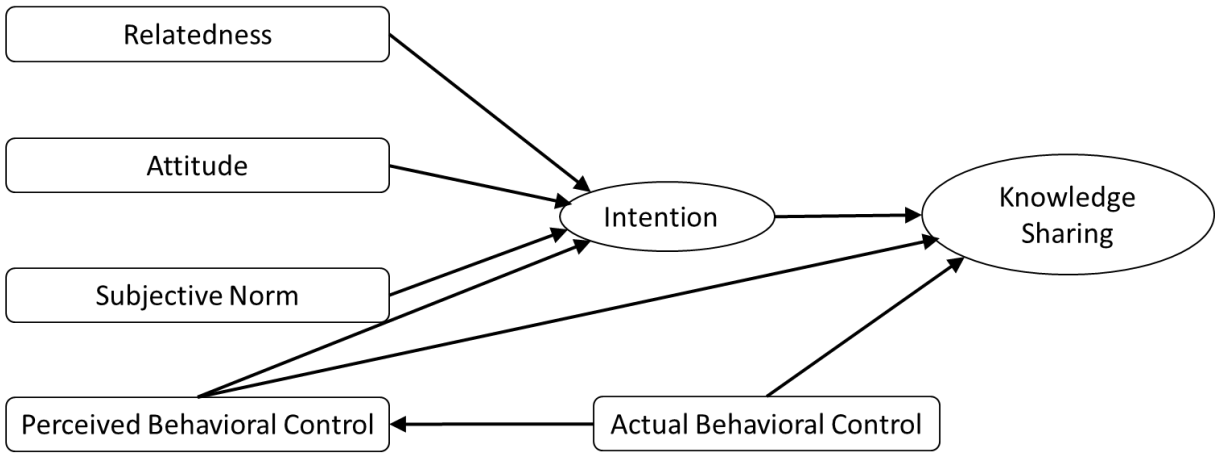

Figure 2. Theory of planned behavior model, including relatedness from the self-determination theory, adapted from Conner and Sparks (2005, p. 177).

2.2.3 Factors influencing knowledge sharing

Various attitudes, views, and opinions on knowledge sharing exist which can influence the intention of a person to share knowledge. This is also called individual cognition and can be related to reciprocity and enjoyment in knowledge sharing and one's own status and reputation (Cheung, Lee, & Lee, 2013). So, next to individual factors, the reciprocating of knowledge sharing by colleagues can also influence the intention to share knowledge. Similarly, Papadopoulos, Stamati, and Nopparuch (2013) that "self-efficacy, perceived enjoyment, certain personal outcome expectations, and individual attitudes towards knowledge sharing are positively related to the intention of knowledge sharing" (p. 133). Charband and Navimipour (2016) elaborate that reputation can affect the attitude one has towards knowledge sharing with a sense of self-worth affecting the attitude as well. This makes the view and opinion one has about knowledge sharing an important factor to consider in the facilitation of knowledge sharing. In addition, how one views the added value of knowledge sharing can vary as younger workers "are motivated by 'self-interest' factors such as gaining name recognition and impressing management", with older workers or workers with a longer tenure being "motivated by more altruistic factors such as sharing and mentoring" (Huffaker & Lai, 2007, p. 595). Another motivational factor related to self-interest is the need of a person to "gain a better

understanding of current knowledge and best practices in the field" (Charband & Navimipour, 2016, p. 1137). In short, the way people view knowledge sharing varies with the view and opinion about knowledge sharing, the perceived added value of knowledge sharing, and the reciprocity in knowledge sharing possibly influencing the intention to share knowledge.

The way people perceive social pressure to perform or not perform a certain behavior may vary and come from specific colleagues or the organization as a whole. According to Kimble (2020), high sociability organizations like universities can encourage knowledge sharing in their organization by "fostering a culture of knowledge sharing, nurturing interpersonal relationships, and creating appropriate organizational structures." (p. 38). As this study focuses on a university department, these types of encouragements by the organization to share knowledge might be of influence on the intention of employees to share knowledge. Similarly, Pan, Hsieh, and Chen (2001) emphasize that a knowledge-sharing environment is a prerequisite for successful knowledge sharing and Cheung et al. (2013) argue that the organizational context should be considered in knowledge sharing. Next to the organizational context, colleagues and their opinion on knowledge sharing might also influence the intention of an individual to share knowledge. Validating and comparing one's own knowledge sharing with that of others who share a similar working situation helps sustain the practice of knowledge sharing (Charband & Navimipour, 2016). Therefore, both the encouragement by the organization and the opinions and views of others can lead to social pressure which influences the intention to share knowledge.

The perceived behavioral control is influenced by the online environment in which knowledge sharing occurs. Charband and Navimipour (2016) argue that the online environment can cause a lack of confidence between the users of said online environment. Since the shift to remote work, employees have had to become more familiar with online applications for knowledge sharing which could influence the intention and the amount of knowledge they share online. Additionally, the technology that is used to share knowledge can form a barrier for knowledge sharing if not used effectively (Charband & Navimipour, 2016). Next, the confidence in sharing knowledge can also be influenced by the familiarity one has with the knowledge one wants to share and whether one perceives their knowledge worth sharing (Charband & Navimipour, 2016). Therefore, confidence online and the way knowledge sharing is communicated should be included as possible influencing factors on the intention of knowledge sharing.

The relatedness to colleagues is important to consider in the facilitation of knowledge sharing, especially since it was affected by the shift to remote work. Cheung et al. (2013) emphasize the need for social interaction and trust to effectively share knowledge. Similarly, Ho, Kuo, Lin, and Lin (2010) found that "trust at the workplace has a mediating effect on online knowledge sharing within organizations" (p. 625). Furthermore, Charband and Navimipour (2016) argue that competitiveness between colleagues can form a barrier for knowledge sharing. Trust between colleagues has become more important in the online environment, as colleagues in virtual teams are more likely to (mis)attribute blame towards each other (Bazarova & Walther, 2009). In addition, De Leede et al. (2020) found that people "experience alienation from colleagues, team, and organization or perceive isolation." (p. 19) which might decrease the relatedness between colleagues. However, Bolisani et al. (2020) found that employees were able "to keep sufficiently good and fruitful interactions" (p. 474). Suh and Shin (2010) elaborate on this by stating that the knowledge sharing in collocated teams is not affected by the frequency of online interaction, but that it does play a critical role in the motivation for knowledge sharing in dispersed teams, like the university department in this study. Therefore, it seems relevant to separate the relationship and

connection between colleagues from the online interaction colleagues have with each other and focus on both in this study.

Lastly, various factors influence the motivation to share knowledge indirectly, also known as factors regarding the actual behavioral control. Appropriate communication technologies should be available (Bolisani et al., 2020; Pan et al., 2001), with communication patterns playing an important role in online knowledge sharing as well (Charband & Navimipour, 2016). Specifically, "the asynchronous nature of the online communication medium", concerning how spontaneously knowledge can be shared, can help sustain online knowledge sharing (Charband & Navimipour, 2016, p. 1137). Sharing knowledge online requires more energy and motivation (De Leede et al., 2020), which increases the required effort to share knowledge, and lack of time or other competing priorities can form a barrier for knowledge sharing as well (Charband & Navimipour, 2016). Finally, the type of knowledge can influence the willingness and ability of people to share said knowledge, with work context and the expertise of the individual playing a role (Eraut, 1994). Therefore, the required effort for knowledge sharing, the spontaneity with which knowledge can be shared and the kind of knowledge that is shared will be included in this study as possible influencing factors on the facilitation of knowledge sharing.

2.2.4 Conclusion influencing factors

Based on the theory of planned behavior and the self-determination theory, attitude, subjective norm, perceived behavioral control, actual behavioral control and relatedness influence the motivation and intention to share knowledge. By comparing literature, specific factors influencing knowledge sharing were related to the factors of the theories. Within these specific factors that influence knowledge sharing a division can be made into motivational factors related directly to the online environment and motivational factors not directly related to the online environment. The first group encompasses the factors of confidence online, the required effort for knowledge sharing, the spontaneous character of online applications, online interaction with colleagues, and the way of communicating online. The second group of motivational factors includes the relationship/ connection with colleagues, the kind of knowledge one wants to share, one's own opinion/view about knowledge sharing, the opinions/views of others about knowledge sharing, the added value of knowledge sharing, whether sharing knowledge is encouraged by the organization, and the reciprocity of knowledge sharing.

The overview of all factors that might influence knowledge sharing in relation to the theory of planned behavior and the self-determination theory, as displayed in Figure 3 on the next page, will serve as input for the data collection. As the factors can be divided into two groups, this study will answer the research question by focusing on the following two sub-questions.

> *"To what extent do factors influencing the workings of an online environment need to be considered in the facilitation of knowledge sharing among knowledge workers through spontaneous interaction?"*

> *"To what extent do factors influencing the motivation and intention of knowledge workers to share knowledge in an online environment need to be considered in the facilitation of knowledge sharing among knowledge workers through spontaneous interaction?"*

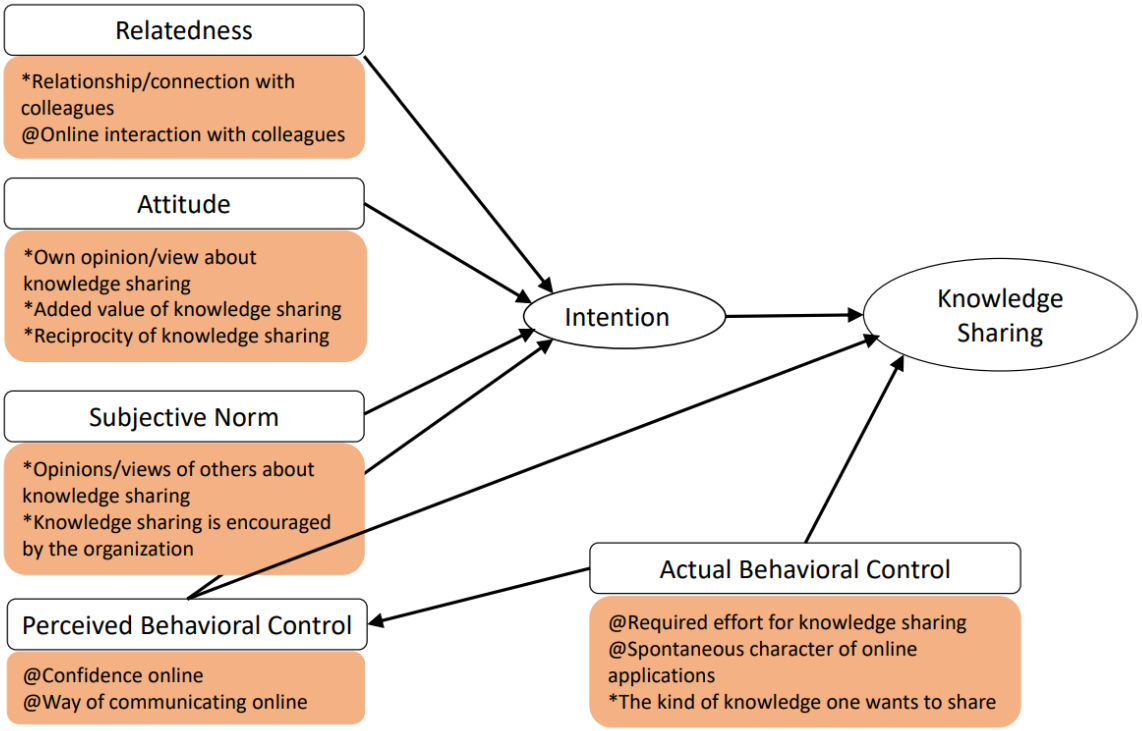

Figure 3. Complete overview of all factors included in the study in relation to the theory of planned behavior and the self-determination theory.

Note. @ is used to indicate motivational factors directly related to the online environment and * is used to indicate motivational factors not directly related to the online environment

3. Method

3.1 Design

As stated before, this study is exploratory and uses some principles of the grounded theory approach to answer the research question. The grounded theory approach fits exploratory research as it focuses on uncovering processes and phenomena (Länsisalmi, Peiró, & Kivimäk, 2004). As Corbin and Strauss (1990) state, the grounded theory should be used "to develop a well-integrated set of concepts that provide a thorough theoretical explanation of social phenomena under study." (p. 5). The end result does not have to be a perfect description, rather the goal is "to develop a theory that accounts for much of the relevant behavior" (Länsisalmi et al., 2004, p. 242). The grounded theory approach distinguishes itself by developing "through constant comparative analysis" using different types of data collection, using no "predetermined theoretical or conceptual framework" and aiming for theoretical saturation in order for a theory to be 'ready' (Länsisalmi et al., 2004, p. 242-243). Due to the timeframe available for data collection and analysis, it is not possible to conduct several cycles of data collection and analysis to reach 'theoretical saturation' as prescribed by the approach (Corbin & Straus, 1990; Länsisalmi et al., 2004). It is therefore important to consider that the resulting theory might not be fully 'ready'.

Other aspects of the grounded theory approach that were used are data triangulation and the partial absence of a predetermined theoretical framework. Data triangulation, also known as the combination of different types of data (Länsisalmi et al., 2004), was reached by creating a literature overview that served as input for qualitative semi-structured interviews. Semi-structured interviews were chosen as they are flexible, allowing the researcher to deviate from the interview scheme by asking relevant follow-up and probing questions (Boeije, 2010). This allows the researcher to explore topics not included in the interview scheme, which could contribute to reaching, partial, 'theoretical saturation'. Additionally, as the facilitation of spontaneous online knowledge sharing is a rather broad topic, sorting tasks were chosen as a means to structure the interviews while also providing insight into what is most important in the facilitation. Similar to the interviews, the literature overview also served as input for the sorting tasks, which means a predetermined theoretical framework was not entirely absent. However, due to the limited timeframe available for data collection and analysis, it was not possible to start data collection without a theoretical basis. Further details about the procedure, interview scheme, and sorting tasks will be discussed in the next section.

3.2 Procedure and materials

To start, all participants were sent an informed consent document and an information sheet about the study one week before their interview was scheduled to take place. Participants were given the chance to ask questions about the study beforehand via e-mail and had this possibility once more during the briefing at the start of their interview, which took place via Microsoft Teams due to the Covid-19 pandemic. Once participants agreed to partake in the study, they were asked to give their informed consent on recording (see Appendix A) after which the interview and the video recording were started. For each interview, the researcher followed the interview scheme (see Appendix B) and started the interview by asking participants about their age, tenure, and function within the organization. Next, spontaneous knowledge sharing was discussed by asking participants for their own definition of the term and their experiences with spontaneous knowledge sharing in both an offline and online context. Then participants were sent a link to a survey with two sorting tasks (see Figure 4 on the next page) and were asked to share their screen with the researcher.

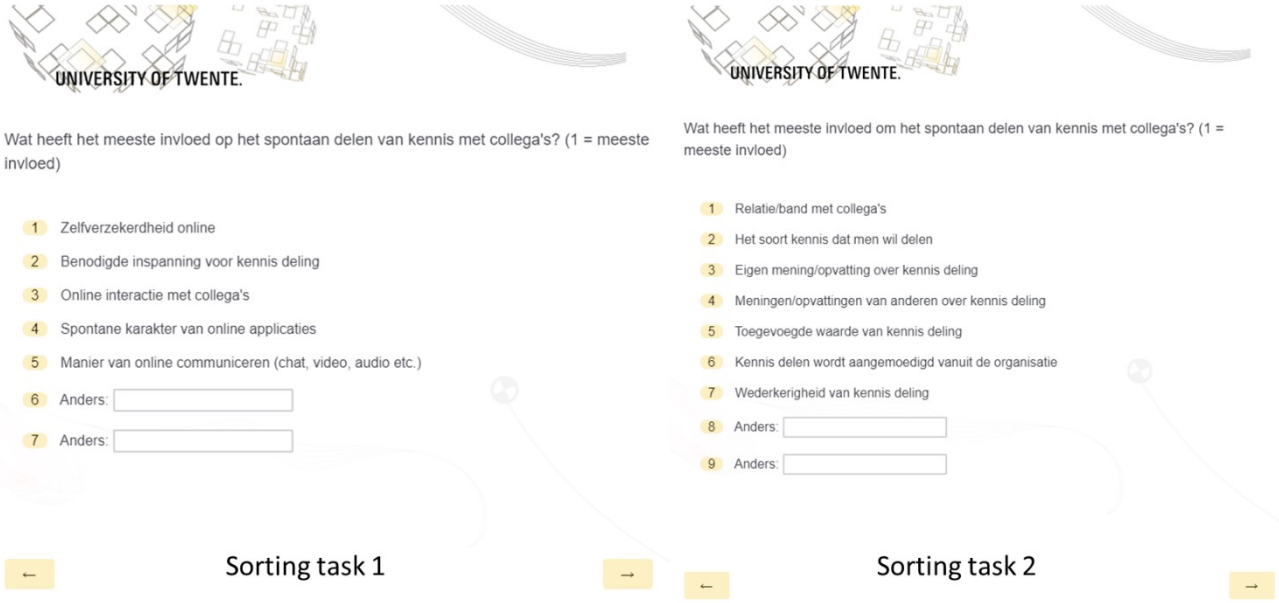

Figure 4. Screenshots of sorting task 1 and 2.

Note. Translation sorting task 1: (1) Confidence online, (2) required effort for knowledge sharing, (3) spontaneous character of online applications, (4) online interaction with colleagues, and (5) way of communicating online.
Translation sorting task 2: (1) Relationship/connection with colleagues, (2) the kind of knowledge one wants to share, (3) own opinion/view about knowledge sharing, (4) opinions/views of others about knowledge sharing, (5) added value of knowledge sharing, (6) sharing knowledge is encouraged by the organization, and (7) reciprocity of knowledge sharing.

For the sorting tasks, the factors that resulted from the literature overview were used. However, as a list of 12 factors would make it difficult for participants to compare the factors while simultaneously maintaining an overview of the factors, a division was made according to the sub-questions presented in the theoretical framework. The first sorting task focuses on factors directly influencing the online environment and the second sorting task focuses on factors influencing the motivation and intention to share knowledge that do not directly relate to the online environment. To mitigate the influence of presenting participants with a set list of factors, no definitions of the factors were provided, and instead participants were asked and encouraged to name their own definitions. In addition, participants were asked if they wanted to add any factors to the sorting task before they were asked to sort the factors in each sorting task in order of importance. Afterward, participants were asked to explain their choices and indicate if and where there was possible room for improvement in their organization. Lastly, participants were given the chance to mention additional remarks or information. At the end of the interview, participants were given a debriefing in which they were given the chance to ask questions about the study to the researcher and were reminded that they had the right to request access to, change, removal, or adjustment of their collected data. In total, 14 hours and 24 minutes of interviews were collected with 13 hours and 50 minutes being transcribed, excluding the debriefings. On average, each interview generated approximately 55 minutes of data for analysis.

3.3 Sampling and participants

A similar sampling approach as suggested by the grounded theory approach was chosen as the recommended sampling strategy would not fit the timeframe of the study. The grounded theory approach advises the use of theoretical sampling, which requires several cycles of data collection and analysis with previous cycles serving as input for sampling in the next cycle (Coyne, 1997). Instead, participants were found using purposeful random sampling where participants are systematically chosen from an identified population of interest, similar to theoretical sampling (Cohen & Crabtree, 2006). However, even though participants were sampled in a similar manner, purposeful random sampling is used for only one cycle of data collection and consequent analysis. As Coyne (1997) states, all theoretical sampling is purposeful sampling, but not all purposeful sampling can also be defined as theoretical sampling. Therefore, random purposeful sampling was chosen as a sampling strategy that would fit the timeframe of the study while also increasing the credibility of the research.

As not every employee in the organization is a knowledge worker, a list of names of the knowledge workers within the organization was used by the researcher to approach potential participants. Potential participants were approached by e-mail and a short announcement by the researcher in an organization-wide meeting. Those who reached out to the researcher by e-mail were given more information about the data collection and a date and time for the interview was proposed. Ultimately, 15 participants reached out to the researcher and were able to plan an interview. Of the 15 participants, 11 identified as female, and 4 identified as male with a mean age of 43 years (see Table 1). All participants are Dutch and therefore all interviews were conducted in Dutch to let the participants talk as freely as possible. The participants have an average tenure of 6.8 years, with many variations in function. Some participants worked solely for the department with others working some days for the department and other days for a specific faculty at the university. Additionally, there are various areas that the participants focus on in their work such as the facilitation of trainings, the advising of teachers, and the innovations in education.

Table 1.

Demographics of participants with their corresponding frequency (n).

Demographics	n
Female	11
Male	4
Mean age (in years)	43
Average tenure (in years)	6.8

3.4 Analysis and instrument

To analyze the interviews a codebook was developed through a combination of open coding and the use of the literature overview that served as input for the sorting tasks. As the grounded theory approach advises against using a predetermined theoretical framework (Corbin & Strauss, 1990), which cannot be entirely avoided in this study as explained before, the content and interpretations of the transcripts were leading for the development of the codebook. To this end, the coding process started by reading through all of the transcripts carefully while taking notes, as advised by Boeije (2010), which resulted in a preliminary codebook. Next, the preliminary codes were compared and, if

relevant, grouped together and given a code name. According to Corbin and Strauss (1990), the purpose of this process of open coding is to give the researcher "new insights by breaking through standard ways of thinking about or interpreting phenomena reflected in the data" (p. 12). Therefore, it was only during axial coding where the preliminary codes were compared and, if possible, connected to the factors in the sorting tasks. Additionally, during this process, preliminary codes were grouped together in categories to further structure the codebook. This resulted in the categories participant number, sentiment, time, and factors influencing knowledge sharing. The last category, factors influencing knowledge sharing, was the largest and could not be divided into several smaller categories. Even though a division was made in the sorting tasks between factors about the online environment and factors that did not directly relate to the online environment, no clear division could be made after analyzing the content of the interviews. Lastly, the codebook was finalized through selective coding by adding definitions to the codes (Corbin & Strauss, 1990), during which a few codes with similar definitions were combined together.

Ultimately, a codebook with a total of 43 codes resulted from the coding process. The codebook consists of four main codes, number of participant, sentiment, time, and factors influencing knowledge sharing. As can be seen in Table 2 on the next page, the first three categories are coded once per unit of analysis, however for the last category, factors influencing knowledge sharing, multiple codes can be coded per unit of analysis. This gives insight into which factors are mentioned together and could thus potentially influence each other. For a detailed overview of the codebook with all definitions, see Appendix C.

To test the reliability of the codebook and to validate the conclusions drawn from this study, 10 percent of the transcripts were coded by the researcher and a second coder, and the agreement between the two coders was calculated (Kurasaki, 2000). For the selection of the 10 percent, care was taken to ensure that all codes within the codebook would be present and thus included in the intercoder reliability. The category participant number was not included in the intercoder reliability as it only served to indicate which transcript belonged to which participant. After the 10 percent of the transcripts was compared, the Cohen's Kappa for each category of codes and the overall Cohen's Kappa were calculated (see Appendix D). The overall codebook has a Cohen's Kappa of 0.78, with sentiment having a Cohen's Kappa of 0.77, time having a Cohen's Kappa of 0.81, and factors influencing knowledge sharing having a Cohen's Kappa of 0.77 (see Table 3 on the next page). Sentiment, factors influencing knowledge sharing, and the overall codebook have a Cohen's Kappa that indicates a substantial strength of agreement (Landis & Koch, 1977). Next, time has a Cohen's Kappa that indicates an almost perfect strength of agreement (Landis & Koch, 1977). To conclude, the reliability of the codebook is substantial, and the consequent conclusions of this study are validated.

Table 2.

Codebook of main codes, sub-codes, and the number of codes per unit of analysis.

Main code	Sub code	Code per unit
1. Number of participant	1.1 Participant 1 - 1.15 Participant 15	One code
2. Sentiment	2.1 Positive	One code
	2.2 Negative	
	2.3 Ambiguous	
3. Time	3.1 Before the pandemic	One code
	3.2 During the pandemic	
	3.3 Comparison between before and during the pandemic	
4. Factors influencing knowledge sharing	4.1 Technical confidence online	Multiple codes
	4.2 Social confidence online	
	4.3 Required effort dependent on others	
	4.4 Own required effort	
	4.5 Amount of spontaneity	
	4.6 Communication online	
	4.7 Amount of interaction	
	4.8 Form of knowledge	
	4.9 Relationship/connection with colleagues	
	4.10 Content of knowledge	
	4.11 Own opinion	
	4.12 Opinion of others	
	4.13 Added value of knowledge sharing	
	4.14 Encouraged by organization	
	4.15 Reciprocity of knowledge sharing	
	4.16 Flow of information	
	4.17 Norms about knowledge sharing	
	4.18 Synchronicity	
	4.19 Overview of colleagues	
	4.20 Time available for knowledge sharing	
	4.21 Usability	
	4.22 Findability of knowledge	

Table 3.

Cohen's Kappa per code category and the overall codebook.

Code category	Cohen's Kappa
Sentiment	0.77
Time	0.81
Factors influencing knowledge sharing	0.77
Overall codebook	0.78

After coding the interviews, the codes were analyzed on the frequency of codes, co-occurrence between codes, and content with the use of quotes. According to Boeije (2010), frequencies need to be used with caution as the number of follow-up questions a researcher asks might also be reflected in them, next to the opinion of participants. In this case, the opinion of participants are also reflected in the sorting tasks, but care was taken for the results to focus on the quotes first as the interpretation of interview content gives richer data than counting codes alone (Boeije, 2010). The analysis of qualitative data cannot happen without the researcher drawing inferences (Boeije, 2010), which makes it important that quotes are used to substantiate said inferences. Additionally, for each quote, it is indicated from which transcript and consequent unit of analysis it originates to show transparency (Boeije, 2010). Quotes are selected based on comprehensibility, however, if quotes are incomprehensible but too valuable to exclude, they are summarized or paraphrased (Boeije, 2010). Lastly, the results of the ranking in the sorting tasks are used to give additional insights into the frequencies of the codes.

4. Results

4.1 Sorting tasks

To analyze the sorting tasks, the average ranking of each factor was calculated by combining the ranking scores of all participants, excluding the ranking of extra factors, and dividing it by the total number of participants. For the first sorting task (see Figure 5), the highest-ranked factor received 5 points per participant with the lowest-ranked factor receiving 1 point. The results of the first sorting task, show that participants ranked the required effort for knowledge sharing highest with 3.9 out of 5 points on average. The online interaction with colleagues was given 3.6 out of 5 points on average and the spontaneous character of online applications was given 3.1 out of 5 points on average. In comparison, the way of communicating online and confidence online are ranked relatively low with 2.3 and 2.1 out of 5 points on average, respectively. In short, the required effort for knowledge sharing, the online interaction with colleagues, and the spontaneous character of online applications are the most important factors, as ranked by the participants, from sorting task 1.

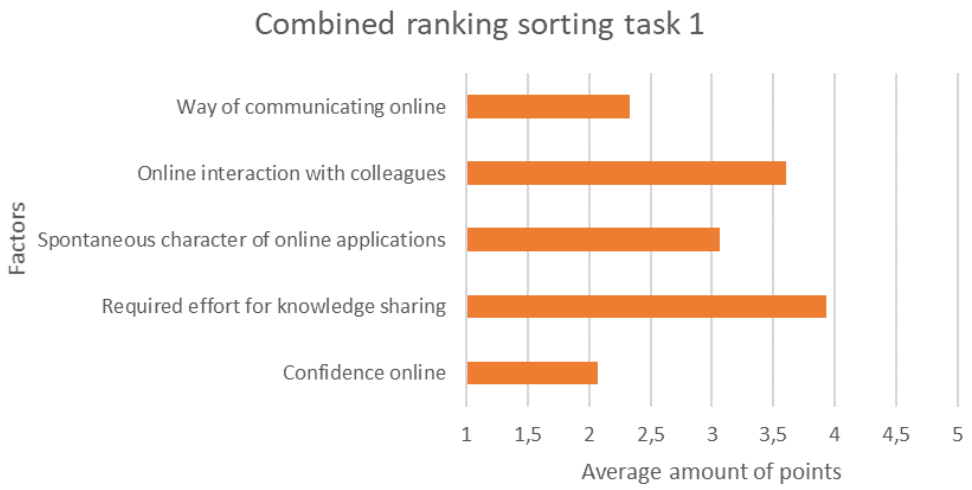

Figure 5. Combined ranking of sorting task 1 based on the average amount of points.

As the second sorting task consisted of 7 factors, the highest-ranked factor received 7 points per participant with the lowest-ranked factor receiving 1 point. Similar to the first sorting task, the combined ranking was calculated by combining the ranking scores of all participants for each factor and dividing it by the total number of participants. As shown in Figure 6, relationship/connection with colleagues and added value of knowledge sharing were ranked highest by the participants in the second sorting task with 6.3 and 5.6 points out of 5 on average, respectively. In comparison, the other 5 factors are ranked relatively low with the kind of knowledge one wants to share receiving 3.9 points out of 5 on average. Followed by own opinion/view about knowledge sharing with 3.6 points, sharing knowledge is encouraged by the organization with 3.1 points, reciprocity of knowledge sharing with 2.8 points, and lastly, opinions/views of others about knowledge sharing with 2.7 points. So, for sorting task 2, the relationship/connection with colleagues and the added value of knowledge sharing were ranked as most important by the participants in comparison to the other factors.

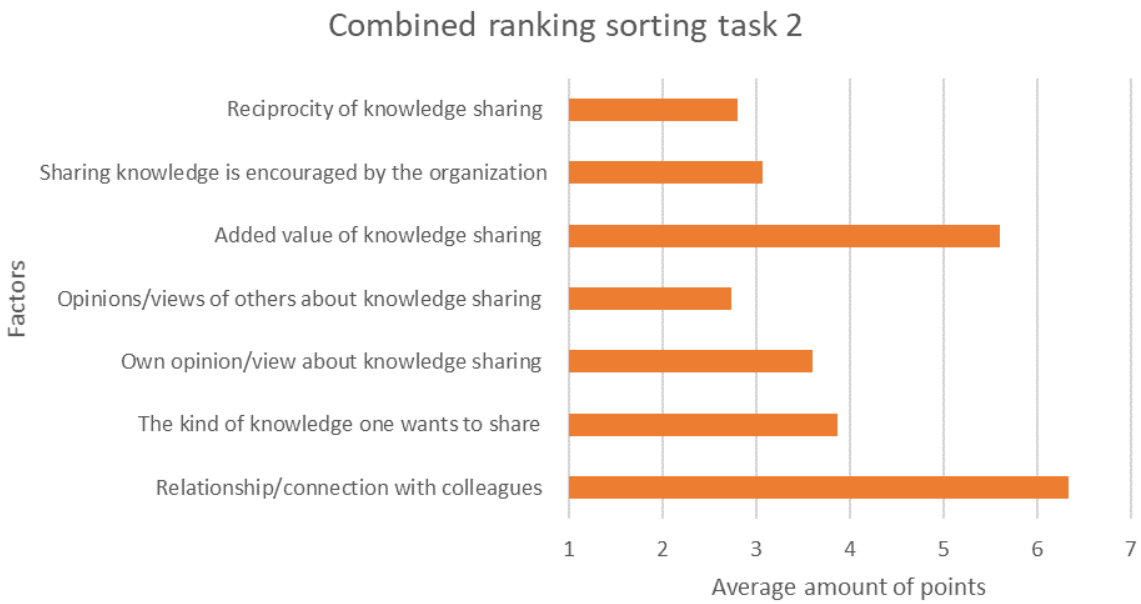

Figure 6. Combined ranking of sorting task 2 based on the average amount of points.

4.1.1 Extra factors added to sorting tasks

As stated before, participants were given the opportunity to add extra factors to the sorting tasks if they felt like the provided list of factors was not complete. In total 24 extra factors were added, with 15 added to the first sorting task and 9 added to the second task, which were all categorized according to the codebook (see Appendix E). Interestingly, several additions to the sorting tasks related to the same factor codes and were ranked relatively high (see Table 4 on the next page). Participants added factors applicable to the norms about knowledge sharing a total of five times. Specifically, safety, privacy, and the opportunity to learn from mistakes were all ranked second in the first sorting task. Additionally, norms about intellectual property and personal product were also added, however, these were ranked relatively low in the second sorting task. Next, factors related to the time available for knowledge sharing were added a total of three times and were ranked first or second in both sorting tasks. Lastly, factors regarding the overview of colleagues were added twice with questions and working activities of others being mentioned specifically. The ranking differs as the overview of colleagues was ranked first in the first sorting task and fifth in the second sorting task. To conclude, the norms about knowledge sharing, the time available for knowledge sharing, and the overview of colleagues are factors to keep in mind as they stand out from the extra factors that were added to the sorting tasks by the participants.

Table 4.

Description of extra factors added to sorting tasks regarding norms about knowledge sharing, time available for knowledge sharing, and overview of colleagues with their respective task and ranking.

Factor code	Description by participant	Task	Ranking
Norms about knowledge sharing	Safety and privacy	First	2 out of 7
	Safety as a conditional factor	First	2 out of 7
	Opportunity to learn from mistakes	First	2 out of 7
	(Agreements about) personal product	Second	6 out of 9
	Agreements on intellectual property	Second	9 out of 9
Time available for knowledge sharing	Time available in regards to others	First	2 out of 7
	Time and ability	Second	2 out of 9
	The time (available)	Second	1 out of 9
Overview of colleagues	Overview of questions of others	First	1 out of 7
	Uncertainty about who is doing what hinders knowledge sharing	Second	5 out of 9

4.2 Content of interviews

4.2.1 Frequency of codes

To gain further in-depth knowledge about the factors influencing spontaneous knowledge sharing in an online environment, the transcripts of the interviews were analyzed. As shown in Table 5 on the next page, the factors confidence online, required effort, and online interaction were split up into two separate codes as a clear distinction could be made in the content of the transcripts about these factors. Confidence online was split up into technical confidence online and social confidence online as participants not only mentioned their confidence in their ability to use online applications but also their confidence in their ability to communicate online. Next, the required effort was changed to own required effort and required effort dependent on others, as participants made a distinction between the effort they would need to take independently and the effort they would need to take where they were dependent on the actions of others. Lastly, the online interaction with colleagues was split up into how communication aspects such as body language influence knowledge sharing, defined as communication online, and the amount of interaction that takes place online.

Compared to the results of the sorting tasks, the five factors ranked highest were all coded more than 100 times. Required effort, a combination of two codes, was coded a total of 143 times (36 + 107 times). Added value of knowledge sharing was coded 146 times, relationship/connection with colleagues 171 times, and amount of spontaneity 208 times. Lastly, online interaction, a combination of two codes, was coded 243 times (52 + 191 times). As for the extra factors that stood out in the results from the sorting tasks, the norms about knowledge was coded 99 times, the overview of colleagues was coded 100 times and the time available for knowledge sharing was coded 79 times. Strikingly, two factors that were not ranked as important were also coded often in the transcripts. Namely, content of knowledge was coded 130 times, and form of knowledge was mentioned the most with a frequency of 257. However, as stated before, frequencies give limited insight into qualitative data. Therefore, the co-occurrences of codes regarding sentiment and quotes that give an impression of how certain codes were mentioned by participants will be discussed in more detail.

Table 5.

Codes with their frequency (n) and corresponding factor sorting task.

Code	n	Corresponding factor sorting task
4.1 Technical confidence online	53	Confidence online
4.2 Social confidence online	79	Confidence online
4.3 Required effort dependent on others	36	Required effort for knowledge sharing
4.4 Own required effort	107	Required effort for knowledge sharing
4.5 Amount of spontaneity	208	Spontaneous character of online application
4.6 Communication online	52	Online interaction with colleagues
4.7 Amount of interaction	191	Online interaction with colleagues
4.8 Form of knowledge	257	Way of communicating online
4.9 Relationship/connection with colleagues	171	Relationship/connection with colleagues
4.10 Content of knowledge	130	The kind of knowledge one wants to share
4.11 Own opinion	59	Own opinion/view about knowledge sharing
4.12 Opinion of others	77	Opinions/views of others about knowledge sharing
4.13 Added value of knowledge sharing	146	Added value of knowledge sharing
4.14 Encouraged by organization	71	Sharing knowledge is encouraged by the organization
4.15 Reciprocity of knowledge sharing	87	Reciprocity of knowledge sharing
4.16 Flow of information	82	Extra factor by researcher
4.17 Norms about knowledge sharing	99	Extra factor by sorting tasks
4.18 Synchronicity	27	Extra factor by sorting tasks
4.19 Overview of colleagues	100	Extra factor by sorting tasks
4.20 Time available for knowledge sharing	79	Extra factor by sorting tasks
4.21 Usability	54	Extra factor by sorting tasks
4.22 Findability of knowledge	23	Extra factor by researcher

4.2.2 Co-occurrence regarding sentiment

As can be seen in Figure 7, the sentiment varied depending on the situation participants were describing in their interview. Situations taking place before the pandemic were mostly mentioned with a positive sentiment. This positive sentiment was also present for situations during the pandemic, but for direct comparisons between before and during the pandemic, the positive sentiment was rarely mentioned. Additionally, for both during the pandemic and the direct comparison, the negative sentiment was mentioned more often than the ambiguous sentiment. This might indicate that the change to working online with regards to knowledge sharing was, in general, not perceived as a positive change by participants.

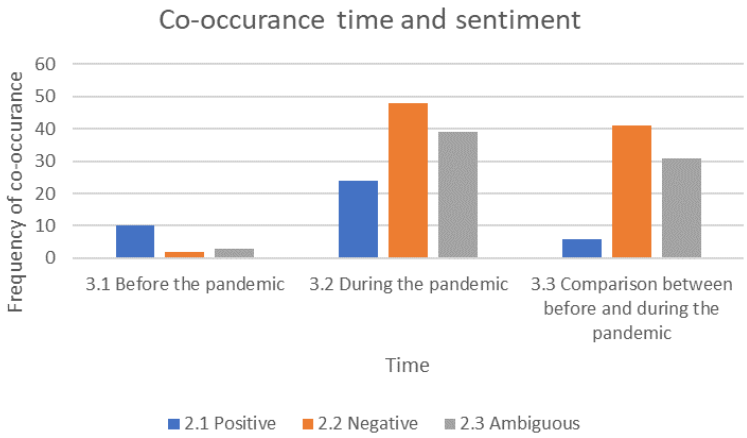

Figure 7. Co-occurrence of time and sentiment.

To gain further insight into the sentiment regarding specific factors influencing knowledge sharing, Figure 8 on the next page provides an overview. As can be seen, almost all factors were mostly mentioned in combination with a negative or ambiguous sentiment. The only exception being 4.10 content of knowledge, which was mentioned both with a negative and positive sentiment an equal number of times. Next, the factors 4.5 amount of spontaneity, 4.6 communication online, 4.7 amount of interaction, 4.19 overview of colleagues, and 4.20 time available for knowledge sharing were mentioned most often with a negative sentiment. Interestingly, for 4.5 amount of spontaneity and 4.7 amount of interaction, the positive sentiment was mentioned relatively often by participants in comparison to other factors. This was also the case for 4.8 form of knowledge and 4.9 relationship/connection with colleagues. To further illustrate how certain factors were discussed positively, negatively, or ambiguously quotes will be presented and discussed.

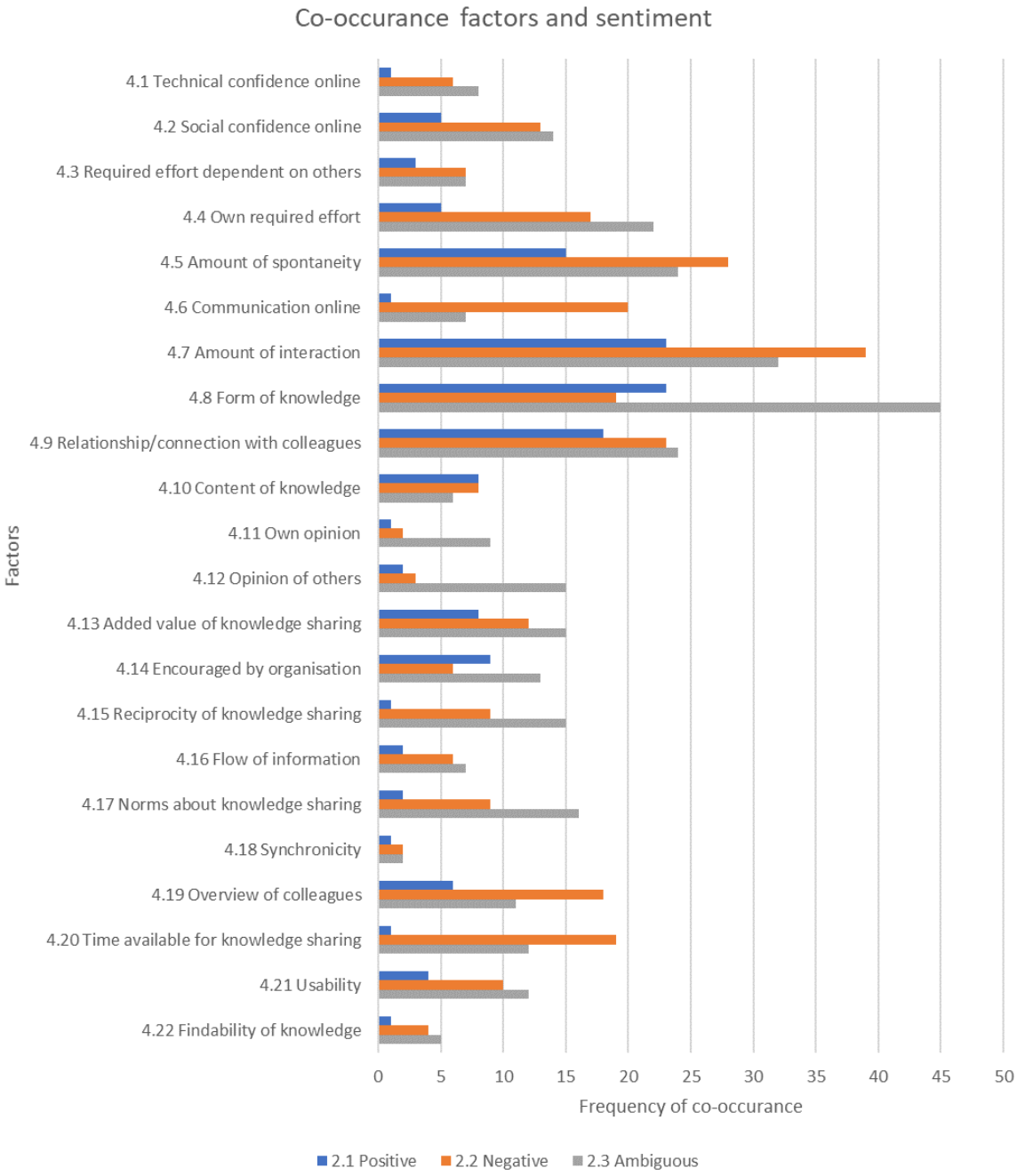

Figure 8. Co-occurrence of factors and sentiment.

4.2.3 Factors explained by quotes

The relationship/connection with colleagues was often mentioned by participants as necessary for knowledge sharing. Participant 6 stated for example that interacting with colleagues prevented them from feeling isolated, *"Well, the interaction means that I am not alone at home here, in my isolation, but that I also speak to people, even if it is only through a screen"* (quote 23). Similarly, participant 1 emphasized the need for working together with colleagues by stating, *"But I don't think we can do our job on our own, so it (sharing knowledge) is indirectly encouraged"* (quote 40). So, the relationship and connection with colleagues was indicated as necessary to share knowledge which matches with the high ranking of this factor in the sorting tasks given by participants.

Another high-ranking factor of the sorting task, the added value of knowledge sharing, was directly related to the intention to share knowledge by participants. Participant 15 elaborated on this by explaining that whether a colleague perceives knowledge as of added value and indicates this to the participant, influences whether the participant will share knowledge with that person in the future (quote 44). Additionally, it was mentioned that there was a need to know the added value of knowledge sharing before performing the behavior, *"(...) I find it increasingly important to know what the benefit of a certain activity is, what we are going to do with it and what will come of it. Because we are all very busy and you still put time and energy into it. And if nothing happens with it again, that is just very stupid."* (participant 13, quote 12). Finally, a participant linked the added value of knowledge to the flow of information by stating that also too much knowledge can be shared. *"...the more that is shared, the more you have to keep track of and then at some point, it no longer fits my work schedule. And at a certain point, I think; I'm done with it. I don't want to read things every night. So, there is also a limit to that."* (participant 8, quote 30). Therefore, the knowledge that is shared should be of added value, while keeping in mind that sharing too much knowledge can have the consequence of colleagues not reading or using the knowledge that was shared. Lastly, if knowledge is of added value, showing appreciation to the person who shared the knowledge can influence the intention of this person to share knowledge in the future.

Participants made a differentiation between the own required effort to share knowledge and the required effort to share knowledge that is dependent on others. For the own required effort, participant 6 related it to the lack of spontaneity in the online environment, *"...it's just calling via Teams. Of course, it is never just walking past someone and spontaneously starting a conversation. You always have to open a program and I think some of the spontaneity disappears because of the online interaction."* (quote 18). Participant 12 adds to this by stating that the spontaneity of online applications concerning the amount of effort required for knowledge sharing influences their intention of sharing knowledge via a specific online application (quote 20). As for the required effort dependent on others, participant 11 mentioned that both the availability and the digital skills of others influence the extent to which knowledge is shared (quote 9). Additionally, the size of the group in which knowledge is being shared influences the required effort as well. "*The main thing is, if you want to discuss something in a group, I think it takes a bit more effort because you have to agree with each other on how you are going to structure the meeting. So, everyone takes turns telling something. (…) yes, the structuring takes more effort.*" (participant 4, quote 18). To summarize, the own required effort for knowledge sharing was connected by participants to the spontaneity with which knowledge can be shared and the required effort dependent on others was related to the availability and digital skills of others, in addition to the size of the group in which knowledge is shared.

Next, the online interaction with colleagues, which was also ranked high in the sorting tasks, was split into amount of online interaction and communication online. For the amount of interaction online participants indicated that the online context has influenced the number of people they are interacting with, *"It is now much more in subgroups, so you are interacting a lot with the colleagues you have projects with and with whom you have a certain connection. But there are also a lot of colleagues that I hardly speak to at all."* (participant 2, quote 40). Additionally, participant 9 explained that the online context in which the interaction takes place causes a lack of human connection, which makes the use of a webcam more important for them (quote 34). Next, communication online was explained as communication being limited in an online context with hesitance in communication and social confidence playing a role (participant 7, quote 6 & 40). Lastly,

participant 13 indicated that miscommunication is more likely to happen in the online context, *"(…) the spontaneous character, that's one thing that went completely wrong during a meeting, in the chat, and that makes it unclear to me what I can or cannot do spontaneously. You know, jokes online are tricky, you always have to put a smiley after it to indicate that it was a joke (laughs), otherwise people take it way too seriously."* (quote 40). In short, for the amount of interaction, the relationship and connection with other people has an influence, with the communication online being mostly mentioned by participants as a barrier to effective knowledge sharing in an online context.

The last factor that was ranked high in the sorting tasks, the amount of spontaneity, was described by participants as having decreased with the interactions having become more business-like (participant 12, quote 8). In addition, participant 12 explained that the way knowledge that is shared is being used has changed, with the creative process between colleagues, in which knowledge is generated and reflected upon, missing in the online context (quote 10). However, the lack of spontaneity was also mentioned in a positive light by participant 2. *"...I also often notice that during meetings, when something spontaneously comes up, it quickly becomes a lot of information and I quickly forget that information. And what we sometimes do is that when someone has something to share spontaneously, that they also put it in the chat or in Teams, and that you can look back on it. I find that very useful, also of the online environment, that you can find things very easily. Normally you would have to take notes, you would have to ask that colleague again and now, if it's in the system, you can easily retrieve things."* (quote 18). Therefore, the amount of spontaneity hinders the creative process related to knowledge sharing in the online context, however, the online context also ensures that knowledge that was spontaneously shared can be stored and retrieved more easily.

As mentioned before, even though the content and form of knowledge were not ranked high in the sorting tasks, they were mentioned often by the participants with form of knowledge being the factor with the highest frequency. The form of knowledge was often mentioned with regards to the preferences for online applications with which knowledge is shared, however preferences differed per participant with some participants having opposing preferences (participant 5, quote 44). Moreover, the form which is used to share and store knowledge can also cause confusion as explained by participant 10, *"We really used the Teams environment and then I see with some colleagues: yes, but is it on the P-disk? Is it now on Teams? You know, so that there can sometimes be confusion about: but which channel do we actually use?*" (quote 13). Next, for the content of knowledge, participants emphasized that knowledge sharing does not always have to pertain to work but can also be about interests or personal information (participant 1, quote 38). Participant 9 elaborated on this by stating, *"I think for spontaneous and informal, a bit of chitchat is also involved. And then, especially if they are your direct colleagues, it is also important that you can do that too. And there should be a little more attention for that, also in an online environment."* (quote 70). Lastly, participant 1 explained that the so-called 'chitchat' occurred more often before the pandemic because there were more spontaneous interactions (quote 34). So, the preferences for the form with which knowledge is shared vary between participants, the form which is used should be clearly communicated to avoid confusion, and the content of knowledge should not only be about work but also about 'chitchat', which requires more attention in an online context.

Lastly, as mentioned before, overview of colleagues, norms about knowledge sharing, and time available for knowledge sharing stood out from the factors that were added to the sorting tasks by participants. For the overview of colleagues, participant 14 indicated that having this overview of the work activities, but also the interests and questions of colleagues was related to the effort

required for knowledge sharing (quote 29). In addition, the overview of colleagues was perceived as less present in the remote work context. As stated by participant 3, *"So, I think I would normally talk more about what exactly I'm working on when I'm walking in the office with colleagues or talking to them. I think that happens less now and therefore it remains a bit vaguer. I have broad ideas about what my colleagues are doing, but before (the pandemic) I knew more details about what they were doing exactly."* (quote 3). Next, norms about knowledge sharing were described as necessary and not yet present in the organization, for example in the form of rules of conduct online (participant 7, quote 33). Moreover, the norms about knowledge sharing were also related to the expectations employees have about others with regards to knowledge sharing. Participant 4 explains this as follows, *"(…) the chat, I think what happens with that, what we didn't have before, is that you can now communicate very quickly with each other. So, before everything went by e-mail, we did have skype for business in which we could send chat messages. But now it is expected that you also keep an eye on the chat and that you respond to it, and a lot more happens in the chat than before."* (quote 23). Lastly, the time available for knowledge sharing was perceived as lacking, with participant 14 mentioning that there is not enough time to gain and share knowledge while also going beyond a surface level of knowledge (quote 37). Additionally, participant 11 relates the time available to the technical confidence that is needed to share knowledge effectively. Namely, *"I do think that there is room for improvement, so other colleagues, maybe they should take a little more time to discover what is possible. In terms of technical possibilities, what is possible and that they might also be able to try more things, different functions or something. Yes, I think there is still room for improvement there, so really the individual professionalization."* (quote 33). To conclude, the overview of colleagues related to the required effort for knowledge sharing and was perceived as less present in the online context. The norms about knowledge sharing were mentioned in relation to expectations and rules of conduct and were described as not yet present in the organization. Lastly, participants indicated that there was not enough time available for thorough and detailed knowledge gaining and sharing, which was also related to technical confidence online.

4.2.4 Co-occurrences between factors

Next to the frequency and content of factors, the co-occurrences between factors were also analyzed. Within the co-occurrence table for the factors influencing knowledge sharing (see Appendix F), two groups of three factors stood out as they were often mentioned together by participants. In Figure 9 below, the two groups are displayed with the solid lines indicating the frequency of co-occurrence between two factors and the dotted lines indicating the frequency of co-occurrence between three factors. For both groups, the amount of spontaneity and the amount of interaction are included, with one group combining the two factors with the relationship/connection with colleagues and the other group combining the two factors with the form of knowledge.

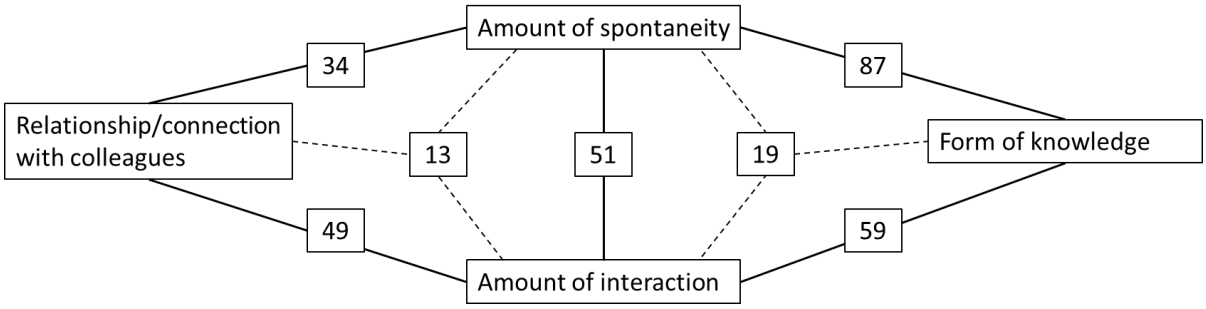

Figure 9. Co-occurrences between interaction, spontaneity, relationship, and form of knowledge.

The amount of spontaneity, amount of interaction, and relationship/connection with colleagues were connected to each other by participants stating that the decrease in spontaneity in the online context causes a decrease in informal interactions, which in turn affects the relationship and connection between colleagues. As participant 3 states, *"Personally, I walked more through the faculties, and then you still used to bump into someone in the hallway or somewhere else, and that is just less now. (…) I just see fewer people (…) the knowledge sharing, it's all just a bit more businesslike and the spontaneity is more present in the informal contacts..."* (quote 9). Participant 7 elaborates on this by mentioning that the online context increases the distance between colleagues, *"Where now, now it becomes much more of an island culture, each person with their own things. And the main points are shared, but not thinking about it together, looking at it together: what does this mean?"* (quote 10). So, the relationship/connection with colleagues is important for spontaneously sharing knowledge, but the amount of spontaneity in interactions also affects the relationship and connection with colleagues.

For the second group of co-occurrences, amount of spontaneity, amount of interaction, and form of knowledge, the form of knowledge influenced the amount of spontaneity and interaction according to participants. For example, the setting in which knowledge is shared influences if and when feedback is received, which in turn influences the amount of interaction and the spontaneity of the interaction. As participant 10 states, *"I think I will share things more spontaneously in a smaller live setting, then in an environment where I will not get direct feedback or where I don't know whom all can see it or read it."* (quote 21). Additionally, the form of knowledge dictates how many people can partake in a, somewhat, spontaneous interaction. Participant 3 explains this in the following way, *"... most systems are aimed at only having one person talking at a time, otherwise you will talk over each other, and you will no longer be able to understand each other. (…) in small groups, you do have a bit more spontaneous knowledge sharing than in larger groups."* (quote 32). In short, the form of knowledge sharing influences the amount of spontaneity and interaction, which in turn influences the effectiveness with which knowledge is shared.

Striking about these two groups of co-occurrences are the factors that are included in the two groups next to the amount of spontaneity and the amount of interaction, which form the core of the research question. The relationship/connection with colleagues is the highest-ranked factor of the sorting task and the form of knowledge is the factor that was mentioned most often by participants. Next, these two groups of co-occurrences, as well as the other results will be discussed and connected to other literature. Furthermore, theoretical and practical implications will be highlighted, as well as limitations and suggestions for further research. Lastly, a conclusion to the sub-questions and main research question will be provided.

5. Discussion

5.1 Discussion of results

This study aimed to analyze the extent to which knowledge sharing through spontaneous interaction among knowledge workers can be facilitated in an online environment. To this end, qualitative interviews were conducted which resulted in a ranking of factors that might influence knowledge sharing and a qualitative analysis of the content of the interviews. For the ranking that resulted from the sorting tasks, it is interesting to note that both factors connected to relatedness, relationship/connection with colleagues, and online interaction with colleagues, were ranked as important. However, the subjective norm, which included the opinions/views of others and the encouragement by the organization, was not ranked as important for both factors. For the attitude towards knowledge sharing the participants only indicated that the added value was important, and for perceived behavioral control only the way of communicating online was ranked as important. Lastly, from the factors initially connected to actual behavioral control the required effort and spontaneous character were ranked as important, but participants also added factors to the actual behavioral control such as overview of colleagues and time available for knowledge sharing. Similarly, norms about knowledge sharing was also added as a factor by participants which could indicate that subjective norm is perceived as important by participants, however, if that is the case it was not directly related to the norms of others. To summarize, all factors connected to relatedness were ranked as important with the factors connected to attitude, subjective norm, perceived behavioral control, and actual behavioral control being partially ranked as important by participants.

Next, in addition to the high-ranking factors in the sorting tasks, it is important to take note of the factors that were ranked low. For the first sorting task, the way of communicating online, in the coding process changed to form of knowledge, was ranked low on importance. However, this factor was mentioned most often by participants which might indicate that although it is not perceived as important by participants in comparison to the other factors, it does influence knowledge sharing. Confidence online was also ranked low in the first sorting task, but a possible explanation for this could be that the learning department for which the participants' work has a team that focuses specifically on technical support for learning. Therefore, it could be likely that the confidence in using online applications was high for most of the participants and thus rated relatively low on importance.

Furthermore, for the second sorting task, one’s own opinion/view about knowledge sharing, the opinions/views of others, and the encouragement by the organization were ranked low on importance. This could indicate that both attitude towards knowledge sharing and the subjective norm do not influence the intention to share knowledge. However, in contradiction, the perceived added value for knowledge sharing was ranked high and the norms about knowledge sharing was mentioned relatively often as an additional factor. This could be an indication that only the perceived added value is relevant for the attitude towards knowledge sharing and that the norms about knowledge sharing are important, but it does not matter if it is one’s own norms, the norms of colleagues, or the norms of the organization. Next, the kind of knowledge one wants to share, in the coding process changed to content of knowledge, was also ranked low but mentioned fairly often by participants. Similar to form of knowledge, this could be an indication that the content of knowledge does have an influence but is not perceived as important by participants in comparison to the other factors. Lastly, reciprocity of knowledge sharing was ranked low, which is not very surprising considering that the participants share knowledge frequently to perform well in their job.

Another surprising result is that the factors influencing knowledge sharing, which were divided into two sorting tasks, could not be divided in the codebook. During the analysis, it became apparent that there is an overlap between motivational factors directly related to the online environment and motivational factors not directly related to the online environment. Participants often mentioned the factors in an online and offline context, which indicates that the online environment does have an influence on knowledge sharing but is not a completely new factor in the facilitation of knowledge sharing. Rather, the context in which knowledge is shared also played a role before the pandemic but has become more prominent since the context has undergone a relatively big and sudden change due to the pandemic. This prominent role is shown in the relatively small distance between the ranking of factors in the first sorting task that focused on the online environment, and the relatively big distance between the ranking of factors in the second sorting task which did not directly focus on the online context. Additionally, the factor relationship/ connection with colleagues from the second sorting task was often mentioned by participants as having been influenced by the change to remote work.

Moreover, there were two groups of three factors that influence knowledge shared that were mentioned relatively often together by the participants. The first group is a combination of relationship/connection with colleagues, amount of spontaneity, and amount of interaction, and the second group is a combination of form of knowledge, amount of spontaneity, and amount of interaction. As knowledge sharing through spontaneous interaction is the core of the research question, these two groups of factors give relevant insights for answering the research question. For the combination with relationship/connection with colleagues, which is the highest-ranked factor of the sorting tasks, it is interesting to note that participants indicated that there was a two-way influence. Not only do the number of spontaneous interactions influence the relationship and connection with colleagues, but the relationship and connection also influence the intention to have spontaneous interactions with colleagues. Within the interviews, some participants mentioned the need for an overview of colleagues, about work activities but also personal interests and questions, in order to connect with and approach colleagues more easily. In addition, participants indicated that in the communication online misunderstandings were more likely to occur, which influences the relationship/connection between colleagues. Therefore, the relationship/connection with colleagues is important in the facilitation of knowledge sharing through spontaneous interactions, with factors as overview of colleagues and communication online having an influence as well.

Lastly, for the combination with form of knowledge, which is the factor mentioned most often by participants, the content of this combination varied between participants. Some participants had opposing preferences for the form with which knowledge is shared, in which one participant saw a certain aspect as an advantage with another participant seeing this aspect as a disadvantage. This study did not focus on analyzing which specific form of knowledge facilitates knowledge sharing in an online context best, which will be discussed in further detail in the limitations section. What can be concluded is that the form of knowledge influences the facilitation of knowledge sharing and that this facilitation can be optimized. For this specific university department, it was indicated by participants that having more time available for discovering the possibilities of online applications can positively influence the technical confidence online. This in turn influences the intention of knowledge sharing and the effectivity with which knowledge is shared.

5.2 Theoretical and practical implications

That the relationship and connection employees have with their colleagues is important, is corroborated by other studies and experts as well. It is indeed a trend that employees have a higher chance of getting disconnected from their colleagues while working remotely (Meester, 2021). However, organizations are also becoming more aware that the relationship and connection between employees are important for the functioning of the organization (Meester, 2021). An annual report by Microsoft (2021) argues that strong workplace relationships contribute towards productivity and innovation. Similar to this study, the annual report concludes that the social networks of employees have shrunk, mentioning pandemic-driven isolation as the main reason (Microsoft, 2021). Hence, the relationship and connection between colleagues should not be underestimated as it affects the knowledge sharing and consequent functioning of an organization. Kimble (2020) also is of the opinion that knowledge sharing is important for organizations and presents three requirements for the facilitation of knowledge sharing. The organizational culture should support knowledge sharing, personal relationships should be developed and nurtured, and organizational structures should be built appropriately (Kimble, 2020). In short, strong relationships can contribute to knowledge sharing as long as reciprocity does not become a requirement, knowing who knows what influences the effectivity with which knowledge can be shared, and knowledge sharing should be embedded in the structure of the organization such as specific applications that facilitate the process or employees that manage the process of knowledge sharing (Kimble, 2020). Although reciprocity was not mentioned as a barrier to knowledge sharing in this study, it should not be discounted. However, the overview of colleagues and the form with which knowledge is shared are indeed important next to the relationship/connection with colleagues.

The effect of the online environment on knowledge sharing is something organizations need to be aware of. Making well-thought-out choices while hybrid forms of working are becoming possible again, due to lockdown restrictions easing up, is important for organizations. Microsoft (2021) states that hybrid forms of work can positively influence the relationship and connection between employees, while also increasing the social networks of employees. Similarly, other organizations are also considering how offices might need to be changed to facilitate a hybrid form of working (Esser, 2020). For example, days at the office could be scheduled around working together and interacting with colleagues, while working at home could be focused on the work that can be completed individually. Some organizations are considering changing individual offices to communal spaces to facilitate the interaction between employees in the office (Esser, 2020). Next to facilitating the relationship/connection with colleagues and the interaction between colleagues, overview of colleagues could also be facilitated in this process. As participants in this study indicated, they knew more details about the work activities and personal interests of their colleagues when they could still meet each other in the hallway or next to the coffee machine. Therefore, creating communal spaces in the office, not only for work-related knowledge sharing but also for non-work-related knowledge sharing could be beneficial for organizations.

Research on which form or medium for knowledge sharing works best is scarce. Additionally, the research that is done emphasizes that the effectiveness of a medium for knowledge sharing differs between organizations (McGregor et al., 2019). McGregor et al. (2019) emphasize that there is no one-size-fits-all solution and that social dynamics in organizations could influence the effectiveness of knowledge sharing within a certain application or medium. Therefore, it is not surprising that the opinions on form of knowledge also differed in this study. Next to a specific form or medium for knowledge sharing, research found that gamification, the use of game elements in

applications, could positively influence knowledge sharing (Spanellis et al., 2020). Spanellis et al. (2020) argue that gamification elements could facilitate more collaboration between employees, make routine work more exciting, and make roles within a company more visible. Therefore, there are possibilities for the form of knowledge to not only facilitate knowledge sharing but also facilitate the social networks of employees and thus the relationship/connection with colleagues. However, one element of gamification is a reward system, and, as stated before, putting too much emphasis on reciprocity in knowledge sharing can form a barrier to forming strong relationships between colleagues (Kimble, 2020). In short, the effectiveness of the form with which knowledge is shared differs per organization and social dynamics should be considered in the process of choosing a medium or application for knowledge sharing.

Within this study, participants gave no clear indication whether their own opinion about knowledge sharing, the opinions of others about knowledge sharing, or the encouragement by the organization was more important. As social dynamics can play a role in the facilitation of knowledge sharing (McGregor et al., 2019), it might be wise to include all employees in decisions or changes regarding the structure of knowledge sharing. Especially since every employee needs to be able to share knowledge effectively within their organization. In this study specifically, it was indicated that creating an equal level of technical confidence among employees could positively impact the effectiveness of online knowledge sharing. However, it was also indicated that it should be the choice of the employee and not a mandatory requirement made by the organization. This is a delicate balance as the organization is the one that gives employees the time to practice and increase their technical confidence. Similarly, organizations are also the ones responsible for supplying their employees with a budget for efficient home office supplies (Usborne, 2020). Most importantly, organizations should be aware of the importance and effect of knowledge sharing and consequent learning on the effectivity with which their organization operates (Eraut, 2004). When the management of an organization is aware of this, they can communicate this importance to their employees while also facilitating the knowledge sharing. One of the results of this study indicated that for the subjective norm, only norms about knowledge sharing in general were found important by participants. So, for this specific university department, it might be wise to discuss the norms about knowledge sharing with everyone involved. Finding a medium or application for knowledge sharing that fits the preferences of all employees might be a challenge but providing extra time and resources to create an equal level of technical confidence could have a positive influence.

5.3 Limitations and suggestions for further research

There are several factors that can be considered a limitation of this study. Firstly, all interviews were conducted in an online setting, which might have affected how openly participants spoke on certain topics. For instance, some participants were hesitant in answering questions about where there was room for improvement within the department. If interviews had taken place in a face-to-face setting participants might have been more open, as there would have been more opportunity for the researcher to build a connection of trust with the participants. Additionally, the researcher would be able to react better to the body language of the participants, as the webcam image of participants was very small throughout a large part of the interview due to the screen-sharing for the sorting tasks. So, for further research with a similar method and topic, it might be best to conduct data collection in a face-to-face setting.

Next, for this study, employees of a very specific organization were interviewed which might make the results less useful in a broader context. However, the results could still serve as inspiration for other organizations to reflect on the knowledge-sharing process and structure in their organization. To gather useful data for this exploratory study, a population was chosen that works with and shares knowledge frequently. However, knowledge workers are not the only type of workers that share knowledge. Therefore, it is interesting for future research to focus on other populations and the facilitation of their knowledge sharing. For example, it could be interesting to study how knowledge sharing should be facilitated for theoretical knowledge and practical knowledge, as knowledge cannot always be shared through written text alone.

As this study was exploratory in nature, not every factor that influences knowledge sharing might be included. As the interviews could not take too long, the sorting tasks were kept relatively short so participants would be able to complete them within the set timeframe. Although the factors were kept general and the interviews focused largely on the interpretation and input of participants, not every relevant factor might have been included or mentioned. Nevertheless, this study provides an overview which further research can use as a starting point. The qualitative nature also means that the results do not include any significant effects of factors on knowledge sharing. Therefore, it might be interesting for further research to study the most important factors, as indicated by participants in this study, by using a quantitative method, so it can be analyzed which factors have a significant effect on knowledge sharing.

Lastly, the study did not focus on any specific form or medium with which knowledge could be shared. As the form of knowledge was only included in the general sense and it was not the specific focus of the study, no overview or comparison can be made between different forms or mediums for knowledge sharing. It could be interesting for future research to focus on which form or medium facilitates knowledge sharing most effectively. Additionally, the transcripts for this study could be analyzed with a codebook focused on specific aspects of online applications that could serve as input for further research on the topic. Finally, as lockdown restrictions are easing up, it could be relevant to focus on forms of knowledge sharing that can be used in an online and offline setting to fit a hybrid form of working.

5.4 Conclusion

In this study, the main research question, “To what extent can knowledge sharing among knowledge workers through spontaneous interaction be facilitated in an online environment?”, was answered by using two sub-questions. As stated before, during the analysis no distinction could be made between the focus of the two sub-questions, motivational factors directly related to the online environment and motivational factors not directly related to the online environment. This shows that the online environment cannot be seen separately from the motivation and intention to share knowledge. However, this study does show that the change to working remotely in an online environment, due to the pandemic, has an impact on the knowledge sharing of participants. In the interviews, participants indicated that relatedness was most important for the facilitation of knowledge sharing. For subjective norm, only general norms were mentioned as important with the opinions of others and the encouragement by the organization being ranked low in the sorting tasks. Similarly, the own opinion on knowledge sharing was ranked low, with only the added value of knowledge sharing being ranked high as a factor influencing the attitude towards knowledge sharing. For perceived behavioral control, the form with which knowledge is shared was not ranked

as important but was mentioned most often by participants. Lastly, for the actual behavioral control the required effort, and spontaneity were ranked as important, and the overview of colleagues and time available for knowledge sharing were added as extra factors by participants. Overall, the amount of interaction and the amount of spontaneity were mentioned together often with both the relationship/connection with colleagues and the form of knowledge, in two groups of three factors. These combinations showed that the relationship/connection with colleagues is important in the facilitation of knowledge sharing through spontaneous interactions, with factors as overview of colleagues and communication online having an influence as well. In addition, it can be concluded that the form of knowledge influences the facilitation of knowledge sharing and that this facilitation can be optimized on the factors time available for knowledge sharing and technical confidence. To conclude, knowledge sharing through spontaneous interaction among knowledge workers can be facilitated online when the relationship/connection with colleagues and the form with which knowledge is shared are considered.

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Appendix A. Informed consent

Since the participants gave their informed consent on videorecording, the recordings cannot be included as appendix as they contain personal identifiable information. To verify that informed consent was given by all participants, access to the recordings can be requested by contacting the researcher at the following email address: m.j.s.luttikhuis@student.utwente.nl.

Appendix B. Interview scheme

Briefing (5 min.) → 0-5 minuten

- Samenvatting informed consent document
- → Start video-opname
- Vraag naar informed consent op video-opname

Demographics (5 min) → 5-10 minuten

- Leeftijd
- Hoe lang werkzaam voor organisatie
- Functie binnen organisatie

Knowledge sharing (10 min.) → 10-20 minuten

- Waar denk je aan bij spontane kennis deling?
- Welke kennis deel jij spontaan met collega's binnen organisatie?
- Hoe deelde je deze kennis voor de pandemie?
- Hoe deel je deze kennis sinds de pandemie? (focus op welke kennis nog wel wordt gedeeld en wat niet?)
    - Waarom werd kennis niet meer of op een andere manier gedeeld?
- Wat zijn de grootste verschillen qua spontane kennis deling met collega's tussen voor en tijdens de pandemie?

Technological factors (15-20 min.) → 20-35 minuten

- ☐ Zelfverzekerdheid online
- ☐ Online interactie met collega's
- ☐ Spontane karakter van online applicaties
- ☐ Manier van online communiceren (chat, audio, video etc.)
- ☐ Benodigde inspanning voor kennis deling

(**EERST DOORLOPEN)** voorbeeldvragen:

- Waar denk je aan bij elk van de factoren?
- Heb je nog andere factoren die je toe zou voegen?

(**BEGIN OPDRACHT**) voorbeeldvragen:

- Waarom plaats je deze factor hier?
- Hoe zie je deze factor terug in de huidige kennis deling binnen organisatie?
- Wat zou verbeterd kunnen worden binnen organisatie voor deze factor?

Motivational factors (15-20 min.) → 35-50 minuten

- Het soort kennis dat men wil delen
- Relaties met/tussen collega's
- Kennis deling wordt aangemoedigd vanuit de organisatie
- Toegevoegde waarde van kennis deling
- Mening van anderen over kennis deling
- Eigen mening/opvatting over kennis deling
- Wederkerigheid van kennis deling

(**EERST DOORLOPEN)** voorbeeldvragen:

- Waar denk je aan bij elk van de factoren?
- Heb je nog andere factoren die je toe zou voegen?

(**BEGIN OPDRACHT**) voorbeeldvragen:

- Waarom plaats je deze factor hier?
- Hoe zie je deze factor terug in de huidige kennis deling binnen organisatie?
- Wat zou verbeterd kunnen worden binnen organisatie voor deze factor?

Debriefing (5 min.) → 50-55 minuten

- Heeft u nog iets toe te voegen aan het interview?
- Kort samenvatten wat met verzamelde data gaat gebeuren
- Herhaal belangrijke onderdelen informed consent document
    - Mijn contactgegevens
    - Hoe wordt met persoonlijke informatie omgegaan
    - Tot slot heeft u het recht een verzoek tot inzage, wijziging, verwijdering of aanpassing van uw gegevens te doen bij de Onderzoeksleider.
- Interesse om samenvatting van resultaten te ontvangen?
- Nog vragen of opmerkingen?
- Bedanken voor deelname

Appendix C. Codebook

Table 6.

Codebook

Hoofd code en gebruiksinstructie	Deel code	Definitie
1. Nummer van participant → Te gebruiken wanneer een code wordt toegewezen aan iets wat een participant gezegd heeft. → 1 code per unit of analysis	1.1 Participant 1 1.2 Participant 2 1.3 Participant 3 1.4 Participant 4 1.5 Participant 5 1.6 Participant 6 1.7 Participant 7 1.8 Participant 8 1.9 Participant 9 1.10 Participant 10 1.11 Participant 11 1.12 Participant 12 1.13 Participant 13 1.14 Participant 14 1.15 Participant 15	Het nummer dat als pseudoniem aan elke participant is toegewezen.
2. Sentiment → Niet gebruiken als er alleen wordt benoemd hoe belangrijk een factor is → 1 code per unit of analysis	2.1 Positief 2.2 Negatief 2.3 Tweeledig	Voornamelijk positieve aspecten van een factor of situatie omtrent kennisdeling worden benoemd. Voornamelijk negatieve aspecten van een factor of situatie omtrent kennisdeling worden benoemd. Zowel positieve als negatieve aspecten van een factor of situatie omtrent kennisdeling worden in gelijke mate benoemd.
3. Tijdsaanduiding → Te gebruiken wanneer een tijdsaanduiding wordt benoemd bij en invloed heeft op een factor of voorbeeld → 1 code per unit of analysis	3.1 Voor de pandemie 3.2 Tijdens de pandemie 3.3 Vergelijking tussen voor en tijdens de pandemie	Er wordt een factor of situatie benoemd in relatie tot de werksituatie voor de pandemie. Er wordt een factor of situatie benoemd in relatie tot de werksituatie tijdens de pandemie (zowel volledige online als een gedeeltelijke online werksituatie). Er wordt een factor of situatie benoemd waarin een directe vergelijking wordt gemaakt tussen de werksituatie voor en tijdens de pandemie (beiden worden benoemd).
4. Factoren → Te gebruiken wanneer dingen benoemd worden in relatie tot kennisdeling en het al dan wel niet plaatsvinden van kennisdeling	4.1 Technische zelfverzekerdheid online 4.2 Sociale zelfverzekerdheid online 4.3 Inspanning afhankelijk van anderen 4.4 Eigen inspanning 4.5 Spontaniteit	Zelfverzekerdheid gerelateerd aan technische vaardigheden om een online applicatie of tool te gebruiken voor kennisdeling. Zelfverzekerdheid gerelateerd aan de omgang/communicatie met anderen omtrent kennisdeling. Benodigde inspanning afhankelijk van anderen, bijvoorbeeld als men afhankelijk is van de beschikbaarheid van collega's om kennis te delen. Benodigde inspanning gerelateerd aan welke stappen men zelf (onafhankelijk) moet nemen voordat kennis gedeeld kan worden. Mate van spontaniteit in de kennisdeling en de invloed dit heeft op de kennisdeling.

→ Meerdere codes per unit of analysis mogelijk	4.6 Communicatie online	Zaken zoals communicatiestijl en lichaamstaal die de communicatie met anderen online beïnvloeden (ook te gebruiken als er een vergelijking tussen online én offline communicatie wordt gemaakt).
	4.7 Mate van interactie	Mate van interactie online in relatie tot hoe vaak het plaatsvindt en hoeveel mensen er bij betrokken zijn.
	4.8 Vorm van kennis	De invloed van de vorm waarin kennis gedeeld wordt, zoals het medium (videogesprek), de tool (Miscrosoft Teams) en hoe de kennisdeling plaatsvindt (facilitator).
	4.9 Relatie met collega's	De relatie, band of connectie die men heeft met collega's en hoe deze de kennisdeling beïnvloed.
	4.10 Inhoud van kennis	De invloed van de inhoud van de kennis die gedeeld wordt (zowel het onderwerp als de specificiteit van de kennis).
	4.11 Eigen mening	De eigen mening en opvatting zijn van invloed op het delen van kennis.
	4.12 Mening anderen	De meningen en opvattingen van anderen zijn van invloed op het delen van kennis
	4.13 Toegevoegde waarde	De mate waarin kennisdeling als nuttig wordt ervaren of toegevoegde waarde heeft en de invloed hiervan op de kennisdeling.
	4.14 Aanmoediging organisatie	De invloed van het aanmoedigen of ondersteunen van kennisdeling vanuit de organisatie (zowel universiteit, organisatie, als directe leidinggevende).
	4.15 Wederkerigheid	De invloed van het over en weer kennis delen, op elkaar reageren in de kennisdeling en of iedereen deelneemt aan de kennisdeling.
	4.16 Informatiestroom	De invloed van de grootte van de informatiestroom aan kennis en het filteren/selecteren wat hiermee gepaard gaat (hoeveel kennis gedeeld en/of gebruikt wordt).
	4.17 Normen over kennisdeling	De invloed van gedragsregels en normen over kennisdeling zoals het mogen maken van fouten, veiligheid van kennis delen en de privacy.
	4.18 Synchroniteit	De invloed van synchroniteit van online tools en applicaties (synchroon of asynchroon).
	4.19 Overzicht van collega's	De invloed van het hebben van een overzicht van de werkzaamheden, interesses, kennis, en vragen van collega's voor de kennisdeling.
	4.20 Tijd	De invloed van de tijd die beschikbaar wordt geacht voor kennisdeling.
	4.21 Gebruiksvriendelijkheid tools	De invloed van de gebruiksvriendelijkheid van online tools, bijvoorbeeld of tools geïntegreerd zijn in de dagelijkse werkzaamheden en of de technische infrastructuur aanwezig is.
	4.22 Vindbaarheid kennis	De invloed van de opslag en vindbaarheid van kennis die gedeeld is.

Appendix D. Intercoder reliability tables

Table 7.

Intercoder reliability for sentiment

	2.1	2.2	2.3	No code	Total
2.1	8		1	1	10
2.2		15		1	16
2.3		1	10		11
No code		1	1		2
Total	8	17	12	2	39

Note. Cohen's Kappa is 0.77.

Table 8.

Intercoder reliability for time

	3.1	3.2	3.3	Nothing	Total
3.1	4				4
3.2		6	1		7
3.3			15	1	16
Nothing			1		1
Total	4	6	17	1	28

Note. Cohen's Kappa is 0.81.

Table 9.

Intercoder reliability for factors.

	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	4.10	4.11	4.12	4.13	4.14	4.15	4.16	4.17	4.18	4.19	4.20	4.21	4.22	Nothing	Total
4.1	3																							3
4.2		12																						12
4.3			3									1								1			1	6
4.4				16																			1	17
4.5					24																		2	26
4.6						1																		1
4.7			1				28									2							4	35
4.8								23																23
4.9		1							12											1			1	15
4.10										8														8
4.11											5						1							6
4.12												3												3
4.13										3			9										2	14
4.14														5										5
4.15									2						11									13
4.16																6							1	7
4.17																	8						1	9
4.18																		1						1
4.19																			8					8
4.20																				16				16
4.21																					3			3
4.22																						2		2
Nothing				1	3	1	5	1							2		1			3	1	1		19
Total	3	13	4	17	27	2	33	24	14	11	5	4	9	5	13	8	10	1	8	21	4	3	13	252

Note. Cohen's Kappa is 0.77.

Appendix E. Extra factors sorting task

Table 10.

Extra factors sorting task 1.

Extra's task 1	Ranking	Corresponding code(s)
Kwaliteit van de internetverbinding en wat deze met de applicatie doet	1	4.21
Beschikbaarheid van mensen, collega's, studenten en anderen	2	4.3
Real time of niet realtime werken (synchroon, asynchroon)	1	4.18
Veiligheid en privacy	2	4.17
Fysieke tools die verbonden zijn (knuffelbeertje)	7	4.8
Onzekerheid: how wordt het opgevat?	1	4.2
Onzekerheid: wat wordt bedoeld?	7	4.6
Interessante inhoud	1	4.10
Hoe goed je de collega kent	3	4.9
Veiligheid als voorwaardelijke factor	2	4.17
Technische infrastructuur	3	4.21
Overzicht van vragen van anderen	1	4.19
Beschikbaarheid qua tijd van anderen	2	4.3 + 4.20
Regisseren en faciliteren van spontane kennisdeling	1	4.8
Mogen leren van fouten	2	4.17

Table 11.

Extra factors sorting task 2.

Extra's task 2	Ranking	Corresponding code
Leidinggevende die het goede voorbeeld geeft qua kennisdeling	6	4.14
Tijd en kunnen	2	4.20
Detail/generiek kennis	3	4.10
Persoonlijk product	6	4.17
Dat iedereen mee doet en dingen deelt	4	4.15
Afspraken over intellectual property	9	4.17
De tijd	1	4.20
Wie kan er wat mee doen?	4	4.13
Onduidelijkheid wie waar mee bezig is, hindert kennisdeling	5	4.19

Appendix F. Co-occurrence table factors

Table 12. *Co-occurrence between factors*

Codes	4.1	4.2	4.3	4.4	4.5	4.6	4.7	4.8	4.9	4.10	4.11	4.12	4.13	4.14	4.15	4.16	4.17	4.18	4.19	4.20	4.21	4.22
4.1	-																					
4.2	12	-																				
4.3	2	3	-																			
4.4	10	6	10	-																		
4.5	3	17	8	28	-																	
4.6	2	11	0	4	8	-																
4.7	3	11	6	8	51*	10	-															
4.8	16	20	11	32	87*	10	59*	-														
4.9	2	15	3	8	34*	11	49*	19	-													
4.10	0	6	0	3	36	0	15	29	18	-												
4.11	1	4	2	2	5	1	4	12	5	2	-											
4.12	2	5	4	3	4	1	5	15	7	9	27	-										
4.13	3	10	1	12	12	3	15	17	14	37	18	20	-									
4.14	3	1	0	2	3	1	10	13	9	0	10	8	6	-								
4.15	2	4	1	8	6	1	16	9	8	3	7	10	10	9	-							
4.16	3	12	1	5	12	3	10	13	10	15	8	12	22	2	9	-						
4.17	2	11	1	4	5	10	15	20	30	1	8	12	8	5	24	6	-					
4.18	0	3	0	2	10	5	9	18	1	4	0	0	0	0	2	0	2	-				
4.19	0	7	2	9	21	1	19	18	25	18	3	4	21	3	4	18	8	0	-			
4.20	4	3	6	18	22	1	14	17	9	7	0	2	13	4	5	3	7	1	7	-		
4.21	9	1	2	15	14	6	8	22	3	0	3	4	0	2	4	1	2	0	0	1	-	
4.22	0	0	0	4	4	0	2	12	2	1	0	1	7	0	1	2	2	0	2	0	0	-

Note. *= co-occurrences as displayed in Figure 9