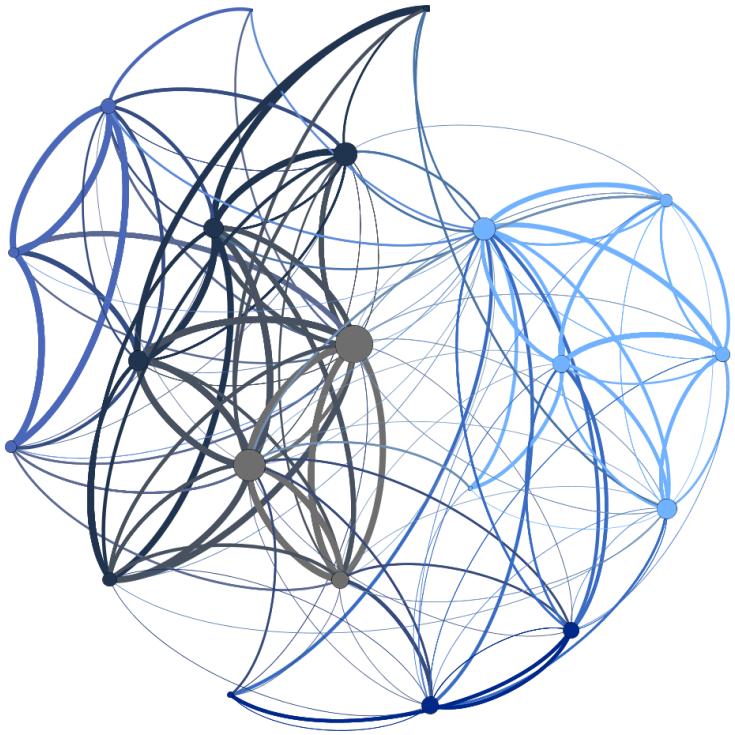
The hierarchy versus the social network; to support or to counteract?

An exploratory social network analysis on the creation and dynamics of tasks in an IT organization



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Acknowledgement

Abstract

Context: The interaction of individuals and organizations create extended structures of interactions which are called a social network. By implicating these relationships, the passing/exertion of ideas, knowledge, and power within a social network becomes possible. Social networks are especially important for organizations. Social networks are not only relevant to increase business by broadening and exploring the social network to make deals, but internal social networks and its communication are the main part of the functioning of the organization.
Aim: This research aims to investigate the emerge and communication of assignments and tasks in a social network from an IT organization by taking into consideration the dynamics of the existing social network to improve interaction between the different roles of system engineer, architect, product manager, and client manager.
Method: The scope of this research consisted of two teams in an IT organization who both deliver a part of an IT-service. An online questionnaire with 10 questions was filled in by eighteen employees to plot sociograms on the variables of assignments, ideas, plans, and social capital. Based on these sociograms, ten participants were selected to interview regarding the process of task creation and the dynamics of the social network when executing these tasks. For the interviews, the two actors with the highest closeness centrality and betweenness centrality were selected based on their prominent position. Besides, the product manager, architect, and client manager were interviewed since these roles have different tasks. Two interviewees were selected based on their position on the edges of the social network to investigate the perspective from employees who are active at the edges of the social network. Further, interviewees were selected based on the mentioning of these actors in other interviews, to explore their role and position in the social network.
Results: It was found that the social network and informal process play a significant role in not only the arise of assignments, but in all processes within the organization. Assignments arise from client requests and team members who have ideas on how to improve the IT-service. It was found that the role of client manager, architect, and product manager do not play a main role in the process of assignments creations and execution as expected. To illustrate, the task of the architect of creating tasks was mainly covered by the team itself. Two other important actors were found in the social network with a significant betweenness centrality and closeness centrality for ideas and knowledge. Moreover, ideas and knowledge are shared informally in the social network. Significantly, the architect is not prominently involved in the social networks of idea-sharing and advice seeking. This is significant because the role of the architect is to provide assignments and direction to improve the IT-service.
Implications: This study showed the relevance of social networks in organizations and provided insights on the interaction at the work floor compared to the hierarchical design. It is important to acknowledge these interactions in an organization. By doing so, these interactions can become a strength of the organization and can create an advantage. For this reason, the found results and recommendations can be used to improve the communication and process regarding the emerge of tasks and the dynamics of the social network in an organization. This research showed that it is important to find a balance between the formal and informal process since the hierarchy should support the interactions at the work floor and should not counteract them. However, it is important to stress that the informal process should not overrule since this might lead to a loss of control. Besides, it is relevant to take into consideration tasks and skills when conducting a reorganization because the formal description of employees does not always cover the informal role and knowledge and skills of employees.

Keywords: social networks, ideas, social capital, organizations, processes

Management Summary

The interaction of individuals and organizations create extended structures of interactions which are called a social network. By implicating these relationships, the passing/exertion of ideas, knowledge, and power within a social network becomes possible. In social networks in organizations, many communication flows are present which are influenced by relationships and hierarchies. In social networks in organizations, many communication flows are present which are influenced by relationships and hierarchies. Individual creativity, ethical behaviour, career mobility, technology adoption and organizational innovation (Brass, Galaskiewicz, Greve, & Tsai, as cited in Humphrey & LeBreton, 2019), are phenomena's that are present in an organizational social network. Moreover, diversities such as age, believes, status, religion, education, and attitudes are present in these social networks.

By using social network analysis, the social capital of knowledge and ideas can be shown. This is especially relevant during, for example, a reorganization because it can cause a shift regarding the emerge of assignments and tasks within a company. Therefore, an IT-organization which is going through a reorganization was selected. The research question was as follows: "*What is the network structure of interactions between different roles regarding the emerge of assignments, and which different perspectives can be identified about ideas, plans and knowledge in the social network?"* To investigate this research question, the constructs of interaction between teams and different roles (system engineer, architect, client manager, and product manager), communication, ideas, and knowledge gaining and sharing were investigated, because these elements are important to create assignments. The role of an architect is to oversee the foundation of basic products and the use of these products for certain end goals whilst the product manager is responsible for the presence and creation of different resources. The client manager is responsible for the contact with the client whilst the system engineers execute the assignment for the client.

Hence, this research aimed to provide advice on how to optimize an IT-service process, for which interaction between two teams is needed. This is relevant for the organization for the reason that it is tempting to focus on the beta aspect in these types of organizations, whilst the social aspect of interaction plays an important role in the process of creation and execution of tasks. Furthermore, organizations have formally designed authorities, but "*all formal or external systems breed informal networks that are grafted onto them*" (Kadushin, 2012, p. 90) which can be made visible to the management by using social network analysis. Additionally, complexity in an organization can be managed by designing hierarchies and communication flows, but it is to question whether these are followed in the organization.

Method

This research is a mix between a whole-network research design (also known as socio-centric) and a personal-network research design. The first part of the research consisted of a whole-network research design. The whole-network research design focusses on global patterns of connections and relationships between all actors (Borgatti, Everett, & Johnson, 2013). In order to collect data on the existing network in the organization and the passing of information regarding ideas, assignments, and plans, and skills, a questionnaire was sent. By the use of a questionnaire, data could be collected that created a sociogram of the existing social network. The representation of the sociogram was used to determine important actors in the social network who could be considered as important actors for arising assignments. In total, twenty participants filled in the survey, but two of these participants filled in the questionnaire after the plotting of the sociograms. However, during the interviews, the answers that were given and the influence of these people on the social network were taken into consideration. Participants fulfilled the function of system engineer, architect, product manager, or client manager. Three participants were employed by the organization for 1-5 years, three participants were employed for 6-9 years, and the other employees had more than 10 years of experience. The second part of the research consisted of a personal-network research design. To gain more detailed information about the interaction between actors in the network and the communication of assignments, interviews were conducted. Ten semi-structured interviews were conducted with employees of the organization. For the interviews, the two actors with the highest closeness centrality and betweenness centrality were selected. Besides, the product manager, architect, and client manager were interviewed because they fulfil a different role than system engineer. Two interviewees were selected based on their position on the edges of the social

network. Further, interviewees were selected based on the mentioning of these actors in other interviews, to explore their role in the social network. Subsequently, the collected data was transcribed and coded in a deductive way. The coding scheme was created based on the interview questions and responses from the participants. A second coder coded 10% of the data to assure the reliability of the coded data.

Results and recommendations

For the arising of assignments, two types of assignments can be distinguished; internal assignments to improve the IT-service and client-related assignments. The internal assignments mainly arise within the team. One actor was identified that receives most ideas and shares ideas most often for new assignments whilst this should be a task of the architect role. The architect and product manager provide a product plan to provide aims and resources. Significantly, the architect is not approached often to ask for advice regarding an assignment.

Other assignments arise from requests submitted by clients. This would mean that the formal role of client manager should be approached often for advice and ideas regarding tasks. However, one system engineer can be identified as the main actor in this process. This can be due to the way of formulating the questionnaire since it asked about assignments in general and no distinction was made between technical aspects and client related topics. The importance of this role was also identified by the participants during the interviews. Therefore, this person can be considered as a broker of information and the relationship between this participant, the client, and client manager should be highly valued.

The role of an architect is to oversee the foundation of basic products and the use of these products for certain end goals. The architect designs how the products of the service can be used and applied; the architect provides boundaries and aims for life cycle management. Moreover, the architect controls a roadmap which can be seen as the plan and future of the service. Subsequently, the product manager replaces this equipment based on the availability of resources. Participants expressed that they would like to learn more about the roadmap since it is sometimes unclear what the plan of the roadmap is. For internal assignments, the product manager creates a product plan with the help and content of the architect. Based on this plan, work orders and workload are planned.

For the plans of the product manager, it can be stated that the capacity to execute assignments are placed beforehand, and the formal administration of portfolio's and administration is done afterwards. Moreover, new assignments are currently accepted based on ad-hoc, however, it might also be relevant for the client manager to approach clients to ask them about future plans to be able to predict plans and future workload. This can also be linked to the product manager who will be able to create a portfolio and provide resources, based on these future assignments instead of placing resources beforehand and outsourcing them based on ad-hoc assignments.

Regarding the social capital, it might be relevant to provide employees knowledge regarding certain topics before encountering issues, by identifying and filling in knowledge gaps. Therefore, it might be interesting to order the present skills and knowledge better in the social network to increase the mobilization of social capital by the employees in the network. This will help to provide better learning strategies. During the interviews, it was expressed that workshops are not an effective way to share knowledge regarding this topic within the main responsible team, however, it was expressed that it might be relevant to let the other department learn more on how the applications of this team work. It is important to stress that within the teams; enough time needs to be scheduled to share knowledge and skills. This can be done by creating a knowledge base for all employees and face-to-face collaboration can be used to increase knowledge and skills. It might be interesting to share ideas and questions with the team in a meeting, so everyone can learn from them. It is important to find the right balance between being able to finish the workload, but still have enough time to share knowledge since the switching of employees should not cause a loss of important information. Overall, the willingness and sharing of knowledge are present within the team, but it might be relevant to implement this more in a formal and structured way to keep improving the service instead of doing this informally.

Regarding the change process, the impact of changes cannot be overseen if adjustments are made without full documentation. If informal interaction takes place, it is important to describe this fully in the log instead of writing a summary of what happened. Moreover, this should be shared with other colleagues, so all involved employees learn from the encountered issue. It is important to focus on quality; the root cause analysis and the backlog have relevant information that might prevent further

problems. When a similar problem is encountered it is easier to fix. Moreover, when incorrect changes are informally resolved, and not discussed, the occurrence of an incorrect change increases. Besides, it is to question if the change executor learns from this informal quick fix. By not registering these issues and actively working on them, it is difficult to measure the amount of encountered errors and how they are fixed if it is done informally.

The results showed that an informal process is present in the organization next to the formal process. This was not only found for the arise of assignments, but for most of the researched aspects in the organization. Therefore, it is to question if the hierarchy supports the social network or if it counteracts the social network. The hierarchy and described communication flows aim to provide a guideline, however, friction was found between this pre-designed structure and the work floor. During the interviews, it became clear that formal routes are too long and that arrangements can be made quicker by informally approaching colleagues. To illustrate, employees would approach executive employees first to discuss their idea, before submitting this to the management. For this reason, it is important to create a balance between formal and informal. Furthermore, it was found that it is quicker for the client manager to talk directly to the team, which was agreed on by the product manager. This informal setting works more effectively, but a hierarchical flow to maintain control is lost. Accordingly, it might be relevant to have a structural meeting to discuss these assignments and possible future assignments. In this way, the informal process can be used in a beneficial way, but no loss of control is present.

The social network offers opportunities to get things done in the organization quicker but can also cause problems if the formal hierarchal process is undermined. It is important to look at the formal processes and informal processes and connect these two better. The hierarchal process should support the social network to work as effective as possible and should not counteract, however, the informal process should not replace the hierarchical process. Hence, it is recommended to research the informal processes to incorporate aspects of this process at the work floor into the formal process to increase effectiveness.

This study showed the relevance of social networks in organizations and provided insights on the interaction at the work floor compared to the hierarchical design. It is important to acknowledge these interactions in an organization. By doing so, these interactions can become a strength of the organization and can create an advantage. For this reason, the found results and recommendations can be used to improve the communication and process regarding the emerge of tasks and the dynamics of the social network in an organization. This research showed that it is important to find a balance between the formal and informal process since the hierarchy should support the interactions at the work floor and should not counteract them. Besides, it is relevant to take into consideration tasks and skills when conducting a reorganization because the formal description of employees does not always cover the informal role and knowledge and skills of employees.

Further recommendations that do not answer the research question but can be used to improve (communication) process of the IT-service:

- Importance of balance between formal and informal process; to support or to counteract.
- Focus on quality; the root cause analysis and the backlog have relevant information that might prevent further problems. Moreover, when a similar problem is encountered it is easier to fix.
- It is important to stress that employees should keep their contact information up to date.
- Reorganization should be conducted while taking into consideration the skills and knowledge of people and not according to the formal title description of employees.
- Importance of transparency; it might be relevant to give the first department the rights to look into the work of the second department. In this way, the first department can already shape their part of the service in a way that it connects easier to the part of the service of the second department. Moreover, the new application of the second department is not yet available for the first department.
- The use of feedback loops should be implemented, and more feedback should be provided on the status of tasks and delivery
- A list of client assignments that can be accepted without consulting the client manager
- Ad-hoc can be decreased by maintaining contact with clients and asking them about their plans to calculate future workload and needed resources

1. Introduction

The world has become more and more connected in the past decades. A couple of decades ago, residents of one city had hardly any contact with residents from other cities, whilst it is very common nowadays for people to connect via social media all over the world. However, social networks are not only present on social media sites. Everyone has a social network based on real-life contact, which may consist out of just family or a broader spectrum of people such as friends and colleagues who may live across the globe. Due to the interactions of individuals and organizations, extended structures are produced; a social network evolves. Social networks are a web of interactions between individuals. Nonetheless, interacting individuals cannot imagine and see these structures (Kadushin, 2012). These interactions among social entities such as individuals and organizations consist of patterns, and by implicating these relationships, the passing/exertion of ideas, knowledge, and power is possible. Social networks arise and exist on many scales and levels such as people, nations, and organizations.

Social networks are especially important for organizations. Social networks are not only relevant to increase business by broadening and exploring the social network to make deals, but internal social networks and its communication are the main part of the functioning of the organization. In social networks in organizations, many communication flows are present which are influenced by relationships and hierarchies. Individual creativity, ethical behaviour, career mobility, technology adoption and organizational innovation (Brass, Galaskiewicz, Greve, & Tsai, as cited in Humphrey & LeBreton, 2019), are phenomena's that are present in an organizational social network. Moreover, diversities such as age, believes, status, religion, education, and attitudes are present in these social networks. Furthermore, an organization often consists of different teams that have to work together. By the means of a social network, ideas, information, and planning can be shared.

The previously mentioned communication flows, relationships and existing phenomena can be analysed by using social network analysis. Social network analysis is a relatively new scientific paradigm in which social structures, such as invisible ties that connect members, are researched by using network and graph theories. The cause of the late rise of social network analysis can be related to the highly technical and mathematical language (Scott & Carrington, 2011). This research method can be considered as a tool that is a late bloomer, but this does not diminish its relevance. It can be applied to investigate different topics such as migration, corporate communication, welfare support, and international trade. Social network analysis has specific relevance to organizations since it offers insights on how organizations operate and how information is spread within the social network of the organization while being influenced by multiple underlying factors. This research method is able to provide a coherent framework and methods of analysis that are able to capture prescribed and emergent processes (Fombrun, Tichy, & Tuschman, 1979). According to Laumann and Pappi (1976), social network analysis can be used in order to understand the social collective behaviour of groups. It helps to gain insights on conflicts and cooperation. Moreover, social network analysis presents the informal social networks in the organization in which, for example, problems are solved. Furthermore, social networks can be used to imply social change (Scott & Carrington, 2011).

By using social network analysis, the social capital of knowledge and ideas can be shown. This is especially relevant during, for example, a reorganization because it can cause a shift regarding the emerge of assignments and tasks within a company. Therefore, an IT organization which was going through reorganization was selected. The current situation is as follows; when a customer request emerges, the request is specified into an assignment by both an architectural team and one or more product managers, whilst 12 teams are supposed to complete these assignments. The role of an architect is to oversee the foundation of basic products and the use of these products for certain end goals whilst the product manager is responsible for the presence and creation of different resources. However, the feasibility of plans made by the management depends on the execution by the teams. For this reason, the supervisor of this department would like the management and the teams to start working together more often on the creation and feasibility of tasks since the organization is redesigning its products and services. Moreover, internal assignments are created to optimize the provided services in a team. Accordingly, the research question will be: *What is the network structure of interactions between different roles regarding the emerge of assignments, and which different perspectives can be identified about ideas, plans and knowledge in the social network?* " To investigate this research question, the constructs of interaction between teams and different roles (architect, product manager, client manager,

and system engineers), communication, ideas, and knowledge gaining and sharing were investigated, because these elements are important to create assignments. Moreover, the process was investigated as well.

Therefore, this research aims to investigate the emerge and communication of assignments and tasks in a social network from an IT organization by taking into consideration the dynamics of the existing social network to improve interaction between the different roles of architect, product manager, client manager, and system engineers. This research does not have a high novelty on a global perspective since social network analyses have been conducted before. However, no consensus has been reached on *what is known* about social network effects in teams (Balkundi & Harrison. 2006). Moreover, the presented research is the first conducted social network analysis within the IT department of the selected organization. Hence, this study does have a high novelty regarding the organization's perspective. This research aims to provide an advice on how to optimize an IT-service process, for which interaction between two teams is needed. This is relevant for the organization for the reason that it is tempting to focus on the beta aspect in these types of organizations, whilst the social aspect of interaction plays an important role in the process of creation and execution of tasks. Furthermore, organizations have formally designed authorities, but "*all formal or external systems breed informal networks that are grafted onto them*" (Kadushin, 2012, p. 90) which can be made visible to the management by using social network analysis. Additionally, complexity in an organization can be managed by designing hierarchies and communication flows, but it is to question whether these are followed in the organization.

2. Theoretical Framework

Teams in large organizations require a high level of interaction, communication, and teamwork to reach set goals due to the dynamics and complexity of their operating environments. The ability of the management team to create a shared understanding of the task, the process and the respective roles of its members determines the success of an activity (Tohidi, 2011). When teamwork is inadequate, individuals, who have considerable task-relevant expertise, can still create poor team outcomes (Gregorich, Helmreich, & Wilhelm; Ruffel-Smith; Schmidt, Keeton, Slack, Leveton, & Shea, as cited in Salas, Shuffler, Thayer, Bedwell, & Lazzara, 2014). This is especially relevant when looking at the arise of assignments which are the base of the organization and its teams' activities.

These teams that communicate at the work floor form a social network, since organizations are social structures designed to achieve goals through the cooperation of individuals (Kadushin, 2012). Interactions are taking place between employees whether this is job-related or personal related. Besides, information is being shared and agreements on tasks are being made which provide the foundation of a functioning organization. These social networks matter for teams. Teams with dense connections and relationships tend to reach their goals better, and they are more likely to stay together (Balkundi & Harrison, 2006). Moreover, teams who have a leader who is a central actor in the social network and has connections with the intragroup, tend to be more productive (Balkundi & Harrison, 2006). "*Social network structures, or the patterns of informal connections (ties) among individuals, can have important implications for teams because they have the potential to facilitate and constrain the flow of resources between and within teams"* (Brass, as cited in Balkundi & Harrison, 2006, p. 50). Furthermore, job-related perceptions and performance, academic performance and learning attitudes, intergroup conflict, and individual performance can be considered as factors that are associated with social networks (Yang & Tang, 2004). Thus, the relationship and interaction between employees are crucial for the success of an organization which are intertwined in a social network.

Therefore, the following theoretical framework will discuss the structure and properties of a social network needed to be able to conduct a social network analysis. Moreover, to further investigate the interaction between management and teams regarding the emerge of tasks, the constructs communication, knowledge gaining and sharing (social capital), and ideas and problem-solving in a social network were investigated.

2.1 Structure and properties of social networks

The following section is going to discuss the structure and properties of a social network which were analysed during this study. First, different types of relationships and their usage will be discussed. Second, the density of the social network, the closeness centrality of an actor, and the betweenness centrality of an actor will be discussed.

As previously mentioned, social networks consist of structures and patterns that consist of relationships. Balkundi and Harrison (2006) identify two main concepts regarding social networks, namely, the connection between parties and the structure of a social network. A social network has three sets of properties of interest according to Fombrun et al. (1979). These three sets of properties are; transactional content (what is exchanged), the nature of the links (quality of relation) and structural characteristics (clustering of groups and density of the network). This means that relational ties (linkages) between actors' function as channels of resources (Wasserman & Fraust, 2009). These resources can be considered the social capital of the network.

According to Yang, Keller, and Zheng (2016): Different types of ties (relationships/connections) can be identified. Transaction relations consists of actors who exchange physical or symbolic objects. In instrumental relations, actors ask one another intending to obtain tangible goods, information, or assistance. To illustrate, these types of relations are used to ask for advice, to find an internship, to get help with taking care of the cats, or even to get your car fixed. Communication relations consist of the passage of messages between actors, whilst sentimental relations are used to express emotions. Finally, authority relations occur most often in formal hierarchical organizations where formal roles and positions are assumed and the receiving and sending of commands is prominent (Yang et al., 2016).

The structure of a social network refers to the dyadic ties, which can be undirected, mutual, or directed, and other social interaction between the actors present in the social network. This means that the previously mentioned relationships form a connection with each other. Most often, actors have

relationships and connections with multiple people, which creates a web of connections. This web is referred to as the social network. This web consists of different paths to reach another actor in the web (social network). When someone needs a calculator and does not own one, he/she might ask their direct connection because they know their connection obtains a calculator. The path is short; only one tie is used. However, multiple ties can be used to borrow a calculator. If you ask your direct connection who does not have a calculator, he/she might now someone else who has a calculator. The path becomes longer since two ties have to be accessed. Yet, the calculator can be obtained by using the network. These paths make sure that people can access other actors in the network, without having a direct connection. This is relevant for the creation and execution of tasks since these ties and their transactional content can be used to obtain information regarding tasks and to gain needed knowledge to execute a task.

The *density* of a network refers to the number of direct connections or ties that exist, divided by the number of possible direct ties (Kadushin, 2012, p. 26). Thus, *density* refers to the connectedness of actors in a social network. The closer to 1, the higher the density of a network. *Closeness centrality* refers to the paths needed to reach an actor by looking at the least number of steps needed to reach another actor in the social network (Kadushin, 2012), so the shortest path that exists. Therefore, *closeness centrality* can identify how many actors are needed to gain certain information, objects, or service. An actor with a high closeness centrality is someone who is easy to approach in a social network. Another measure for the centrality of an actor in a social network is the *betweenness centrality*. The betweenness centrality measures how often an actor serves as a bridge between other actors. This means that if the bridging actor is removed from the network, the other actors are no longer connected. Additionally, the person with the highest betweenness centrality is most likely the person to be the gatekeeper of power (Kadushin, 2012). Thus, the actors with high centrality and betweenness measures fulfil an important role in the social network. These actors can be used in a strategic way to make the flow of information quicker in the social network. The social network of employees will become more knowledgeable and information can be spread more efficiently.

2.2 Social capital and brokerage

The social capital of a network has multiple descriptions due to its complexity. The unanimously descriptions and definitions of social capital becomes clear in the research of Salajegheh and Pirmoradi (2013). One of these descriptions of social capital is provided by Field (2016) which focuses on the sum of resources, actual or virtual, that are present in the possessed durable network of relationships of mutual acquaintance and recognition and that provide a benefit for an individual or group. Moreover, Kadushin (2012) adds the aspect of social capital that you do not own but have access through via your social network. Social networks offer the opportunity to quickly mobilize sources and transfer of knowledge and can be a platform for innovation (Moore & Westley, 2011). Burt (2004) stresses the aspect of creating an advantage by using the actor's location in the social structure. This can be linked to the creation of assignments when looking at the present social capital and the use of this capital. For instance, ideas might be present in the social network, and problems might be easier to solve than thought by effectively mobilizing the present knowledge in the social network by an actor. Additionally, the presence of brokerage across structural holes provides the opportunity to share knowledge in different clusters of actors. Burt (2004) states that individuals "*whose networks span structural holes have access to diverse, often contradictory, information and interpretations, which gives them a competitive advantage in seeing good ideas'* (p. 356). By creating a so-called "durable'' network, this knowledge can be obtained. However, this can also become a limitation since the bridging actor functions as a serving hatch for both clusters and might transfer information with a bias. Besides, a broker might not want to function as a bridge between two clusters. When a broker does function as a bridge and influences opinions, this person can be considered as an opinion broker. Opinion brokers influence between groups, rather than within groups and transmit information across social boundaries between, for example, status groups (Burt, 1999). Additionally, according to Salajegheh and Pirmoradi (2013), social capital can facilitate the exchange of resources between units, is able to stimulate multi-functional team performance, and is able to support learning in organizations. This can result in the benefits of material goods and services sources, information coordination, and service brokerage which helps to gain effective access to different services. Therefore, the frequency of usage of social capital and the

degree of brokerage in the social network are important to analyse, since these variables can improve the knowledge of the social network and can improve the quality of assignments.

2.3 Ideas and problem-solving in social networks

For the emerge of assignments, an idea is needed. Within social networks, communication about ideas and knowledge, stimulate new insights (Ohly, Kase, & Škerlavaj, 2010). The research of Perry-Smith and Shalley (as cited in Ohly, et al., 2010) shows that people with weak connections are more likely to provide unique insights and novel information than people with strong connections. Moreover, the research of Ohly et al. (2010) shows that formal leaders are consulted more often for idea generation, that individuals with the same position in the hierarchy consult each other more often, and that employees do not necessarily consult their own supervisor for generating ideas. Overall, idea-related communication is related to the commitment of the employee to the further process of this idea (Ohly & Sonnentag, 2007). Moreover, employee involvement can positively affect the effectiveness of a company. Non-managerial employees have specific knowledge about their work processes and are able to combine skills and certain expertise due to their activity in groups (Levine & Tysion; Cooke; Hübler & JirJahn, as cited in Zwick, 2004).

Problem-solving can be linked to the emerge of tasks and assignment because by designing tasks, problems might need to be solved to be able to implement an idea. However, individualization and value pluralism have caused that relevant criteria to judge solutions and problems no longer emerge automatically (Koppenjan & Klijn, 2004). Therefore, Koppenjan and Klijn (2004) state that more interactions and management is needed to find solutions for problems. Moreover, Leavitt, Smith, and Bavelas (as cited in Freeman, 1978) all concluded that centrality was related to group efficiency in problem-solving. Nonetheless, Cross, Parker, Prusak, and Borgatti (2001) state that relationships need to feel safe for deeper levels of knowledge sharing and true learning. The previously mentioned interactions can be made visible and actionable by conducting a social network analysis with the aim of increasing the number of ideas and employee participation.

2.4 Communication flows in social networks

Social networks are depending on communication to maintain its existence. By social exchanges, information can be passed, and learning can be achieved as a social and collective outcome. Next to the management communication styles designed by Richmond (as cited in Cho, Gay, Davidson & Ingraffea, 2007), it is important that individuals are willing to communicate. Willingness to communicate is the degree to which an individual initiates communication with different people in different social settings (Cho et al., 2007). This is especially important when looking at social networks and the arise of assignments since employees need to willingly discuss and communicate ideas and tasks to get them done.

Complex organizations have complex communication flows and to manage this complexity, divisions and units are created. Moreover, communication flows are often pre-designed. Consequently, different social networks arise which can be connected through certain actors within these social networks. These social networks that make the interaction between units possible can be considered as an advantage because this informal part of the communication flows can share information more quickly and effectively (Kadushin, 2012). Nevertheless, management can lose control and supervision of informal interaction. These dynamics can explain how employees interact and how tasks are created and conducted which can be used in a beneficial way by the management. Thus, it is important to look at the informal aspects of the social network regarding the arise of assignments and the execution of these assignments and tasks since this influences the dynamics at the work floor.

2.5 Conclusion

The previously discussed theoretical framework showed the relevance of social networks in organizations. Despite task-relevant expertise, a team can still create poor outcomes when teamwork is inadequate. Besides, dense connections and relationships improve goal achievement. Moreover, social networks facilitate the flow of resources between and within teams.

Furthermore, the theoretical framework presented variables that are important to look at when conducting a social network analysis regarding the arise and dynamics of task execution. First, this research will look at the structures and properties of a social network, by looking at the density of the

social network, and by identifying important actors based on their betweenness and closeness centrality. Second, the variables of ideas, social capital, and communication flows will be looked at. Additionally, the formal role of the social network will be looked at.

3. Method

The following section is going to discuss the methodology of the conducted study. It is important to note that this study functioned as exploratory research regarding social networks in an IT-organization. First, the research design will be discussed. Second, the sample composition will be explained. Third, de process of data collection will be presented. Fourth, the used methods to analyse the data is going to be discussed. Fifth, the aspects of reliability and validity regarding this study will be discussed. Lastly, ethical considerations will be described briefly.

3.1. Research design

This research is a mix between a whole-network research design (also known as socio-centric, complete, and full) and a personal-network research design. The first part of the research consisted of a whole-network research design. The whole-network research design focusses on global patterns of connections and relationships between all actors (Borgatti, Everett, & Johnson, 2013). In order to collect data on the existing social network in the organization and the passing of information regarding ideas, assignments, and plans, and skills, a questionnaire was sent. By the use of a questionnaire, data could be collected that created a sociogram of the existing social network. The representation of the sociogram was used to determine important actors in the social network who could be considered as important actors for arising assignments. Moreover, by analysing the social network, more information could be gained on the interactions and dynamics at the work floor.

The second part of the research consisted of a personal-network research design. To gain more detailed information about the interaction between actors in the network and the communication of assignments, interviews were conducted. Semi-structured interviews were conducted with employees of the organization. The interviews were semi-structured because this way of interviewing allows the researcher to rephrase the question when it is not understood, and it gives the possibility to ask additional questions that might lead to more in-depth information.

3.2. Sample composition

The boundaries for this research were difficult to determine. The organization is a complex environment with many departments and teams that work together. Due to time limitation, one pilot IT-service (an end product) was selected by the contact of the researcher who was active as a manager in the organization. This team consisted of twenty employees. These employees were active in two different departments, but both delivered a part of the same service. They all carry the same title of *system engineer*. Moreover, the product manager and architect who are responsible for the design and resources to execute this service were selected. Besides, the client manager was asked to take part in this research as well since requested assignments by colleagues from different departments are supposed to be introduced to the team via this client manager. Three participants were employed by the organization for 1-5 years, three participants were employed for 6-9 years, and the other employees had more than 10 years of experience. No relation between years of employment and the formal role was found for this sample when looking at the formal function of the participants and their years of experience.

However, it is important to note that the response rate is sensitive to cultural and social context (Church 2001). The organization stated that they had an open policy in which they expected the employees to participate in studies conducted by students. Therefore, a smaller sample was taken based on the expectation of a high response rate. In total, eighteen participants filled in the questionnaire after sending one or two reminders and ten interesting actors of the social network were selected and interviewed. Two participants filled in the questionnaire after the deadline which means that the answers of these two participants are not included in the sociogram, however, their answers were taken into consideration during the interviews. For the interviews, the two actors with the highest closeness centrality and betweenness centrality were selected because they have a prominent position in the social network. Besides, the product manager, architect, and client manager were interviewed because they fulfil a different role compared to the system engineers. Two interviewees were selected based on their position on the edges of the social network to investigate the perspectives from the edge of the social network. Further, interviewees were selected based on the mentioning of these actors in other interviews, to explore their role and position in the social network.

3.3. Data collection

An online survey was created to create a representation of the social network within the department. The data of the first part of the research was collected via an e-mailed online survey with no personal contact between the researcher and participant. The questions were presented in an online survey which also included an explanation of the research and instructions for the participants. This enabled the participant to answer the questions. The second part of this research consisted of a semi-structured interview in which a broad spectrum of in-depth data was collected.

3.3.1 Survey

The survey used in this research was created with Qualtrics. This program has an ethical approval given by the BMS lab of the University of Twente. The data collected by the use of this survey was used to gather data to plot a sociogram. Therefore, questions were designed to ask about social interactions regarding the emergence of assignments and tasks. To make the emerge of ideas and social interactions regarding assignments and tasks within the social network presentable, the questions were formulated that existing ties could be easily derived from the data (Appendix C).

According to Borgatti et al. (2013), missing edges and actors are more common to open-ended format questions for the reason that participants might forget to mention certain actors. Moreover, each actor does not have an equal chance of being chosen. Therefore, the decision was made to use closed-ended questions in which all actors were present as a multiple-choice option to choose from with a maximum of 3. To make it easier for participants to find the person in the list, the employees were ranked in alphabetical order.

After the acceptance of the consent form (Appendix B), the participant could start the survey. The first part of the survey consisted of demographics. For this research, only the name of the participant, and the participants' years of employment were asked. The years of employment was included to gain insights on relationships based on employment years and the influence of power based on present years. This question was asked with a Likert-scale of 5 points, including the following choice options: Less than a year, 1-5 years, 6-9 years, 10-15 years, and more than 15 years.

The second part of the survey (Appendix C) consisted of questions regarding the actors who were approached when having questions regarding the plans of architects and product managers. Besides, a work-related question regarding a certain action was asked because this activity is the executed assignment. The question focused on who was approached when having questions regarding this activity to finish a task. Moreover, two questions regarding ideas were included, namely, "When I have ideas for tasks, I go to … most often (maximum of three names)" and "Who has helped you to execute an assignment in the past 6 months? (If not applicable, tag nobody)". These questions will provide insights on people who are able to share and develop ideas together, and who is able to implement these ideas. To be able to make a distinction between the actual helping to execute an idea, and the gaining of advice, the question "who has given you advice for an assignment? (If not applicable, tag nobody)''. By asking these questions, a comparison could be made between the existing social capital in the network and the people who are most often approached for their knowledge. To ask more explicitly, the question "who has knowledge or skills that you do not possess or need help with? (If not applicable, tag nobody)".

To determine the strength of relationships, the question "how often do you approach this person for non-work-related topics?'' was asked. Participants were asked to select an answer for every actor regarding the service varying from never to often on a Likert-scale of 5.

The decision was made to not rank the questions in order of topic, to stimulate reading and thinking about the question. For this reason, most questions had bold and underlined words. Moreover, by not ranking the questions in order, repetition of answering the same answers out of ease was avoided.

3.3.2 Interviews

The conducted interviews aimed to gain in-depth knowledge regarding social interactions within the social network regarding a service. The interviews were created after the visualization in a sociogram. The topics that were discussed during these interviews can be found in Table 1 followed by an example of a question that was asked. For the reason that it was a semi-structured interview, additional questions were asked and not all topics were covered.

At the beginning of the interview, the participant was explained what kind of questions were going to be asked and what the topic of the interview would be with more in-depth information. Since the participants filled in the questionnaire three weeks before the interview, a short recap of the research and questionnaire was presented. After that, it was explained that the topics of the interview were in line with the questionnaire, but the aim was to gain more insights on the reasoning of answers and the thoughts and feelings of the participant. All participants agreed on being recorded before the interview.

Table 1: *Topics interview and example questions*

Topic	**Example question**
Ideas	"Could you describe how your ideas arise?''
Plans from architects and project managers	" How would you describe the interaction between you and the product manager/architect?'' "When is this collaboration important''
Social capital	"What is your role in the social network regarding skills and knowledge?''
	"Would you like to learn more skills and gain more knowledge?''
Creation of assignments	"How would you describe the formal process of the creation of assignments?''
	"How would you describe the informal process of the creation of assignments?''
	"What is your role in the creation of the (in)formal tasks?''
Interaction between teams	"How would you describe the interaction between the team of networks and the team?''
	"Do you value their knowledge and skills more than others?''
Recommendations for management	"Do you think that there are aspects that might be interested to look at when researching the service?''
	"How do you think that the service is going right now?''

3.4. Data analysis

The data collected in the online survey were analysed by using an open-source program named Gephi. This program is known to provide insights regarding social networks and is able to plot relationships in a sociogram. "*Sociograms serve as simple visual illustrations in helping people to explore and understand network structure and to communicate specific information about network characteristics to others"* (Huang, Hong, & Eades, 2005, p. 262). The social network was analysed by calculating the density, betweenness centrality, and closeness centrality of the social network by using the program Gephi. Based on the results of this analysis, ten actors in the social network were selected to interview based on the criteria mentioned in paragraph 3.2.

The interviews were recorded and transcribed by using the program Amberscript. However, the transcriptions were not sufficient. Due to time pressure, the interviews were listened to, and relevant sections were transcribed since the data included descriptions of technical aspects that are not relevant for the research question. To analyse this data, a codebook was used. A codebook was created prior to the interviews. The codes were created by using the interview questions; each question or group of questions represented one code. However, after three interviews, the semi-structure of the interview led to different insights and a different focus of the interviews than presented in the codebook. Consequently, the codebook did not cover all the relevant data collected in the interviews. Therefore, the codebook was adjusted (Appendix D). Terms such as "feedback'' and "other comments'' were included. The code "other comments'' was used to collect relevant information that could not be linked directly to another code.

Two coders both coded one interview (10% of collected data) separately. In Table 2, the Cohen's Kappa and interrater reliability were calculated. The Cohen's Kappa value should be above 0.61 to have a substantial agreement between the two coders. The codes were not sufficient except for the code "ideas''. The code "changes'' has the lowest value because it was applied once by both coders and twice by only one coder. The two researchers discussed the codes. One coder coded a description of a process in which the interviewee used 'I' as personal pronoun as role of interviewee, whilst the other coder coded this section as an informal process description. After a thorough discussion, the coders agreed

that if sections were assigned to two codes more often, the codes would be sufficient, since the agreement would have been almost perfect. Moreover, the decision was made to exclude the code "years of experience'' since this code was unclear to use and only two comments were made regarding the years of experience of the participant itself.

The used deductive way of coding caused the elimination of certain comments or perspectives since not all comments were being placed in the codebook. Therefore, when conducting the analysis, an inductive way of interpreting all data were included as well to cover other relevant information that was given about the social network, but which was not included in the code "other comments''.

Table 2: *Interrater reliability interviews tasks in organization*

Subject	**Cohen's Kappa**	**Interrater reliability**
Social capital	.58	80%
Roles	.33	50%
Ideas	1.00	100%
Changes	.00	33%
Informal process	.58	70%
Formal process	.55	66%

3.5. Reliability and validity

The validity of the social network analysis is difficult to determine since very little research on the construct of measures of social network analysis has been conducted (Wasserman & Fraust, 2009). Besides, social networks are constantly evolving and changing. However, the constructs measured in this research are derived from literature and can, therefore, be considered as valid. For social network analysis, the interest is focussed on long term social structures rather than single occurrences. Freeman, Romney, and Freeman (as cited in Wasserman & Fraust, 2009) state that by letting the respondent recall interaction, it is not a required that all participants recall the interaction true to frequency, but that it still provides valid and reliable information on long term interactions in a social network.

In the first part of the data collection, the participants had no interference with the researcher to increase the reliability of the instrument. By e-mailing the questionnaire, participants were able to fill in the questionnaire at their own speed and based on their own opinion. Moreover, the questions were formulated in an easy to understand way because participants should be able to quickly identify ties. However, Wasserman and Faust (2009), state that it is difficult to draw general conclusions regarding the reliability of social network analysis. As previously mentioned, closed-ended questions were used to increase the reliability of measuring active actors in the social network. Nonetheless, the participant remains responsible for identifying the ties and selecting the right number of actors from the list.

Moreover, to increase the validity of the social network analysis, an alternative method was used, namely, interviews. For this second part of the research, the first round of coding of the interviews between two coders was insufficient according to the Cohen's Kappa (Table 2) due to answers of participants that describe a certain context (formal or informal), but also describe, for example, a role or the arise of ideas. By using a double coding system in which parts were coded by coding the context and the content of the description, the reliability of the interviews was assured.

To summarize, to increase the validity of the social network analysis, interviews were conducted. To create a sufficient validity for the interviews, a codebook derived from theory was used. For the reliability of the social network analysis, a closed-ended questionnaire was used and no interference with the researcher was present. Besides, for the interviews, an independent coder coded an interview as well which was discussed afterwards to assure the reliability of the interviews.

3.6. Ethical considerations

Ethical considerations regarding the research entail the impossibility of anonymity. In a social network analysis, actors can still be identified without taking part in the research. Therefore, employees could send an e-mail to be deleted out of the social network sociograms if possible, or their data would be used in a completely anonymous way; no anonymous function description. Moreover, to secure the researcher's position and agreements between the management and protection of employees, the consent form designed by Borgatti and Molina (2005) was used which can be found in Appendix A. By agreeing in the questionnaire, the consent form for participants is agreed on (Appendix B). Besides, the interviews

were scheduled and set on private on the agenda, so no other employees could identify the participants who took part in the study.

4. Results

The following section is going to discuss the results of this research. First, general findings from the interviews will be discussed. Secondly, the variables used in this research will be analysed by analysing the sociograms and the interviews. Thirdly, a significant distinction between the formal and informal creation of tasks was found and will be presented.

4.1. General remarks

All participants in this research had an overall satisfaction regarding the process of providing the service and its products. It was stressed that the service has been significantly improved in recent years. Overall, actors in the social network mentioned that they are able to physically find each other at the office, however, three participants mentioned that it is difficult to find someone else who is not closely related to the service. To illustrate, the overview of contact information of people in the system was found to be outdated for some employees and employees shift workplaces during the reorganization. Moreover, the role indication in this contact information program is often not specified enough. Formal function descriptions are used to indicate someone's role, but this does not give any information regarding the performed task of this employee. Consequently, employees do not know who to contact for certain tasks or information. Besides, the client managers were considered to be difficult to find but a webpage for client managers and their services is available. This can be linked to the difficult to use intranet.

Another found aspect is the reorganization. The participants often referred to old situations while trying to describe the current situation. This is notable since the organization is in the middle of a reorganization. Some participants could therefore not describe their formal function, however, they do have a significant role in the informal process by, for example, connecting different teams. This result shows that it is important for employees to fully understand their new function and their role in the organization.

4.2. Arise of ideas and help with implementation of ideas

A significant result was found for the sharing of ideas for tasks in the plotted sociogram. The two departments who both deliver a separate part of the service do not approach each other to share ideas. Moreover, a different density can be found when analysing the different departments. The members of the department presented on the left in Figure 1 (the main deliverer of the service) share ideas with more actors in the social network compared to the department presented on the right. Participants from department 2 expressed that this could be due to the size of the department presented on the right. This department consists of fifty employees who are split up in three different subteams who share the same floor but are spread across this floor, whilst the other plotted team is a section of a department of which the members work in the same workspace. These results also explain the average path length of 2 (Appendix E3) in this sociogram, which means that two actors are needed to reach another actor. Most interviewees expressed that they mainly come up with ideas when encountering certain problems or when they notice that improvement is possible. Besides, clients approach the departments for the creation of tasks. A formal moment to share ideas is a gathering of the architect, manager, and team called "virtual team''. However, employees identified that this setting has not been used often in the past two years. Employees share ideas, but this mainly happens in an informal setting when encountering a problem or incorrect implementation. This can be linked to Ohly et al. (2010) who states that leaders are consulted more often for idea generation and that employees do not necessarily consult their own supervisor for generating ideas.

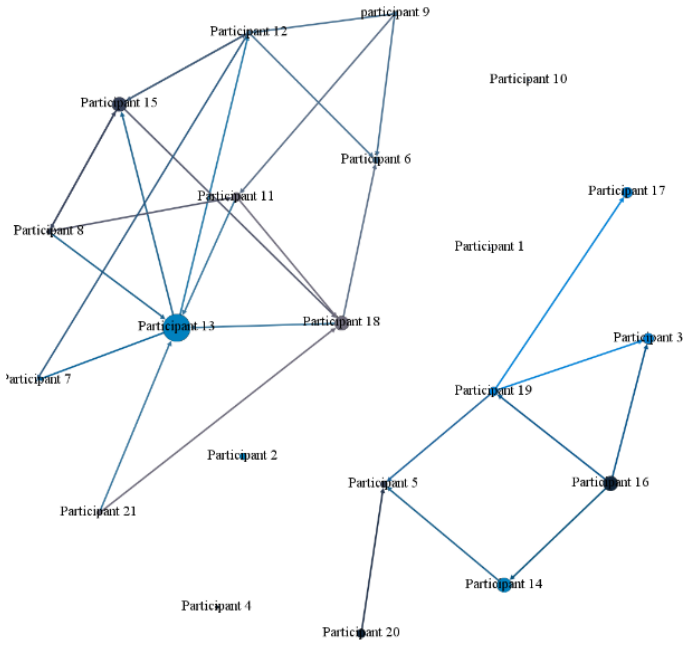

Figure 1: Sociogram of idea-sharing for tasks in the social network.

Participant 13 is not only approached to receive ideas but is also the main actor in the implementation of ideas for tasks. This participant does not only have the highest in- and out-degree as seen in figure 1 but also has the highest betweenness centrality for the idea variable. Regarding the implementation of ideas, the betweenness centrality value of participant 13 was 97.2 whilst participant 16 who has the second-highest value is only 40.5 (Appendix E6). The betweenness centrality was calculated with a 0.5 resolution.

Participant 13 does underestimate its role in the implementation of ideas in the social network. The participant mentioned that everyone tells everyone about their ideas because they work in the same workspace. Moreover, it should be every employee's task to monitor ideas and try to implement these ideas. However, it is participants 13's role to put these ideas on the planning. Other interviewees also mention this participant often when talking about the service and who to approach. For this reason, participant 13 can be identified as a broker.

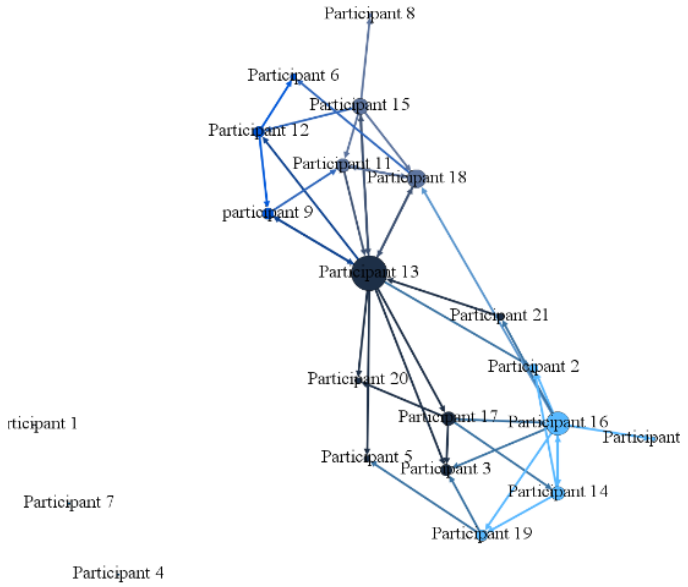

Figure 2: Sociogram of employees who approach other employees to get ideas implemented.

The found results regarding ideas are significant since this shows the relevance of certain actors in the social network regarding the informal process. It shows that this role is fulfilled in an informal way, whilst it could be interesting to give participant 13 more opportunities to actually work with these ideas since the rise of ideas form the base of the arise of assignments and improvements within the IT-service.

4.3. Advice and help to perform a task

As can be seen in Figure 3, participant 13 is also the participant who is approached most often to gain advice from regarding tasks whilst this person does not obtain the most technical knowledge regarding the service. Noticeably is that the client manager is not approached to gain advice from regarding tasks. This can be due to the question in the questionnaire which mentioned 'assignments'. During the interviews, it became clear that two types of assignments exist; internal tasks to optimize the service, and tasks requested by clients. The architect is not often approached for advice gaining regarding an assignment whilst the architect provides the design for the foundation of the service which describes the possibilities of the service.

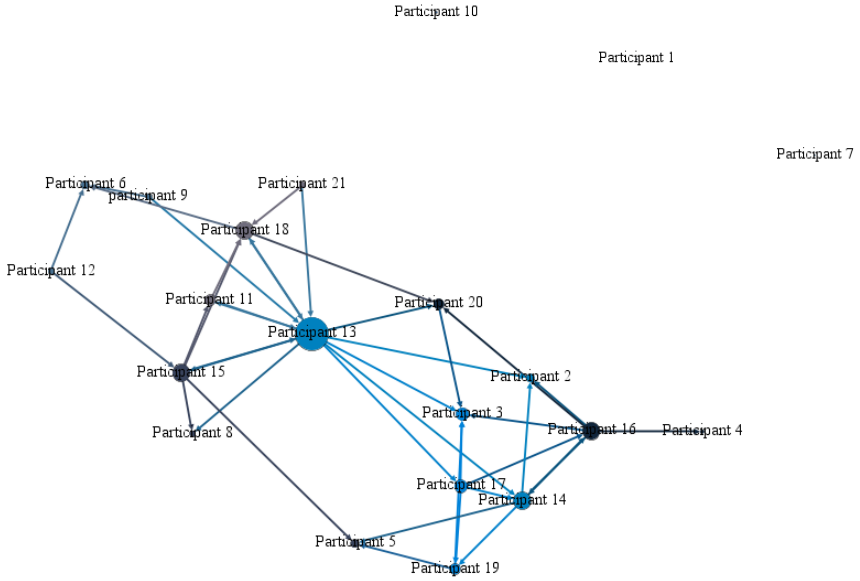

Figure 3: Sociogram of employees who approach other employees to receive advice regarding a task.

Figure 4 presents relevant information regarding the help received to conduct a task. Overall, the closeness centrality of this variable in the social network is relatively low with lowest value of 0.26 and a highest value of 0.73 (Appendix E2) . This means that actors are easy to find in the social network and are therefore easy to approach regarding this topic. Furthermore, a second relevant actor, Participant 18, can be identified. Participant 18 does not only help others from the department to conduct tasks but is also the main connecting actor between the two departments. In the interviews, it became clear that Participant 18 can be considered as a senior employee regarding the provided service. This can be linked to the research of Brass (1984) which states that a leader who has connections with the intragroup can increase productiveness. However, this also has a downside, because if employee participant 18 is removed from the social network, it will significantly be less connected, and its density will decrease.

Participant 17 and Participant 14 are the main actors who help to conduct tasks for the second department. A noticeable result is that for both departments, the employees who takes care of the planning and the employees who have most knowledge regarding the service, are approached most often. This can be used in advance by the management by asking questions regarding the process and needed tasks by asking these types of actors. Moreover, it also works the other way around; if the management would like to implement certain aspects to a service or process, they should be introduced to these types of actors first since they know what kind of questions regarding tasks are present and what kind of help is needed.

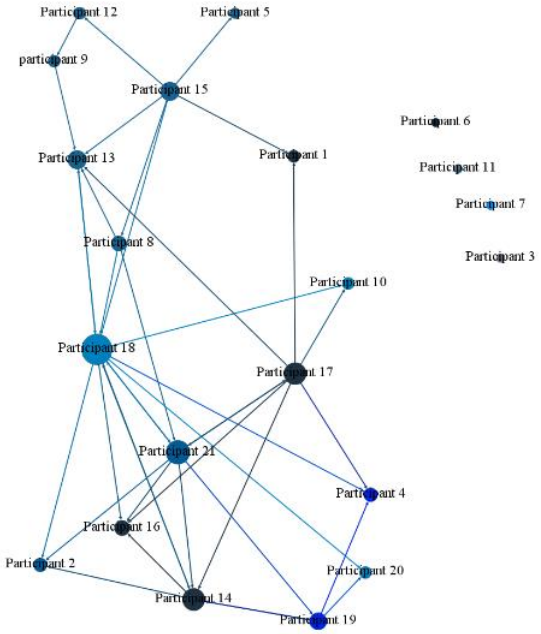

Figure 4: Sociogram of employees who approach other employees to receive help to conduct a task.

4.4. Plans of architect and product manager and their role

During the interviews, it became clear that the two departments have different architects and product managers who negotiate at a higher level. This does not entail the executive employees, but this is not a necessity as long as executive employees are asked about the feasibility of the plans. The second department only has to verify if the plans of the first department are executable regarding their field of work. Moreover, the service is only a very small part for the second department, which diminishes the relevance for the executive employees to actively engage in the process of task creation. An interviewee of the second department described the process and stressed that if the plan for a task is written down correctly and discussed properly, the interaction between the executive parties should not be about the plan of a task, but only about (un)expected problems. As can be seen in Figure 5, the second department does not approach the architect (Participant 6) of the service directly. As a result, the density of this graph is low with a value of 0,055 (Appendix E7) .

The role of an architect is to oversee the foundation of basic products and the use of these products for certain end goals. The architect designs how the products of the service can be used and applied; the architect provides direction and aims for life cycle management. Moreover, the architect controls the replacement of the technical equipment that is written down in a roadmap. Subsequently, the product manager replaces this equipment based on the availability of resources. Participants expressed that they would like to learn more about the roadmap since it is sometimes unclear what the plan of the roadmap is. For internal assignments, the product manager creates a product plan with the help and content of the architect. Based on this plan, work orders and workload are planned. Once in every two to three weeks, a workload meeting is scheduled with the product owner and planner of the team. This means that other team members are not as much involved as this employee. Yet, all employees approach the architect directly when they have questions regarding the plans of the architect. Significantly, the architect is not approached often to get ideas implemented, whilst this person is responsible for this aspect. This means that the formal role is being fulfilled in an informal way via Participant 13.

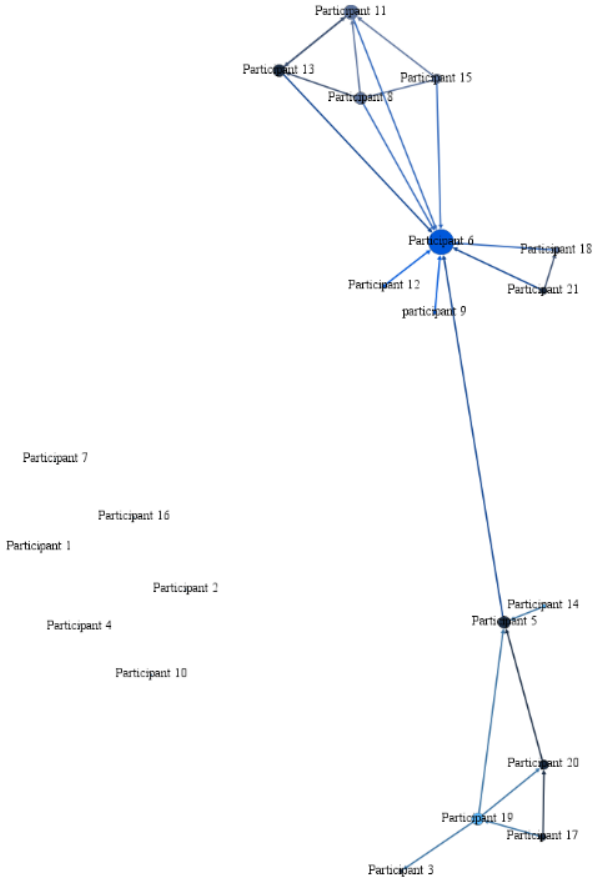

Figure 5: Sociogram of employees who approach other employees to answer questions regarding the plans of the architect.

The following sociogram (Figure 6) presents the interaction regarding questions about the plans of the product manager. The role of the product manager is to create the product plan; what resources are needed to perform an assignment. The results are similar to the results found regarding the plans of the architects. The departments have two product managers whilst only one was included. The second department which is represented at the bottom of the sociogram do not approach the product manager (Participant 12) directly but via their manager, this can be due to the fact that the product manager of this team was not included. Nonetheless, an interesting result is that 5 ties can be found directed to Participant 13 whilst the product manager has 6 approaching ties. However, it is important to note that the results are not ranked, and no conclusions can be drawn on how often these participants are approached and who is approached first.

Regarding the plans of the product manager, an informal process is used. It was mentioned that the formal process was not known by the participants. It can be stated that the capacity to execute assignments are placed beforehand, and the formal administration of portfolio's and administration is done afterwards. For the arise of assignments, the architect describes the assignment to the product manager and the manager places the resources. The so-called "virtual teams'' work on a more detailed description of the internal assignments.

Innovation is made possible by the product manager. However, this role is not approached often to share ideas or ask advice from for tasks and assignments. Even though the description of assignments as a questionnaire question was too broad, it can be linked to the aspect of sharing ideas and asking for advice. If the product manager is the one to implement the resources, this person might become more relevant to approach regarding ideas, since this person is the one able to implement these new ideas that may be about innovation. This person identified themselves as someone that tries to be present and adjusting their role in different situations. However, this person is not as central in the social network as

would have been expected regarding this comment. Moreover, this person identified to levels of interaction: The formal, administrative and responsible network, and the informal interactions on the operational level. The formal process takes too long, this means that it is easier to take the informal route to get things done.

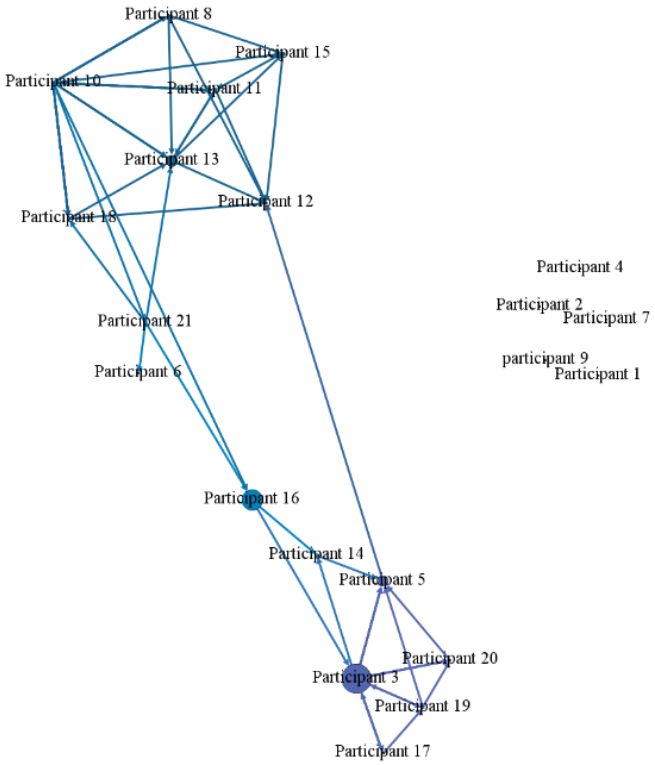

Figure 6: Sociogram of employees who approach other employees to answer questions regarding the plans of the product manager.

4.5. Changes

A technical aspect of the service is the request for a "change'' which can be considered as an assignment. This is the component for which most interaction is needed between the two executive departments. As can be seen in the sociogram of figure 7, the person who has the formal role to take in these changes is Participant 17. The formal process entails a request for a change via this participant via a form. This participant is responsible for the monitoring of process, priorities and requests. However, this person does not have all the technical knowledge to complete these changes. Therefore, the requests are forwarded to the technical executives. According to the interviewees, this is done based on expertise regarding topics, but changes are not always assigned to this person. Nonetheless, when the technical executor has questions about the send form, the question is sent back to Participant 17 and then returned to the other department to ask for clarification. According to four interviewees, this formal way of requesting changes is too slow compared to the informal route. Moreover, the interviewees mention that this system can cause confusion or unclear messages because Participant 17 has to transfer these messages to the right person and in the right way. According to the formal process, this participant should function as a broker which is verified by the highest value for betweenness centrality regarding this sociogram. This leads to people approaching each other in an informal way to address the issue. These issues are mainly identified as mistakes by the executor or a deeper-rooted problem. In both situations, these issues are tackled by a conversation between the two executive parties. When the problem is solved, it is reported in the system. This means that no interaction takes place to inform others about the found problems and how these problems can be solved. This only happens when the same problem is encountered again, and an employee asks another employee how to approach this issue. Therefore, more attention should be paid to the encountered issues and the quickest way to fix these problems.

During the interviews, it became clear that the request form to request changes is not optimal for this particular service. This leads to confusing requests or incorrectly applied changes to the server. Subsequently, this leads to more interaction between teams to fix the implemented change. Though, it is to question whether these forms can be adjusted since many teams make use of these forms. Another aspect is the communication flow. Overall, communication is done via a log system. This is not always efficient since not every employee fills in the right information for the other party. Therefore, it is important to stress that all needed information needs to be filled in for the request of a change and also the rejection of a change.

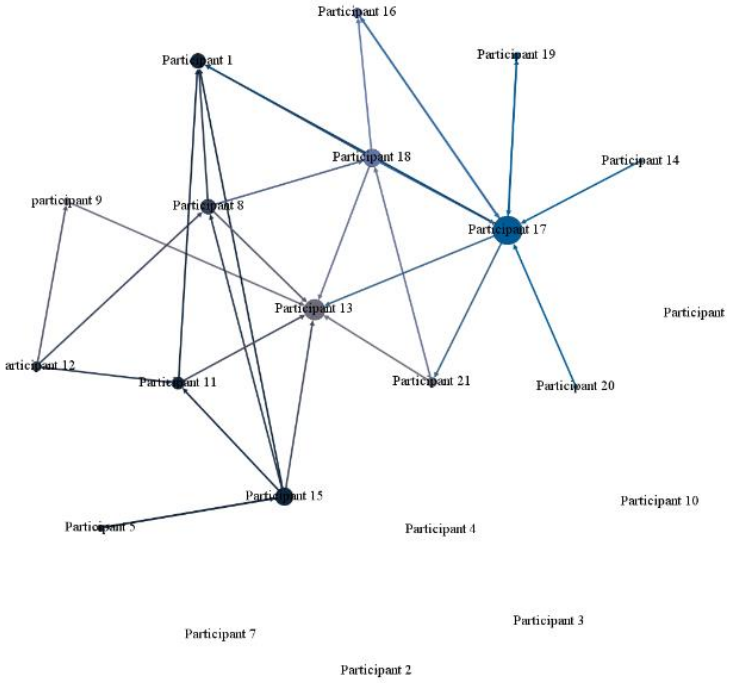

Figure 7: Sociogram of employees who approach other employees regarding changes

4.6. Social capital

Figure 8 shows the sociogram in which the knowledge and skill ties are plotted. In the questionnaire, it was asked who possessed skills and knowledge which the participant did not possess or needed help with. The actor's size is based on betweenness centrality. Only in this sociogram, the colour of the actors represents the departments. The colour grey was used for the first department, and the colour blue was used for the second department. A significant triangle can be found when looking at the betweenness centrality (Figure 8) and the in- and out-degree of actors (Figure 9). All actors are part of the first department. Participant 18 with a betweenness centrality value of 34.4 (Appendix E8) can be identified as an important bridging tie between the two departments. This was also mentioned during the interviews because this employee possesses a broad range of knowledge regarding tasks of both departments. The significant triangle can be considered the source of knowledge and skills. These actors are able to share and receive knowledge the quickest in the social network. By providing this triangle the opportunity to increase knowledge and skills, the entire social network can benefit from it since they are the source of knowledge and skills.

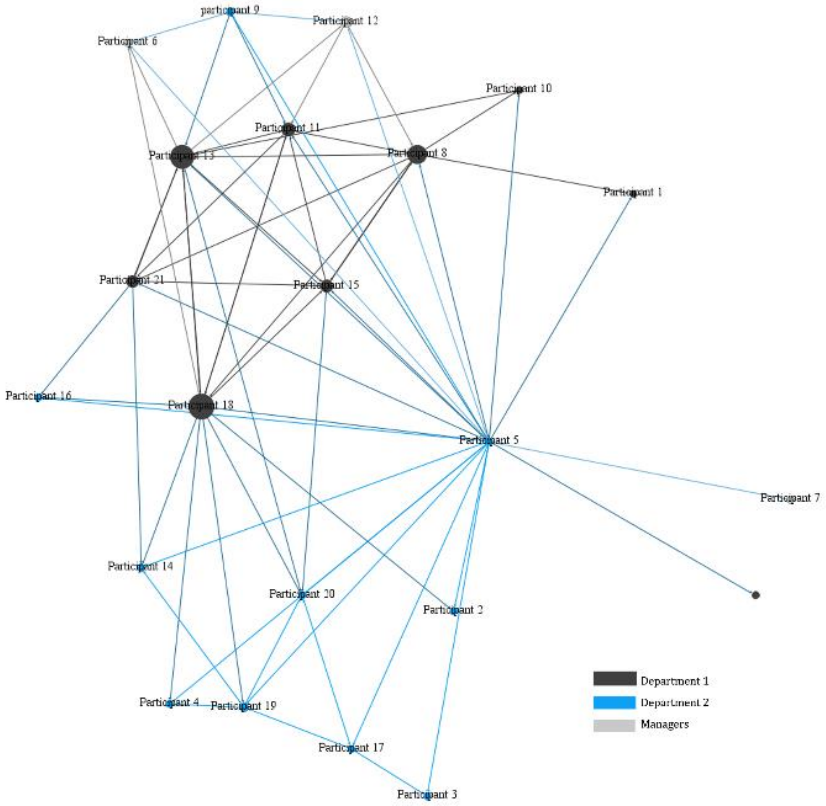

Figure 8: Sociogram of employees who mentioned other employees to have skills and knowledge they do not have or need help with based on betweenness centrality

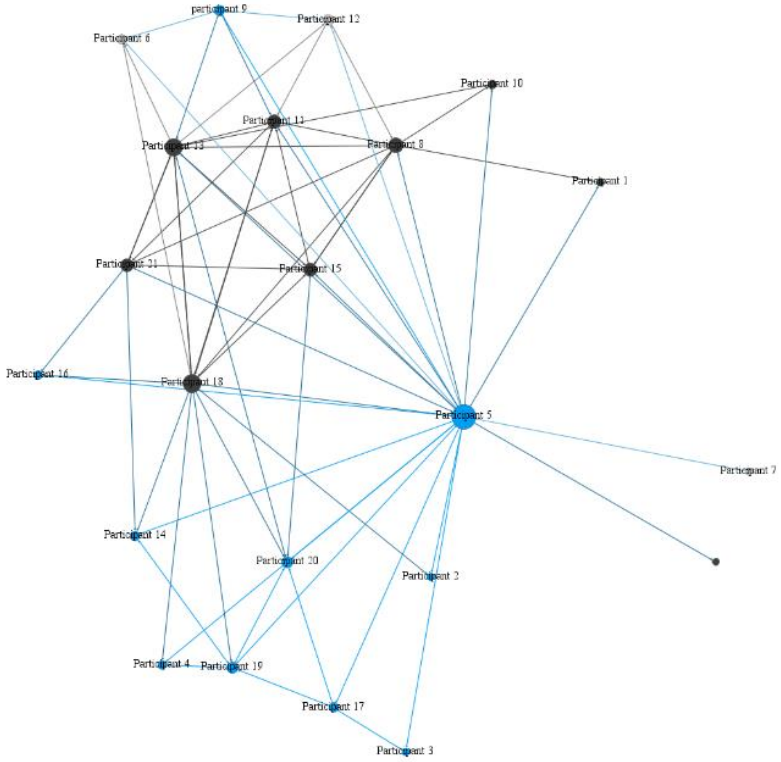

Figure 9: Sociogram of employees who mentioned other employees to have skills and knowledge they do not have or need help with based on in and outdegree

During the interviews, one participant from the second department mentioned that no further knowledge of skills needed to be shared or gained between the two departments because the changes were a small percentage of the assignments they have. Another participant agreed but added that it might be relevant for people from the second department to learn more about the service part of the first department since only few colleagues had full knowledge of this process.

Participants mentioned that they are able to mobilize knowledge and skills in the social network that they might need. It was often mentioned that the employees know each other and are able to find each other. However, it was mentioned that employees who are new in the organization or employees who are not very out-going, could have a disadvantage in this social network since favours are often received and given based on previous interaction within the organization or even based on friendships outside of the organization. Employees who are less outgoing mentioned that they are able to mobilize knowledge and skills by asking another employee to get something done.

These results show that skills and knowledge are shared often, however, during the interviews it became clear that there is not enough time to share skills and knowledge on a daily base. Two ways of formally exchanging knowledge were mentioned. Most often, the spreading of knowledge called the "oil spreading'' technique was used. A limited group of people gained new knowledge who are supposed to share this knowledge with colleagues. Besides, managers make use of a matrix to order present skills and knowledge and expend knowledge of their employees by providing workshops.

Nevertheless, for the main department, a gap in knowledge can be found between junior and senior employees. Currently, learning is based on solving-problems since it is too much information to share. The executing of tasks depends mainly on experience and recognition of IT-situations. The team provide each other with the needed knowledge by asking and helping each other. However, this means that this is added to the daily tasks of the senior employees. Therefore, it might be interesting to order the present skills and knowledge better in the social network with the aim of increasing the mobilization of social capital by the employees in the network.

To summarize, employees are connected and are able to find each other to mobilize social capital. However, this is based on the level of personal interaction and the willingness to interact, which can be linked to the theory of Cho et al (2017) which states that a willingness to interact should be present. Yet, social capital is only mobilized when issues are encountered. It might be relevant to provide employees knowledge before encountering certain issues.

4.7. Tie-strength

Figure 10 shows the relationships of the actors within the network based on a Likert-scale of 5. The relationships were measured based on frequency of approaching actors about non-work-related topics. Three main clusters can be identified, namely, the first department and its lead manager, the second department and its team manager, and a third cluster which is the management of product manager, the assistant of the product manager, and the architect. The team manager is part of the cluster of the first department and the management. Noticeable is that stronger relationships are present between actors who also interact often regarding work tasks. Stronger ties are present in the first department compared to the actors active in the second department regarding the selected service. Again, this can be linked to the work floor and division of activities.

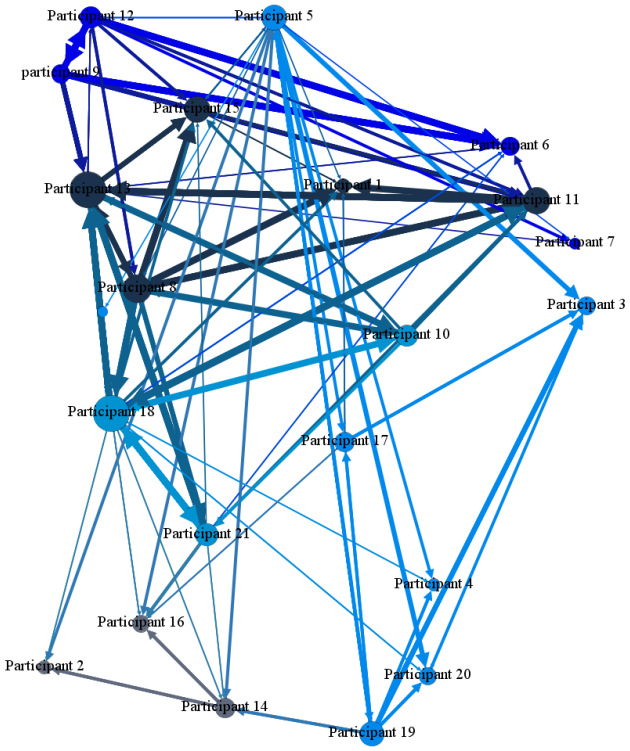

Figure 10: Sociogram of employees and their tie-strength based on non-work-related conversations

4.8. Feedback

An aspect that was mentioned during the interviews was feedback moments. The management expressed that they would like to receive more feedback after the finishing of a task/assignment. The architect mentioned that the most important things found in production should be used to put in the architecture of the service for improvement. Therefore, it was mentioned that asking for feedback/providing feedback should become more frequent to keep improving. Moreover, scrum backlogs can be used for this. The meeting of the virtual team, that includes all parties, can be used to get a clear view of the plans and direction to take.

Furthermore, it would also be relevant for a client manager to hear about the finished product and the "delivery'' and not just about the rise and creation of tasks. The client manager considers updates on the process of execution of a task important as well since this person is the one to maintain contact with the client on the progress of the product. Moreover, it was also stressed that updates regarding the status of a task should be given more often. Thus, the communication regarding the plans and execution of tasks is sufficient and running smoothly, but the "aftercare'' of assignments is insufficient.

4.9. The formal process compared to the informal process of assignments

The formal process of creating tasks consists of a client (another section of the organization) that requests a product out of the offered services. This should be done by approaching the client manager. The client manager is the person who talks with the client and who formally writes down the assignment. This person can also make the consideration of not accepting the assignment if the team cannot deliver the requested product. The client manager makes sure that the budget, technical aspects, and resources are available by approaching the product manager. Moreover, the role of a client manager is to oversee and guide the interaction between the client and team. If the product manager has made a product plan or uses an already existing plan, the planner and product owner of the executing team is approached. Two results were found in the interviews that can be linked to the informal process, namely, the product manager is not as involved in the conversations of the client manager and planner of the execution team (product owner) as mentioned, and the role of the planner of the team is shaped in an informal way. Friction between formal and informal can be found; the product manager is responsible for this process, but the client manager and the planner of the team are the main two actors to shape this process. None of the active roles in this process expressed difficulties with this process.

In the formal process, only the client manager should accept assignments from clients. However, teams are allowed to take on assignments if they have finished assignments before for this client or if it is a basic assignment selected from the offered products. Nonetheless, it is not clear which assignments can be accepted beforehand. This is informally discussed as well. The team is also allowed to do a consultancy, in which assignments are discussed with the client and then later presented to the client manager to ask for permission to be executed. The teams are expected to communicate these accepted assignments with the client manager. However, the team mentioned that they limit this informal acceptance as much as possible. All actors were satisfied with this informal process. Also, clients approach the team directly to ask for products (assignments), but they are sent to the client manager.

Most employees have been working for the organization for a long time and have worked at different departments over the last years. Consequently, employees know each other well and also know people from many different departments. This means that is easier to approach someone informally, than following the long formal process with extra steps. One participant compared this process with a tree in which he had to climb up every time he wanted to get something done. Another participant mentioned that instead of climbing the formal tree, he would just approach someone who would need to execute something to gain support and would then go up the formal tree to increase the change of acceptance.

For internal assignments, the assignments are most often initiated by the team. Some of these internal assignments are being executed next to the formal assignments. For bigger internal assignments, the architect and product manager are asked to make the resources available. In the formal process, the architect should be involved with all internal assignments.

5. Discussion

The following chapter is going to discuss the findings of this study and the meaning of these results. In chapter 4, the sociograms were analysed with substantiation of data collected during the interviews. The following chapter is going to answer the research question by discussing the found results in chapter 4 with additional information, and by providing recommendations regarding these aspects. Besides, the theoretical implication of these results will be discussed. Moreover, the limitations of this study will be discussed and suggestions for further research will be given. Finally, a conclusion regarding the previously presented study will be given.

5.1. Answering the research question and recommendations

This study focused on the research question: *What is the network structure of interactions between different roles regarding the emerge of assignments, and which different perspectives can be identified about ideas, plans and knowledge in the social network?* The aim of this study was to explore the arise of assignments and the different roles regarding this process by looking at the social network interactions and the variables of ideas, plans, and knowledge within the social network in order to write an advice to optimize the IT-service and the communication flows and dynamics in the social network.

The scope of this study included one IT-service which two departments execute tasks for. However, before setting this scope, it was unknown to the researcher that the responsibility and activities for this IT-service were unequal for the two departments and that only architects interact for the creation of assignments that include both tasks sets of both departments. Therefore, these results mainly focus on the main responsible department.

5.1.1 Emerge of assignments

The interviews showed that for the arise of assignments, two types of assignments can be distinguished; internal assignments to improve the service, and client related assignments. The internal assignments mainly arise within the team. According to the sociogram, participant 13 is an actor that receives many ideas and shares ideas most often for new assignments. Overall, the knowledge sharing within the main responsible department is sufficient, but ideas can be shared more often during for example the ‘day start’. Instead of looking at encountered problems, it may also be interesting to do a quick round of idea-sharing. For the provided service, the other team could share ideas more often, since not all team members share their ideas with all team members. However, this can be related to the fact that these employees provide multiple services and are not as focussed on this service as the other department. The architect and product manager provide a product plan to provide aims and resources. Significantly, the architect is not approached often when advice regarding an assignment is needed.

Other assignments arise from requests submitted by clients. This would mean that the client manager should be approached often for advice and ideas. However, in the sociograms, participant 13 can be identified as the main actor in this process. The importance of this role was also identified by the participants during the interviews. Therefore, this person can be considered as a broker and the relationship between this participant, the client, and client manager should be highly valued. Moreover, the client manager is not approached to gain advice from regarding tasks whilst this role should facilitate communication between client and team. This means that a difference can be found between the formal role of client manager and the informal role of participant 13 who has an important informal role.

For both types of assignments, the exact role of the architect remained unclear in the arise of assignments during the interviews. Participants were able to describe the role of the architect and the scope of work but did not go into detail regarding the role in the rise of the assignments. In the formal process, the architect should design the assignments that need to be worked on. A recommendation would be to make use of the roadmap (plans of the architect) more frequently.

In conclusion, assignments mainly arise when clients have requests for assignments and if team members would like to improve their IT-service. Ideas are shared often within the team, but not as much with the architect and product manager.

5.1.2 Sharing and gaining of knowledge

Different perspectives regarding the sharing and gaining of knowledge (social capital) were identified during the interviews. Overall, employees are connected and are able to find each other to mobilize social capital as can be seen in the sociogram. The willingness to interact is present, which can be linked to the study of Cho et al (2017) which stresses the importance of the willingness to interact. Yet, social capital is only mobilized when issues are encountered, and new or less outgoing employees might experience a disadvantage in mobilizing social capital.

It might be relevant to provide employees with knowledge regarding certain topics before encountering issues by identifying and filling in knowledge gaps. Therefore, it might be interesting to order the present skills and knowledge better in the social network to increase the mobilization of social capital by the employees in the network. This will help to provide better learning strategies. It was expressed that workshops are not an effective way to share knowledge regarding this topic within the main responsible team, however, it was expressed that it might be relevant to let the other department learn more on how the applications of this team work. It is important to stress that within the teams; enough time needs to be scheduled to share knowledge and skills. This can be done by creating a knowledge base for all employees and face-to-face collaboration can be used to increase knowledge and skills. Currently, the increase of knowledge is done by asking questions when a problem is encountered by one person. However, it might be interesting to share these questions with the team in a meeting, so everyone can learn from them. It is important to find the right balance between being able to finish the workload and to have enough time left to share knowledge since the departure of employees should not cause a loss of important information. Moreover, during the interviews, it was expressed that asking another employee for help is quicker than looking for information themselves, but it is to question if this quick fix is moved to knowledge foundation of the asking employee. For this reason, it is also important that employees have enough time to figure out problems themselves to be able to learn from the experience. Thus, the willingness and sharing of knowledge is present within the team, but it might be relevant to implement this more in a formal and structured way to keep improving the service instead of informally maintaining this.

5.1.3 The hierarchy versus the social network

The results of both the sociograms and interviews showed that an informal process is present in the organization next to the formal process. This was not only found for the arise of assignments, but for most of the researched aspects in the organization. Therefore, it is to question if the hierarchy supports the social network or if it counteracts the social network. The hierarchy and described communication flows aim to provide a guideline, however, friction was found between this pre-designed structure and the work floor during the interviews. The interviews showed that formal routes are too long and that arrangements can be made quicker by informally approaching colleagues. To illustrate, employees would approach executive employees first to discuss their idea, before submitting this to the management. For this reason, it is important to create a balance between formal and informal. Furthermore, it was found that it is quicker for the client manager to talk directly to the team, which was agreed on by the product manager. This informal setting works more effectively, but a hierarchical flow to maintain control is lost. Accordingly, it might be relevant to have a structural meeting to discuss these assignments and possible future assignments. In this way, the informal process can be used in a beneficial way, but no loss of control is present.

Moreover, for the arise of assignments, clients approach the teams often. The researched teams do not accept these assignments without consulting the client manager, however, other teams do according to the interviews. This informal way of working can cause problems regarding planning and resources. In this example, the informal process of the social network and present ties undermine the importance of a hierarchy. Another example is the aspect of assignments and ideas that need to be accepted by the architect. This formal process might decrease employee participation due to the hierarchy. For this reason, it is important to have sufficient interaction between the architect and team members.

Regarding the change process, the impact of changes cannot be overseen if adjustments are made without full documentation. If informal interaction takes place, it is important to describe this fully in the log instead of writing a summary of what happened. Moreover, this should be shared with other colleagues, so all involved employees learn from the encountered issue. It is important to focus on

quality; the root cause analysis and the backlog have relevant information that might prevent further problems. When a similar problem is encountered it is easier to fix. Moreover, when incorrect changes are informally resolved, and not discussed, the occurrence of an incorrect change increases. Besides, it is to question if the change executor learns from this informal 'quick fix'. By not registering these issues and actively working on them, it is difficult to measure the amount of encountered errors and how they are fixed if it is done informally.

The social network offers opportunities to get things done in the organization quicker but can also cause problems if the formal hierarchal process is undermined. It is important to look at the formal processes and informal processes and connect these two better. The hierarchal process should support the social network to work as effective as possible and should not counteract, however, the informal process should not replace the hierarchical process. Hence, it is recommended to research the informal processes to incorporate aspects of this process at the work floor into the formal process to increase effectiveness.

5.1.4 Further recommendations

This section will discuss recommendations to optimize the process of the IT-service based on the interviews, but that do not answer the research question directly. This section can be considered as additional recommendations based on additionally found data. These recommendations provide aspects that can help to improve the (communication) process of the IT-service but cannot directly be linked to the plotted sociograms.

It is important to stress that employees should keep their contact information up to date. Participants mentioned that the function description did not fully describe the aspects of the role of an employee. Furthermore, reorganization should be conducted according to skills and knowledge of people and not according to formal description. This result is not only applicable to the researched services but are found throughout the organization. The researcher noticed while being present in the organization that people have a formal function but shape their role in an informal way with more or fewer aspects as described in their formal function. Since the organization relies on the informal process, it is important to acknowledge this strength by not shifting employees around based on formal function but based on knowledge and skills.

Another recommendation is the recognition of the relevance of transparency between departments and services. For this particular IT-service, it might be relevant to give the main responsible department rights to look into the work of the other department. In this way, the first department can already shape their part of the service in a way that it connects easier to the part of the service of the second department. Moreover, the new application of the second department is not yet available for the first department but is too other departments. By applying these recommendations, the interaction regarding issues can be decreased. This means that informal interactions will decrease as well, which makes it easier to keep track of the formal process. This offers opportunities regarding the control of issues and interactions.

In addition, the use of feedback loops should be implemented as mentioned by the architect. By using this feedback loop, ideas will be placed in the product plan and will lead to new assignments and work orders for the team. By frequently using the root cause analysis to find design flaws, these flaws can be fixed by shaping them into new assignments. Again, this will lead to a better overview and control of issues regarding the service. Also, it might be relevant to look at the full structure of the service. This makes it easier to execute an impact analysis for a change easier and decreases the chance of incidents.

Finally, a result that is not only applicable to this particular IT-service, is the uncertainty regarding the ability of teams to accept assignments from clients who they have worked with before. It might be relevant to create a list of products and clients that can be accepted before consulting the client manager. This can be done by, for example, maintaining an editable sheet with the team of which products and clients can be accepted. It is important to stress that by informally agreeing on this, the employees are not able to retrieve the agreements from a written down file but must memorize it. Therefore, it is highly recommended to create this list and place it in an easy to retrieve way for employees. Moreover, new assignments are currently accepted based on ad-hoc, however, it might also be relevant for the client manager to approach clients to ask them about future plans to be able to predict plans and future workload. This can also be linked to the product manager who will be able to create a

portfolio and provide resources, based on these future assignments instead of placing resources beforehand and outsourcing them based on ad-hoc assignments.

Even though the previously mentioned recommendations do not answer the research question directly, they should be considered important for the reason that the IT-service can be optimized by using these recommendations.

5.2. Theoretical implications

Previously conducted social network analysis mainly focused on the fields to apply this research method on and the existence of social networks in organizations. Burt (2004) mainly looks at the perspective of an individual and the effects of the social network on this individual. However, this research combined two research methods with the aim of using social network analysis to provide practical advice for an organization. This research investigated the aspects of communication flows and ideas in the social network like the studies of Burt (2004) but approached this data from a process related point of view. The aspects of combining research methods and using a different approach, increase the theoretical novelty of this research and makes it complex to compare to previously conducted research. Furthermore, previous research has not investigated the arise of a process within organizations. Social network analyses have been conducted regarding leadership, power, trust, or mobilization of social capital (Carter, DeChurch, Braun, Contractor, 2015; Scott, 1988; Erickson, 2017) but no study has combined the aspects of ideas and social capital. Nonetheless, this research did include the basic aspects of a social network analysis which are betweenness centrality and closeness centrality. The results found regarding the role of a broker and the importance of closeness centrality are in line with Burt (2004). Besides, this research found behaviour that is in line with Ohly et al. (2010) research which states that the formal leader plays an important role in idea generation and that individuals with the same position in the hierarchy consult each other more often. Thus, the results of this study are in line with previously conducted researches, but a novel approach was taken regarding the scope of the research and the combination of methods.

5.3. Reflection of the methodology of the study and its limitations

The use of a questionnaire to collect data regarding social networks can be considered as quick. By using clear and easy to answer questions, the participants were able to fill in the questionnaire quickly. However, a limitation of a questionnaire is that the reason for certain ties cannot be explained. Social structures are more complex than can be visualized in a graph (Otte, Rousseau, 2002; Scott, 1988). Therefore, the interviews were an important addition to the questionnaire since the interviews did not only explain a certain aspect of the sociogram but also gave the reasoning behind the answers given in the questionnaire. The use of a questionnaire in combination with an interview can be considered as a methodology that can provide in-depth data regarding social networks and has a higher validity compared to a social network analysis only.

However, in this research, the questionnaire was not complete since two actors' outgoing ties were missing. Besides, the participants mentioned that the survey did not express clearly enough that the scope was only related to one service since it referred to it as being an example. Moreover, the two departments had different architects and deep interaction between the executive departments regarding the arise of tasks is not a must. Nonetheless, when looking at problem-solving, interaction becomes more prominent and needed. This encountered problem was caused by not investigating the scope of the research before conducting the research and the complexity of the organization. Besides, the participants mentioned that the used terms such as "ideas" and "advice" were too vague to answer the question.

Another limitation of this study is that this study is case related. All teams might benefit from the recommendations, yet more research needs to be conducted to be able to generalize the found results. Moreover, the sample size of this research can be considered as small compared to the size of the organization. Besides, this research question used for this study can be considered as too small whilst the variables covered a broader spectrum of data than expected. The organization has many different processes and procedures for one aspect such as "plans of an architect''. By measuring too many aspects, the interviews became too superficial and too many topics were addressed. This was also due to the lack of IT knowledge of the researcher; it was difficult for the researcher to interview participants regarding processes and tasks without knowledge regarding these topics. However, this study did find aspects that

are important to address within the organization that can help to optimize the IT-service, which was the aim of this study.

5.4. Suggestions for further research

This explorative study presented how tasks arise within and between two departments. For further research, it is recommended to investigate the hierarchies and roles better before researching this topic and IT-knowledge is wished for. Furthermore, this research presented friction between the formal and informal process and formal and informal roles. For further research, it is interesting to look at the tasks and responsibilities of employees and whether they are performing according to the formal process or if they apply a more informal process. If employees have shaped an informal process that is more effective, it might be relevant to take a second look at the formal process to optimize the functioning of the organization. This can be used for the reorganization of the organization. Besides, this study functioned as a pilot study, but the results showed that it is relevant to research the arise of assignments regarding other IT-services as well to be able to compare results and to generalize recommendations.

5.5. Conclusion

This explorative study combined two research methods to investigate the arise of assignments and the dynamics in the social network regarding ideas, plans, and knowledge in an IT-organization. It was found that the social network and informal process play a significant role in not only the arise of assignments, but in all processes within the organization. It is important to find a balance between the formal and informal process, since the hierarchy should support the interactions at the work floor and should not counteract them. However, it is important to stress that the informal process should not overrule since this might lead to a loss of control. It was found that the role of client manager, architect, and product manager do not play a main role in the process of assignments creations and execution as expected. To illustrate, the task of the architect of creating tasks was mainly covered by the team itself. Besides, ideas are shared mainly within teams and knowledge is shared informally. Therefore, it is recommended to create formal moments to share ideas and knowledge.

This study aimed to provide advice for the management of the organization. Next to the explained social structures and recommendations regarding idea and knowledge sharing, recommendations were given that were found in additional data. These recommendations included visibility, transparency, feedback, and looking at possible assignments.

This study showed the relevance of social networks in organizations and provided insights on the interaction at the work floor compared to the hierarchical design. It is important to acknowledge these interactions in an organization. By doing so, these interactions can become a strength of the organization and can create an advantage. For this reason, the found results and recommendations can be used to improve the communication and process regarding the emerge of tasks and the dynamics of the social network in an organization.

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Appendix A
Management Disclosure Contract

1. Study authorization

This document authorizes …. to conduct a social network study at the department of …. during the period March 1, 2019 to June 30, 2019.

2. Rights of the researchers
The data will be properly anonymized so that neither individual nor the company can be identified in the report or thesis presentation. The anonymous version of the report will be published.

3. Rights of the company
In addition, the researchers will furnish the company with a copy of all the data by leaving this data on the assigned laptop. The company agrees that these data will not be shared among the employees and will only be seen by the management. The company agrees that the data will not form the basis for evaluation of individual employees, but will be used in a developmental way to improve the functioning of the company.

4. Rights of the participants
There are no obvious physical, legal or economic risks associated with this study, however, there may be some discomfort due to sensitive topics. Participation in this study does not guarantee any beneficial results to employees. The participants of the survey – the people whose networks are being measured – shall have the right to see their own data to confirm correctness. They may also request a general report from the researchers that does not violate confidentiality of the other participants regarding what was learned in the study.

5. Approval by BMS ethics committee
I have been given the guarantee that this research project has been reviewed and approved by …….. and by the BMS Ethics Committee. For research problems or any other question regarding the research project, the Secretary of the Ethics Commission of the faculty Behavioural, Management and Social Sciences at University Twente may be contacted through ethicscommittee-bms@utwente.nl or ……

_____	_____	_____
Name internship coordinator organization	Signature	Date
_____	_____	_____
Name researcher	Signature	Date

Appendix B

Consent Form Participants

Bedankt voor het openen van de link!

Deze vragenlijst is ontworpen om een onderzoek uit te voeren binnen ……. Momenteel wordt een transitie naar het leveren van diensten doorgemaakt binnen ….. Samenwerken tussen en over teams heen is daarbij essentieel. Het doel van deze vragenlijst is om te onderzoeken hoe de kennis en het ontstaan van opdrachten zich verhouden binnen het sociale netwerk van de groep medewerkers die zich bezighoudt met een service. ….. kan als voorbeeld dienen, om te kijken of er bijvoorbeeld meer communicatie nodig is, of dat er misschien al veel van elkaar geleerd wordt en kennis gedeeld wordt. De resultaten van dit onderzoek zullen een advies vormen voor het management om de communicatie en het delen van kennis, indien nodig, te optimaliseren.

Dit betekent dat het management de resultaten van dit onderzoek geanonimiseerd te zien krijgt. De insteek van dit onderzoek is niet om het algemeen functioneren van teams te evalueren, maar om, indien nodig, communicatie en het delen van kennis te optimaliseren. Dit onderzoek zal niet dienen als evaluatie voor het algemeen functioneren van teams, waarvoor op papier een akkoord is gegeven. De verzamelde data zal in het bezit blijven van ……., maar de resultaten zullen geanonimiseerd gepubliceerd worden in een scriptie.

Je kunt te allen tijde stoppen met je deelname aan deze vragenlijst. Na het verzenden van de vragenlijst is het stoppen van deelname aan het onderzoek mogelijk door contact op te nemen met de onderzoeker. Voor eventuele vragen over rechten als deelnemer aan het onderzoek, verdere informatie of discussiepunten, kun je een e-mail sturen naar……..

Door op akkoord te klikken geef je aan dat je deze voorwaarde hebt gelezen en begrijpt. Door akkoord aan te vinken en te klikken op de pijl rechtsonder, zal de vragenlijst in beeld komen.

Appendix C
Survey

Naam
Vul alsjeblieft je naam in (zal enkel te zien zijn voor de onderzoeker en zal bij analyse geanonimiseerd worden tot rol)

Q1 Hoelang werk je al voor …….?
- Minder dan een jaar
- 1-5 jaar
- 6-9 jaar
- 10-15 jaar
- Meer dan 15 jaar

Q2 Als ik vragen heb over de plannen van de productmanager ga ik meestal naar (Indien niet van toepassing niemand aanvinken, anders maximaal 3 aanvinken):

Q3 Als ik vragen heb over de plannen van de **architect** ga ik meestal naar (Indien niet van toepassing niemand aanvinken, anders maximaal 3 aanvinken):

Q4 Als ik ideeën heb voor opdrachten ga ik meestal naar (Indien niet van toepassing niemand aanvinken, anders maximaal 3 aanvinken):

Q5 Wanneer ik een vraag heb over de plannen voor een change of over lopende/uitvoerende changes, ga ik naar: (Indien niet van toepassing niemand aanvinken, anders maximaal 5 aanvinken):

Q6 Welke personen bezitten kennis en vaardigheden die jij zelf niet hebt of hulp bij nodig hebt? (Indien niet van toepassing, niemand aanvinken)

Q7 Welke personen hebben je de laatste 6 maand geholpen met uitvoering van een opdracht? (Indien niet van toepassing, niemand aanvinken)

Q8 Welke personen hebben jouw ideeën verder gebracht naar mogelijke implementatie? (Indien niet van toepassing, niemand aanvinken)

Q9 Welke personen hebben je geholpen met advies voor een opdracht (Indien niet van toepassing, niemand aanvinken)

Q10 Hoe vaak benader je de volgende persoon voor **niet** werk gerelateerde onderwerpen (Bij jezelf graag ‘nooit’ invullen)

Appendix D
Coding Scheme

Coding scheme used to code interviews

Table D1: *Coding scheme used to code interviews*

Number	Name	Description	Participant answers
1	Years of experience	Comments regarding the years of experience	
2	Work dynamics	The participant gives a description of work dynamics	
3.1	Arise of ideas	Participant gives a description of the arise of ideas	
3.2	Implementation of ideas	Participant gives a description of how ideas are implemented	
3.2.1	Implementation of ideas with help	Participant gives a description of how ideas are implemented with help of others	
3.3	Advice regarding ideas	Comments about who gives advice when ideas are brought up	
4.	Comments regarding the product manager	Comments regarding the product manager	
4.1	Comments regarding the **plans** of product manager	Comments regarding the **plans** of product manager	
5.	Comments regarding the architect	Comments regarding the architect	
5.1	Comments regarding the **plans** of the architect	Participant gives a comment regarding the plans of the architect	
6.	Comments regarding changes	Comments regarding changes	
7.	Tasks	Participant gives a description of certain tasks	
7.1	Help and tasks	Participant gives a description of the dynamics of helping/receiving help from colleagues	
7.2	Formal creation of tasks/assignments	Participant gives description how tasks are created	
7.2.1	Formal role in creation of tasks/assignments	Participant gives a description of their formal role in the creation of tasks/assignments	
7.3	Informal creation of tasks/assignments	Participant gives description how tasks are formally created	
7.3.1	Informal role in creation of tasks/assignments	Participant gives a description of their role in the creation of tasks/assignments	
8	Knowledge and skills	Participant mentions certain knowledge and skills	
8.1	Gaining of knowledge and skills	Participant gives a description how knowledge and skills are gained in the social network	
8.2	Sharing knowledge and skills	Participant gives a description about sharing knowledge and skills	
9	Dynamics and relationships	Comments regarding relationships with colleagues	

10	Recommendations from employees regarding tasks	Participant gives a description of recommendations to optimize creation of tasks
10.1	Recommendations from employees regarding knowledge and skills	Participant gives a description of recommendations to optimize knowledge and skills sharing
11	Feedback	Participant mentions the aspect of feedback
12	Other comments	Relevant comments that cannot be ascribed to another code

Appendix E
Output Gephi

Output sociogram data from question regarding advice for assignment

Table E1: *Graph Density, Modularity, Average Path Length*

Measurement	**Value**
Graph density	.10
Modularity	.19
Average path length	2.00

Table E2: *Closeness centrality and Betweenness centrality*

Participant	**Closeness centrality**	**Betweenness centrality**
Participant 1	.00	.00
Participant 10	.00	.00
Participant 11	.45	.00
Participant 12	.38	.00
Participant 13	.70	60.50
Participant 14	.70	16.00
Participant 15	.52	15.50
Participant 16	.78	12.00
Participant 17	.66	10.50
Participant 18	.47	6.00
Participant 19	1.00	1.00
Participant 2	.00	.00
Participant 20	1.00	.50
Participant 21	.46	.00
Participant 3	.00	.00
Participant 4	.00	.00
Participant 5	.00	.00
Participant 6	.00	.00
Participant 7	.00	.00
Participant 8	.00	.00
Participant 9	.46	.00

Output sociogram data from question regarding ideas for assignment

Table E3: *Graph Density, Modularity, Average Path Length*

Measurement	**Value**
Graph density	.07
Modularity	.20
Average path length	2.00

Table E4: *Closeness centrality and Betweenness centrality*

Participant	**Closeness centrality**	**Betweenness centrality**
Participant 1	.00	.00
Participant 10	.00	.00
Participant 11	1.00	.83
Participant 12	.44	.00
Participant 13	.00	.00
Participant 14	.50	.00
Participant 15	.48	9.00
Participant 16	.50	.00
Participant 17	.86	33.00
Participant 18	.75	20.00
Participant 19	.50	.00
Participant 2	.00	.00
Participant 20	.50	.00
Participant 21	.55	5.00
Participant 3	.00	.00
Participant 4	.00	.00
Participant 5	.33	.00
Participant 6	.00	.00
Participant 7	.00	.00
Participant 8	.54	15.83
Participant 9	1.00	.33

Output sociogram data from question regarding who to approach to get ideas implemented

Table E5: *Graph Density, Modularity, Average Path Length*

Measurement	Value
Graph density	.10
Modularity	.26
Average path length	2.38

Table E6: *Closeness centrality and Betweenness centrality*

Participant	Closeness centrality	Betweenness centrality
Participant 1	.00	.00
Participant 10	.00	.00
Participant 11	.42	1.33
Participant 12	.32	2.33
Participant 13	.61	97.17
Participant 14	.36	5.00
Participant 15	.46	9.66
Participant 16	.59	40.50
Participant 17	.40	34.00
Participant 18	.43	19.33
Participant 19	1.00	3.50
Participant 2	.00	.00
Participant 20	.00	.00
Participant 21	.41	9.50
Participant 3	.00	.00
Participant 4	.00	.00
Participant 5	.00	.00
Participant 6	.00	.00
Participant 7	.00	.00
Participant 8	.00	.00
Participant 9	.41	15.67

Output sociogram data from question regarding changes

Table E5: *Graph Density, Modularity, Average Path Length*

Measurement	Value
Graph density	.07
Modularity	.20
Average path length	2.00

Table E6: *Closeness centrality and Betweenness centrality*

Participant	Closeness centrality	Betweenness centrality
Participant 1	.00	.00
Participant 10	.00	.00
Participant 11	1.00	.83
Participant 12	.44	.00
Participant 13	.00	.00
Participant 14	.50	.00
Participant 15	.48	9.00
Participant 16	.50	.00
Participant 17	.86	33.00
Participant 18	.75	20.00
Participant 19	.50	.00
Participant 2	.00	.00
Participant 20	.50	.00
Participant 21	.55	5.00
Participant 3	.00	.00
Participant 4	.00	.00
Participant 5	.33	.00
Participant 6	.00	.00
Participant 7	.00	.00
Participant 8	.54	15.83
Participant 9	1.00	.33

Output sociogram data from question plans of architect

Table E7: *Graph Density, Modularity, Average Path Length*

Measurement	Value
Graph density	.06
Modularity	.38
Average path length	1.27

Table E8: *Closeness centrality and Betweenness centrality*

Participant	Closeness centrality	Betweenness centrality
Participant 1	.00	.00
Participant 10	.00	.00
Participant 11	1.00	.50
Participant 12	1.00	.00
Participant 13	1.00	.00
Participant 14	.66	.00
Participant 15	.80	.00
Participant 16	.00	.00
Participant 17	.56	.00
Participant 18	1.00	.00
Participant 19	.80	2.00
Participant 2	.00	.00
Participant 20	.66	1.00
Participant 21	1.00	.00
Participant 3	.00	.00
Participant 4	.00	.00
Participant 5	1.00	4.00
Participant 6	.00	.00
Participant 7	.00	.00
Participant 8	1.0	.50
Participant 9	1.0	.00

Output sociogram data from question plans of product manager

Table E7: *Graph Density, Modularity, Average Path Length*

Measurement	Value
Graph density	.14
Modularity	.41
Average path length	1.63

Table E8: *Closeness centrality and Betweenness centrality*

Participant	Closeness centrality	Betweenness centrality
Participant 1	.00	.00
Participant 10	.56	.00
Participant 11	.75	1.21
Participant 12	.00	.00
Participant 13	1.00	6.16
Participant 14	.66	.80
Participant 15	.75	.55
Participant 16	.54	12.00
Participant 17	.54	.00
Participant 18	.66	.82
Participant 19	.66	.65
Participant 2	.00	.00
Participant 20	.66	.00
Participant 21	.50	1.00
Participant 3	.86	17.55
Participant 4	.00	.00
Participant 5	1.00	6.00
Participant 6	.00	.00
Participant 7	.00	.00
Participant 8	.80	.26
Participant 9	.00	.00

Output sociogram data from question regarding social capital

Table E7: *Graph Density, Modularity, Average Path Length*

Measurement	Value
Graph density	.15
Modularity	.15
Average path length	1.82

Table E8: *Closeness centrality and Betweenness centrality*

Participant	Closeness centrality	Betweenness centrality
Participant 1	.00	.00
Participant 10	.00	.00
Participant 11	.43	11.53
Participant 12	.46	8.00
Participant 13	.64	30.57
Participant 14	.00	.00
Participant 15	.42	9.53
Participant 16	.00	.00
Participant 17	.71	.00
Participant 18	.66	34.40
Participant 19	1.00	2.00
Participant 2	.00	.00
Participant 20	.00	.00
Participant 21	.49	9.50
Participant 3	.00	.00
Participant 4	.00	.00
Participant 5	1.00	.00
Participant 6	.00	.00
Participant 7	.00	.00
Participant 8	.62	21.77
Participant 9	.43	1.70

Output sociogram data from question regarding execution of tasks

Table E7: *Graph Density, Modularity, Average Path Length*

Measurement	**Value**
Graph density	.09
Modularity	.19
Average path length	2.16

Table E8: *Closeness centrality and Betweenness centrality*

Participant	**Closeness centrality**	**Betweenness centrality**
Participant 1	.00	.00
Participant 10	.00	.00
Participant 11	.00	.00
Participant 12	.26	1.00
Participant 13	.44	22.53
Participant 14	.52	12.07
Participant 15	.57	.00
Participant 16	.00	.00
Participant 17	.69	9.33
Participant 18	.73	55.60
Participant 19	.41	2.23
Participant 2	.00	.00
Participant 20	.00	.00
Participant 21	.69	21.90
Participant 3	.00	.00
Participant 4	.00	.00
Participant 5	.00	.00
Participant 6	.00	.00
Participant 7	.00	.00
Participant 8	.55	1.33
Participant 9	.32	12.00

Appendix F
Literature Log

Criteria preferred materials
The materials used for this study were mainly books and journals. Only English written sources were used since the report of this study needed to be written in English. Moreover, English is the most often used language in publications regarding social network analysis. Overall, studies and books were selected from well-known researcher who have been studying social networks often.

Selected databases
The most well-known books and advised books by universities were used. These books were selected on content and guidelines regarding the steps to take when conducting social network analysis. One book was collected from the library from the Vrije Universiteit Amsterdam. Moreover, Scopus was used to search for articles. This database was most appropriate since it included peer-reviewed journals. However, Google Scholar was used to find some articles as well but only UTwente access links were used that forwarded to ScienceDirect.

Relevant terms

Table F1: *Relevant terms for search queries*

Concepts	Related terms	Smaller terms	Broader terms
Betweenness centrality	Actor, path, correlation	Brokerage	Social network structure
Social network	Structures, ties, patterns	Individual interaction	Interaction pattern
Ideas	Innovation, Sharing,	Assignments	Concept
Social network analysis	Visualization, triads	Relationships	Methodology, Sociology, studies

Search actions

Table F2: *Search actions*

Search action number	Date	Database	Search actions	Total hits
1	15.02.2019	FindUT	Social network analysis	201,225
2	22.02.2019	FindUT	Social capital	149,968
3	03.03.2019	Google	How to conduct social network analysis	217000000
4	10.04.2019	Google Scholar	Ronald Burt	56500
5	10.04.2019	Google Scholar	Social network analysis	475000
6	11.04.2019	Scopus	Ideas AND organization	35506
7	11.04.2019	Scopus	Social capital Search within results: Social network	21857
8	28.04.2019	Google Scholar	Social capital	4130000
9	28.04.2019	Google Scholar	Ideas in organizations	3660000
10	28.04.2019	Scopus	Problem-solving	328,532

Reflection

Before starting this study, books and articles were read about how to conduct social network analysis. To select books, a teacher from the Vrije Universiteit Amsterdam was approached. Based on this knowledge, it was easier to select qualitative good information. First, well-known and often used literature was studied to collect relevant literature for the theoretical framework. After this, more specific terms were used to investigate certain aspects of the theoretical framework. It was difficult to find literature that covered the topics of the study. However, I did manage to find relevant literature. Since I was not familiar with conducting social network analysis, I decided to search for the broad term social network analysis only to select my variables. After that I decided that I would only focus on searching literature for my variables since I had not conducted a social network analysis before and I wanted to limit my scope. I decided to use older literature and studies as well, since interesting data and conclusions could be drawn from these studies.

I think that the order of reading guides first was very useful since I did not have knowledge regarding conducting social network analysis. I did have some theoretical knowledge, but I did not know how to approach this type of research. Next search operation, I would keep my search terms broader for a longer period of time to not limit myself regarding the found literature results. Moreover, I would not use one study to draw conclusions from but incorporate multiple studies and create a better overview. However, considering the limitation of time and knowledge, I think I found a good balance between the use of different literature and limiting my searches to not make it too complex for myself.