

# Studies on advice network information flows in customer support process

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This thesis contributes to the social network analysis of information flows in knowledge management systems. The main research question for the article was "How to understand information flows of individuals in customer support process?" and "How the interdepartmental online collaboration influence on job performance?". With these questions, the purpose of the study and the main objective is to understand how the internal support process works between the departments and individuals and obtain information about the importance of cooperation in the efficiency of the work.

The research methodology chosen was case study research, since it was best suited for evaluating a contemporary phenomenon in its real life context. The study process was following the general case study research guidelines: Plan, design, prepare, collect, analyze and share. The research started with a literature review in order to get an understanding of knowledge management, suggestions from social capital theory, and what kind of studies had been conducted. The empirical research was conducted for a small IT company to study its knowledge sharing process between help desk and technical staff. The chosen individuals in the organization were studied with case study methods providing rigor for the research. The case study was mainly conducted by accessing online messages in team collaboration tool (Flowdock) for over a nine-month period. Multiple research methods enable triangulation thus improving the reliability and validity of the study. After completing the case study research, the results were presented in The 26th International Conference on Information Modelling and Knowledge Bases as a contribution to academic knowledge and the discipline.

The main approach to study the social network was Social Network Analysis (SNA). SNA is a process of investigating social structures through the use of network and graph theories. There is a notable implication to be drawn from the research findings of SNA anomalies to help managerial decision-making. Anomalous activities in social networks represent unusual behaviors of individuals present in the reference group. In this study, the presented SNA approach was proven effective to detect anomalies from the analyzed data.

The main results show significant correlation between collaboration and job performance. Advice networks provide open and trustworthy relationship between personnel establishing an innovative organization culture and climate. In addition, individuals with greater experience are those who frequently provided advice to others within the team. These findings promote the importance of social relations in work communities and encourage managers to support team collaboration solutions in favor of firm's sustainable competitive advantage.

More studies in this field need to be conducted to find additional support for the provided results. Valuable insights would come from similar analyses in companies of various sizes, different industries and other countries. These results apply only to communities in a specific setting, while to allow for a generalization of implications further research is required.

**Keywords:** Social Network Analysis, Knowledge Management Systems, Customer support

Kaisti, Tero

### Sosiaalinen verkostanalyysi yrityksen asiakaspalveluprosessin tietovirroista

Vuosi 2016

Sivut

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Tämä opinnäytetyö perehtyy sosiaalisen verkostanalyysin keinoin yrityksen tietovirtojen mallintamiseen tiedonhallintajärjestelmässä. Opinnäytetyö keskittyy kysymyksiin "Miten asiakaspalveluprosessin informaatiovirrat muodostuvat henkilöstön välillä?" ja "Kuinka osastojen välinen kommunikointi vaikuttaa työn tehokkuuteen?" Näillä kysymyksillä pyritään löytämään vastauksia siihen, miten yrityksen sisäinen asiakaspalveluprosessi toimii eri osastojen ja yksilöiden välillä, sekä saada tietoa yhteistyön merkityksestä työn tehokkuuteen.

Tutkimusmetodiksi valittiin tapaustutkimus, koska se sopii parhaiten tulkitsemaan syvällisesti yksittäisiä tapauksia niiden erityisessä kontekstissa, ja ymmärtämään ilmiöön liittyvän toiminnan dynamiikan ja prosessit. Opinnäytetyö mukailee tapaustutkimuksen yleisiä suuntaviivoja: Suunnittele, mallinna, valmiste, kerää, analysoi ja julkaise. Aiheeseen tutustuminen aloitettiin kirjallisuuskatsauksella, jonka avulla perehdyttiin ilmiön ympärillä oleviin käsitteisiin: tiedonhallintajärjestelmiin, sosiaalisen pääoman teoriaan, organisaation oppimiseen sekä alan kirjallisuuteen ja aiempaan tutkimukseen. Empiirinen tutkimus kohdistui taloushallinto-ohjelmistoa valmistavaan IT-alan yritykseen ja sen sisäiseen asiakaspalveluprosessiin. Valitun kohderyhmän tutkimiseen käytettiin tapaustutkimusmenetelmää tulosten luotettavuuden takaamiseksi. Tutkittava aineisto koostui yhdeksän kuukauden aikana kerätystä tiimityökalun viestinnästä. Tulosten validiteetti ja relibiliteetti saavutettiin tiedon keruun tarkalla kuvauksella ja trianguloimalla aineistoa eri tutkimusmenetelmillä. Opinnäytetyön pohjana on ollut tekijän kirjoittama ja "The 26th International Conference on Information Modelling and Knowledge Bases" -konferenssissa julkaistu akateeminen tutkimus.

Tutkimuksen päätulosten perusteella työntekijän oma aktiivisuus sisäisen asiakasprosessin aikana korreloi suoraan työn tehokkuuteen. Työpaikan sisällä olevat sosiaaliset verkostot parantavat yhteishenkeä työntekijöiden välillä ja edesauttavat innovatiivisen organisaatiokulttuurin luonnissa. Tulosten perusteella kokeneemmat työntekijät ovat keskimäärin halukkaampia auttamaan ja vastaavasti nuoremmat pyytämään apua verkoston muilta toimijoilta. Löydökset viittaavat sosiaalisten verkostojen tärkeyteen työyhteisön tehokkuuden kannalta, ja antavat esimiehille vahvan lähtökohdan kehittää verkostoja ja parantaa yrityksen toimintaedellytyksiä kilpailussa.

Asiasanat: Sosiaalinen verkostanalyysi, tiedonhallintajärjestelmät, asiakaspalvelu



## Table of Contents

1	Introduction .....	6
2	Literature review .....	8
2.1	Knowledge Management in IT .....	8
2.2	Knowledge yields competitive advantage .....	12
2.3	Knowledge Management Systems facilitate learning .....	13
2.4	Organizations succeed with social capital .....	14
2.5	Advice networks contribute work performance .....	16
2.6	Analyzing and modeling social networks .....	17
3	Research methodology .....	18
3.1	Research approach.....	19
3.2	Researcher's role .....	20
3.3	Operational environment .....	21
3.4	Data Collection and Analysis .....	22
3.5	Research attributes.....	24
3.6	Triangulation of study .....	26
4	Results .....	27
4.1	Sociogram of individual involvement and activity .....	27
4.2	Exploration to interdepartmental knowledge sharing.....	29
4.3	Correlation analysis of work performance .....	29
4.4	Analysis of reflexive research.....	31
5	Process of Study .....	31
5.1	Study I: The first version of the paper.....	32
5.2	Study II: Changing the article based on the reviews .....	33
5.3	Study III: Conference presentation .....	35
6	Discussion .....	36
6.1	Contribution to research questions .....	36
6.2	Implications.....	39
6.3	Validity and reliability .....	40
6.4	Limitations and shortages .....	40
7	Conclusion.....	41
	References .....	43
	Figures.....	48
	Tables.....	48
	Appendices.....	48

## 1 Introduction

“I Store My Knowledge In My Friends”, Karen Stephensen.

During the last decades, the rapid development of information technology has changed the way to produce services. Because the change has become constant for new digital services to update frequently, users have less time to adapt new features and understand how to use them. In this constant change, companies need to provide a channel for users to get instant help when problems occur. Atalik (2007) states that this is an emerging trend and has increased the responsiveness from company to its customers.

The service experience on customer satisfaction has been entitled on many researches, including Goodman and Newman (2003), and Chebat, Davidow, and Codjovi (2005). One of the key factors from these studies is that the vast majority of dissatisfied customers refuses to complain but are more likely to abandon their relationship with the company as a consequence of their frustration. According to Aksim, Armony and Mehrota (2007), the importance of the telephone assistance in this relationship is underscored by an assertion that 80% of communication with its customers is through call centers, and 92% of customers base their options on their experience with call centers.

The studies recognize that the fast reaction to users' problems increases customer satisfaction and establish long-term relationships with companies (de Waal, 2012; Homburg & Fürst, 2005). An ongoing dialogue with customers offers a good opportunity for companies to receive valuable insights and gain better understanding of customers' needs (Hunt, Catherine P. Killen, González Bosch, & Tamayo Enríquez, 2005). On the other hand, inadequate complainment handling leads to dissatisfied customers who express their bad experience affecting negatively on company image (Richins, 1983).

According to Omona, van der Weide and Lubega (2010), knowledge management is understood as a discipline concerned with analysis and technical support of practices used in an organization to identify, create, represent, distribute and enable real-world practices to organizational processes. Effective knowledge management is an increasingly imperative shared source of collaborative and rationale advantages. In this regard, it is a key to success in hi-tech organizations bolstering the collective and shared expertise of its employees, actors and partners.

Operational environment and context of this study is based on a small IT firm that produces industry specific accountant software for construction and maintenance-service sector. The firm employs currently 12 people and is a subsidiary of a major financial and HR service conglomerate operating in 7 countries. Nevertheless, the firm has sustained its autonomy and is

actively developing its internal working methods to improve employees' commitment, learning and work performance.

The urgency of this study is based on the fact that the vast majority of people operating in help desk services have changed during the past two years. Because the firm is developing proprietary software with industry specific solutions, the learning curve is steep and most know-how must taught from the scratch to new staff. Therefore, one of the key factors to understand activity is to visualize information flows among employees. In this context, social network analysis (SNA) provides a subtle tool to measure individual activity and understand how information flows distribute in organization. In general, this study focuses on how a specific team collaboration tool (Flowdock) is being used to help solving customer support cases.

The foundations of this study are based on three concepts: Advice network structure, interpersonal dyads and work performance. SNA approach is used to understand the network topology, reveal interpersonal and interdepartmental dyads during handling of the support process in collaboration between different departments. Many recent studies (Hollenbeck & Jamieson, 2015; Tuominen, 2013) stress the importance of SNA in strategic human resource management from a wide range of disciplines. In addition to that, descriptive statistics (Bivariate Correlation) was conducted to investigate relationships between advice-receiving (in-degree), advice-giving (out-degree), tenure and work performance (telephone assistance call duration and quantity) in order to get better understanding of findings.

This study is unique in its prospective analysis of the influence of network social capital on customer support processes, thus providing greater support for influences on team collaboration. In formal SNA, the data is collected using quantitative methods like name-generator surveys, which produce numerical data on the presence or absence of ties (Edwards, 2010). With modern technology and KMS that assist online teams, data collection has become more quantitative process. In addition to the unique collection method, the author's subjective approach with autoethnography extends the understanding on research objectives in this thesis.

To understand participation in knowledge management processes, this research concentrates on the following research questions: 1) Who is involved in the customer support process, 2) how active the participants are, 3) how the participation varies between departments, and 4) how the online activity influences on work performance? Based on these questions, the main objective and the purpose of the research is to study how the internal support process works between the departments and individuals and obtain information about the importance of cooperation in the efficiency of the work.

The rest of this thesis is organized as follows. In chapter 2, a literature review of applied theories and concepts are presented. Chapter 3 describes the research methodology, data collection and analysis with the attributes of the study. Results of the study are presented in chapter 4. The process of the study and authoring an academic inquiry with conference proceedings is presented in chapter 5. Finally, conclusions and discussions are left for last chapters.

## 2 Literature review

End-user support and help desk operations are one of the most important functions for companies to appear to its customers. In addition to assist customers to use products, help desk is also responsible to take care of complaints. Complaint handling stands for operational activities directly aimed at helping customers to resolve their complaints (Vos, Huitema, & de Lange-Ros, 2008).

One of the reasons slowing the customer support process is an inefficacy of information flows between the complaint handling personnel. That is why a company should be able to visually observe information flows to point out the operational bottlenecks of areas that need more attention (Sitko-Lutek, Chuanchaoen, Sukpitikul, & Phusavat, 2010). To address the problem, a visual presentation of information flows is a prerequisite to understand the internal support process. Using this visual approach helps managers to make decisions to facilitate organizational learning and improve work performance.

### 2.1 Knowledge Management in IT

The digital revolution has drastically expanded our definition and understanding of knowledge, information, and data. To understand the concept of “justified true belief” coined by Plato, knowledge does have some properties that are absent in almost all other resources used in a company. Most important characteristics that set knowledge apart from other resources (Wiig, de Hoog, & Van Der Spek, 1997) are: 1) Intangible and difficult to measure, 2) volatile, that is, it can ‘disappear’ overnight, 3) most of the time, embodied in agents with wills, 4) not ‘consumed’ in a process, it some-times increases through use, 5) has wide ranging impacts in organizations (e.g. ‘knowledge is power’), 6) cannot be bought on the market at any time, it often has long lead times, and 7) can be used by different processes at the same time.

According to Davenport (1994), “Knowledge management (KM) is the process of capturing, distributing, and effectively using knowledge”. Bhatti and Qureshi (2007) describe that KM is an effort to explore knowledge of individuals, groups, and organizations and to change this information useful for managers to advantage it in decision-making. KM is also presented as a management strategy that stores, transmits, transfers, develops, and implements knowledge so

that it can leverage performance of individuals in organization (Gholami, Asli, Nazari-Shirkouhi, & Noruzy, 2013).

Cantú, Criado and Criado (2009) acknowledge that strategic knowledge generation is important to SME's to build competitive advantage. Increased collaboration and knowledge sharing in organization help decision-making and problem solving. Knowledge sharing and transfer process can lead to improved decision-making and ultimately improves work performance. In another research (Stasser & Titus, 1985), the results indicate that the process of sharing information and knowledge among employees will ultimately lead to better work performance. The amount of knowledge that flows in to the organization correlates with the capability to solve problems in a more effective way (Soo, Devinney, Midgley, & Deering, 2002).

Technologies that complement human interaction are critical to organizational success (Dixon, 2007, p. 4). For SMEs, adaptive and intelligent strategies including KM processes and best practices are key elements to survive in a competitive market. These practices can be applied in various forms and operate in different configuration. (Alavi & Leidner, 2001; Davenport, 1994.)

A common distinction drawn in knowledge management literature is the separation between explicit and tacit knowledge (Table 1). Explicit knowledge is knowledge that can be readily articulated, codified, accessed and verbalized in words, numbers, and formulae and is often technical, scientific or academic in nature. It is codified knowledge transmittable in formal, systematic language whereas tacit knowledge is personalized knowledge that is hard to formalize and communicate and deeply rooted in action, commitment and involvement in context. Individuals built tacit knowledge by cognitively organizing what they have learned from past. Tacit knowledge can be further divided into technical, and cognitive, which includes beliefs, values, schemas, and mental models. (I. Nonaka & Takeuchi, 1995; I. Nonaka & Konno, 1998; Polanyi, 1962; Smith, 2001.)

<b>Tacit Knowledge</b>	<b>Explicit Knowledge (Objective)</b>
Knowledge of experience (body)	Knowledge of rationality (mind)
Simultaneous knowledge (here and now)	Sequential knowledge (there and then)
Analog knowledge (practice)	Digital knowledge (theory)

Table 1: Two Types of Knowledge (I. Nonaka & Takeuchi, 1995, p. 61)

Knowledge management from a process perspective is concerned with the creation, dissemination, and utilization of knowledge in the organization. The process focuses on knowledge sharing and diversity across individuals and how it affects the development of organizational absorptive capacity (Cohen & Levinthal, 1990). Therefore, a well-structured process needs to be

in place to manage knowledge successfully. Carrying out knowledge management effectively requires support from a repertoire of methods, techniques and tools.

Theory of organizational knowledge creation states that knowledge is created through an iterative process between tacit and explicit knowledge in four phases: 1) Socialization, 2) combination, 3) internalization, and 4) externalization (I. Nonaka, Takeuchi, & Umemoto, 1996). In addition, Wiig and Van der Spek (1997) provide a similar set of sequentially performed methods known as the knowledge management cycle. A comparative analysis of KM frameworks in the literature indicates that they identify various knowledge management activities (Holsapple & Joshi, 1999). Some of these activities are treated at an elemental level while others deal with higher-level knowledge activities. These are summarized in Table 2.

Leonard- Barton, 1995	<ol style="list-style-type: none"> <li>1. Shared and creative problem solving</li> <li>2. Importing and absorbing technological knowledge from the outside of the firm</li> <li>3. Experimenting and prototyping</li> <li>4. Implementing and integrating new methodologies and tools.</li> </ol>
Arthur Andersen and APQC, 1996	<ol style="list-style-type: none"> <li>1. Share 2. Create 3. Identify 4. Collect 5. Adapt 6. Organize 7. Apply</li> </ol>
Wiig, 1993	<ol style="list-style-type: none"> <li>1. Creation 2. Manifestation 3. Use 4. Transfer</li> </ol>
Choo, 1996	<ol style="list-style-type: none"> <li>1. Sensemaking (includes “information interpretation”)</li> <li>2. Knowledge creation (includes “information transformation”)</li> <li>3. Decision making (includes “information processing”)</li> </ol>
van der Spek and Spijkervet, 1997	<ol style="list-style-type: none"> <li>1. Develop 2. Distribute 3. Combine 4. Hold</li> </ol>
Nonaka, 1996	<ol style="list-style-type: none"> <li>1. Socialization</li> <li>2. Internalization</li> <li>3. Combination</li> <li>4. Externalization (conversion of tacit knowledge to explicit knowledge)</li> <li>(conversion of tacit knowledge to tacit knowledge)</li> <li>(conversion of explicit knowledge to tacit knowledge)</li> <li>(conversion of explicit knowledge to explicit knowledge)</li> </ol>

Alavi, 1997	1. Acquisition (knowledge creation and content development) 2. Indexing 3. Filtering 4. Linking (activities 2, 3, and 4 involve screening, classification, cataloging, integrating, and interconnecting internal and external sources) 5. Distributing (packaging and delivery of knowledge in form of Web pages) 6. Application (using knowledge)
Szulanski, 1996	1. Initiation (recognize knowledge need and satisfy that need) 2. Implementation (knowledge transfer takes place) 3. Ramp-up (use the transferred knowledge) 4. Integration (internalize the knowledge)

Table 2: Summary of Knowledge management activities identified in the literature (Holsapple & Joshi, 1999)

Knowledge needs to be created and solicited to serve as inputs for the knowledge management process. Data mining and knowledge discovery relate to the process of extracting potentially useful piece of information from raw data (Desouza, 2005). As knowledge management is all about sharing, in order to be able to share knowledge, it must be given exact format. To be able to capture, store and distribute, the collected knowledge must be encoded in predefined format. Codification of knowledge calls for transfer of tacit knowledge into explicit form first and then to electronic representations. Taking advantage of centralized repositories facilitates fast access to knowledge, eliminate duplication of efforts at the departmental or organizational levels and hence saves cost. Employee usage of knowledge systems for purposes of work performance is a key factor of the organization's development (Alavi & Leidner, 2001; Desouza, 2005.)

To understand the nature of information flows, the process of conversion must be explained. A process called mobilization is used to make tacit knowledge explicit in the creation of new knowledge. Ideas that can easily be written down are more often transferred to other people. Databases, books, and other repositories presenting knowledge artifacts are considered explicit or codified. However, codified explicit knowledge is only a small proportion and “the tip of the iceberg” of the entire body of knowledge what an individual knows. In this sense, team collaboration systems must handle both tacit and explicit forms of knowledge. (Dixon, 2007, pp. 20-21; I. Nonaka & Takeuchi, 1995, p. 60.)

There is heavy reliance on figurative language and symbolism to make tacit knowledge explicit (I. Nonaka & Takeuchi, 1995). Individuals must be encouraged to share knowledge with each other without fear of looking foolish (Ahmed, 1998). This process is an extent to which employees are able to generate new solutions, ideas and ways of working as well as to facilitate organizational learning and apply new skills to better work performance (Soo et al., 2002). Furthermore, the use of knowledge-based products on the job will be critical to their economic success (Davis & Botkin, 1994).

As discussed in the research background, different models are considered to describe KM practices in various ways. In this research, workflows in a team collaboration tool are explored in knowledge creation, acquisition, sharing, storage and implementation in the customer support process of the firm under study. KM systems such as team collaboration tools utilize information flows among actors. Ensuring free flows of information increases the effectiveness of KM practices and promotes social interactions in the firm.

## 2.2 Knowledge yields competitive advantage

When material-based production moved towards information-based production in companies, it started a need to reevaluate the skills of workers. Knowledge workers are mostly found at the core of firm's key operations, such as concept and technology designers, and finance and management functions (Curado, 2006), and the responsibilities normally fall with middle managers, as they have to prove its worth to top-level executives (Desouza, 2005).

An emerging theory known as the "knowledge-based view of the firm" (KBV) considers knowledge as the most strategically resource of a company. The KBV argues that knowledge achieve a competitive advantage for firms over generic resources. In fact, the theory argues that companies solely exist because they better integrate, apply and protect knowledge than their rivals. (Marvel, 2012, s. 290.)

The proposed theory emphasizes the important aspect of knowledge management where services rendered by tangible resources depend on how they are combined and applied, which is in turn a function of the company's know-how (i.e., knowledge). Because knowledge-based resources are usually hard to discover and complex, the view states that these knowledge assets can yield competitive advantage. Moreover, it is the company's ability to effectively apply the existing knowledge to develop new knowledge and to take action that forms a competent environment to produce knowledge-based assets. In this context, information technologies play an important role in effectuating the knowledge-based theory of the firm (Alavi & Leidner, 2001; Gholami et al., 2013).



Cohen and Levinthal (1990) found that the absorptive capacity of workers in problem solving and applying knowledge to commercial purposes, are intangible resources for the organization. Furthermore, numerous studies indicate that age and organizational tenure have been associated with work performance (Sykes, Venkatesh, & Johnson, 2014). While the KBV's main focus is on organizational level, individuals and their human capital are the ones to create the real knowledge (Marvel, 2012, s. 291).

DeNisi, Hitt and Jackson (2003) consider knowledge-based capabilities to be the most strategically important ones to create and sustain competitive advantage. To deliver promised values, knowledge management must address strategic issues and provide for competitive advantages in enterprises (Desouza, 2005). As stated in Davis and Botkin (1994), business that is based on providing information to customers will do better and those who convert information into knowledge will be the most successful. Understanding the knowledge management process and how people are involved in it forms the basis of the KBV theory.

The KBV of the firm is an implication for knowledge integration in the production processes. Organizational knowledge and the company's competitive advantage relate to capacity to integrate and apply knowledge. In this sense, research has changed towards the coordination mechanisms and their respective contexts. (Alavi & Leidner, 2001; Curado, 2006; DeNisi et al., 2003). To better understand these coordination mechanisms, the KBV theory is applied into this thesis.

### 2.3 Knowledge Management Systems facilitate learning

In recent years, the discussion about technologies for learning has moved away from only institutionally managed learning management systems to the use of personal and social online platforms. Communication is always partially ineffective to some degree beyond the control of any one individual or organization (Shulman, Clegg, Hardy, & Nord, 1999, p. 117). Although, giving interdepartmental access to knowledge through groupware systems, it likely facilitates learning because an opportunity for engaging is provided.

Mostly, literature on organizational learning has its interpretation from individual oriented psychology (Huber, 1991). Such psychological theories cannot be applied directly to organizations because they do not adequately explain organizational learning processes (Weick, Sutcliffe, & Obstfeld, 2005). Therefore, organizations must be seen as a different type of entity in opposite to individuals and interact with environment differently. This makes the studying of the phenomenon far more complex, because it must be viewed as individuals' participation in everyday life at work

The idea of the organization as a learning unit views learning as a social practice and a part of ongoing, continuing processes of everyday practice at work (Argyris & Schoen, 1978; Senge, 1990). When focusing on informal learning as participation, the unit of analysis is a social interaction between members in social practices. In this sense, everyday practice at work mostly occurs through social relations where organizational learning is facilitated through the combination of knowledge production and integration (Dixon, 2007, p. 126). In this study, we concentrate on these informal learning patterns and analyze how they affect on work performance in order to provide managerial implications to help decision-making.

It has becoming more evident that in addition to know-how and know-what, employees should be more aware of know-where. Creating and maintaining social platforms to support free information flows among co-workers is one of the key elements of successful organization and an important element in organizational effectiveness (Siemens, 2005). It is consistent with other learning theories that imply knowledge sharing as a competitive advantage and a key driver of corporate performance and innovation (Jiménez-Jiménez & Sanz-Valle, 2011).

The use of knowledge management systems to support collaborative learning gives researchers an opportunity for evaluation, due to their storage and processing capabilities (Martínez, Dimitriadis, Rubia, Gómez, & De La Fuente, 2003). These kinds of team collaboration systems enhance individual learning and have the potential to be extended to organizational as well (Dixon, 2007). Analyzing learning networks using the collected data is therefore evaluated as a good approach to seek answers for research questions posed.

## 2.4 Organizations succeed with social capital

Social capital can be defined as resources embedded in a social structure, which are accessed and/or mobilized in purposive actions. The theory behind the term gained importance through the integration of classical sociological theory with the description of an intangible form of capital. Highly diverse network ties can help employees develop more complete, creative, and unbiased views of issues. Unique and exceptionally valuable resources are provided when trading information or skills with people with different experiences resulting increase of social capital for organization. (Lin, 1999; Uzzi & Dunlap, 2005.)

According to the different explanations of the theory revised in Ferragina (2010), social capital can be defined as social network transactions marked by reciprocity, trust and cooperation. Market agents exploit social capital in their networks to produce goods and services in terms of common good, but also for their own benefit. In this context, social capital can only be generated collectively to the presence of networks. On contrast, it can also be used individually as “investment in social relations with expected returns (Lin, 1999)”.

Burt (1993, p. 58) argues that social capital is jointly owned resource in which no one has exclusive ownership rights to. Withdrawn connections in network reduce social capital it contained. Through relations with colleagues, friends, and clients come the opportunities to transform financial and human capital into profit. The capital invested into workers should reward company with the opportunities to sell the product at a profit. Social capital is the final arbiter of competitive success (Burt, 1993, p. 9).

Lin (1999) finds that embedded resources in social networks will enhance the outcomes of actions by 1) facilitating in the flow of information, 2) being influential on important decision makers, and 3) certifying the social credentials of individuals. To measure social capital in organization, network size and quantification of social relationships are often focused rather than accessible social resources (Lin, 1999). Estimating the size of social networks by counting the interconnected ties between dyads is a valid analysis method to estimate the network activity. Therefore, measuring social networks has stressed the importance of bridges in networks in facilitating information and influence flows. On the other hand, it has been very difficult to standardize network size measures because individual goal and network size do not have same meaning within every context. (Granovetter, 1973; Van der Gaag & Webber, 2008, pp. 45-46.)

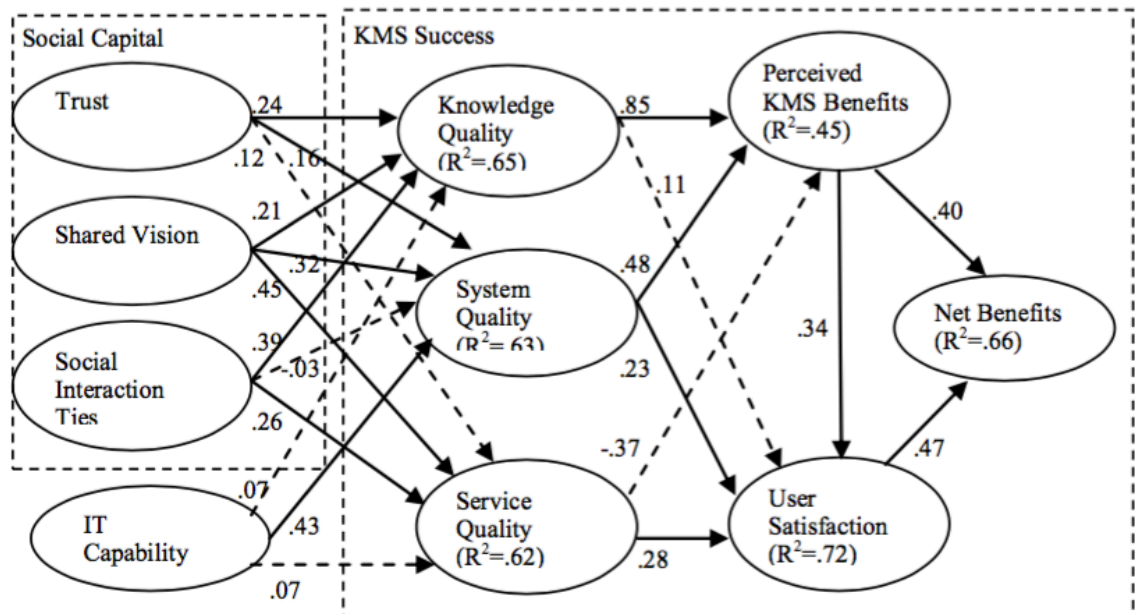


Figure 1: SEM analysis result on the influence of Social Capital in KMS success (Chen, 2009)

Sine IT has become a fundamental factor of business, organization's capability in utilizing IT to explore and exploit valuable knowledge may determine the extent to which such competitiveness may be sustained. According to the analysis result represented in Figure 1, social interaction ties influence on knowledge and service quality in advice networks and IT system quality correlates with KMS benefits and satisfaction. In addition, shared vision among the employees

is positively and significantly associated with KMS quality. These findings are consistent with the social capital theory, which states that when a common interest is shared among employees, they are more likely to cooperate to accomplish the collective goal.

## 2.5 Advice networks contribute work performance

Advice networks comprise employees in an organization who seek and provide information, assistance, and share knowledge between each other in order to execute their duties (Sparrowe, Liden, Wayne, & Kraimer, 2001). A dominant concept in the study of advice networks is network density, which is a proportion of direct ties in a network relative to the total number possible (Passmore, 2011). Although, prior social network research has typically treated advice as a unitary concept. The more nuanced treatment of advice in social network is necessary to better understand processes that influence on work performance of individuals (Sykes et al., 2014).

Employees who give and receive advice share knowledge, power and influence in the customer support process. Such employees obtain expertise that they re-spread with others in the advice network. This evolving understanding allows network members to both learn by requesting for advice (advice-receiving) as well as to improve their own learning process by sharing existing knowledge to others (advice-giving). This process is similar to learning by teaching where helping others reinforces obtained knowledge and improves understanding (Torrey, Walker, Shavlik, & Maclin, 2005). Knowledge sharing in advice networks also contributes positively to work performance as it provides opportunities to see problems from different perspectives. Those employees who are active in advice networks are in a better position to distinguish information gaps and problem areas than their less engaged coworkers (Sykes et al., 2014).

Advice networks are related to important work outcomes, but not many studies consider whether an individual gives or receives advice but focus on general communication. It is likely that advice-giving and advice-receiving have very different impacts on performance and work-related attitudes. For instance, receiving advice may help team members to learn appropriate community behaviors and norms. In addition, job involvement correlates with task autonomy, task significance, task identity, skill variety and feedback and supervisory behaviors such as leader consideration, participative decision-making and amount of communication (Brown, 1996). On how employees evaluate the importance of their jobs is associated with work satisfaction, organizational commitment, and reduced turnover intentions (Zagenczyk & Murrell, 2009). Job involvement and advice network research suggest that a positive relationship exists between these variables. Findings show that job involvement will be highest when the work environment is able to fulfill the following list of requirements (Brown, 1996, p. 239): 1) Makes one believe that their work is meaningful, 2) offers control over how work is accomplished 3)

maintains a clear set of behavioral norms, 4) makes feedback concerning completed work available, and 5) provides supportive relations with supervisors and coworkers.

Nevertheless, studies on social networks propose that advice-giving may negatively impact on work performance. Cross and Prusak (2002) found out that central employees spend much of their time helping others, and therefore struggle on their own duties. As a result, they tire of their roles and eventually focus their effort on tangle tasks they were originally assigned to. In addition to that, employees in their formal assignment who are required to consistently go above and beyond the call of their duties had increased stress levels and suffered mental health problems in the workplace (Bolino & Turnley, 2005).

Recent studies agree that information sharing has positive effects on group performance in organization (de Waal, 2012). Open and trustworthy relationship to customers is an establishment of innovative organization culture and climate. Highly innovative companies appear to place equal emphasis on the technical side as well as the social side of the organization. In addition, they look to nurture not only technical abilities and expertise but also promote a sense of sharing and togetherness. Nevertheless, less innovative firms tend to create environments of independence, whereas more innovative ones create environments of co-operation (Ahmed, 1998). When group members share information, their expertise, knowledge and experience develops and they are capable of doing better decisions. This enhances co-operational activities and increases knowledge of other members' fields of expertise. Free information flows between different operations improve knowledge management processes in company (Massingham, 2014).

As a conclusion, helping others by providing advice in social network may have negative impacts on employees. Therefore, it is important to examine whether advice-giving and advice-receiving correlate with helpdesk's call records and does interdepartmental communication have a positive effect on work performance.

## 2.6 Analyzing and modeling social networks

A discipline that has showed to be appropriate for the efficient study of these social and participatory aspects of learning is Social Network Analysis (SNA) (Wasserman & Faust, 1994). Social networks are seen as a specific set of linkages among a defined set of persons, with the additional property that the characteristics of these linkages as a whole may be used to interpret the social behavior of persons involved (Mitchell, 1969, p. 2). Social network theory views social relationships in terms of nodes and ties. Network analysis is concerned with the structure of the relationships and tries to understand their causes and consequences (Tichy, Tushman, & Fombrun, 1979).

Patterns of relations in social networks have been used as predictive tools based on the assumption that when others are placed in a similar social situation they will behave like those in corresponding social situations. (Dixon, 2007, p. 45-46.)

A sociogram is a linear directed graph to represent the linkages found within social networks. They are used illustrate diffusion, social mobility, political organization, and social cohesion they can diagram the structure and patterns of group interactions. A sociogram can be drawn on the basis of many different criteria: Social relations, channels of influence, lines of communication etc. The power of sociograms stems from its alternate view, where the attributes of individuals are less important than their relationships and ties with other actors within the network. It's a useful approach to explain real-world phenomena, but lacks the ability for individuals to influence their success, because so much of it rests within the structure of their network. (Granovetter, 1973; Passmore, 2011, p. 6.)

Networks can be described as dense or sparse, closed or open, and they vary in size. Lin (1999) argued that dense or closed networks are seen as the means by which collective capital can be maintained and reproduction of the group can be achieved. On the other hand, a dense network is inefficient as it returns less diverse information for the same cost as the sparse network (Burt, 1993, p. 65). However, there are limits to the amount of information anyone can process at one time. Social networks provide a significant brokering function, affecting the timing of information receipt, and constitute a significant screening device for information.

SNA leverages the approach and provides multiple metrics to analyze the data collected of advice networks. Zhang et al. (2006) argue that the sum of links between the actors as the vertex degree is the most important topological property of the network. Wassermann and Faust (1994, p. 101) explain the density of a graph is the proportion of possible lines that are actually present in graph. It is the ratio of the number of lines present to the maximum possible. These measures were relevant to the analysis associated with this study.

### 3 Research methodology

The subject of this study is to understand information flows in customer support process and how it correlates with work performance and facilitates learning. To investigate a contemporary phenomenon with an empirical inquiry, a case study as a methodology was employed to this research project. Case study research is described in more detail by several sources and is an established method to conduct research on a person, group, or situation that has been studied over time (Eisenhardt, 1989; Runeson & Höst, 2009; Yin, 2009).

This research consists of the following parts: First, a literature review to understand the phenomenon is described in more detail in its own chapter. Second, the research data was collected

from the team collaboration tool used in customer support. Data collection procedures are explained with accuracy to provide repeatability and reliability for results. Third, the results derived from data were analyzed using mixed methodologies. The research adapted Yin's (Yin, 2009, p. 1) process model represented in Figure 2.

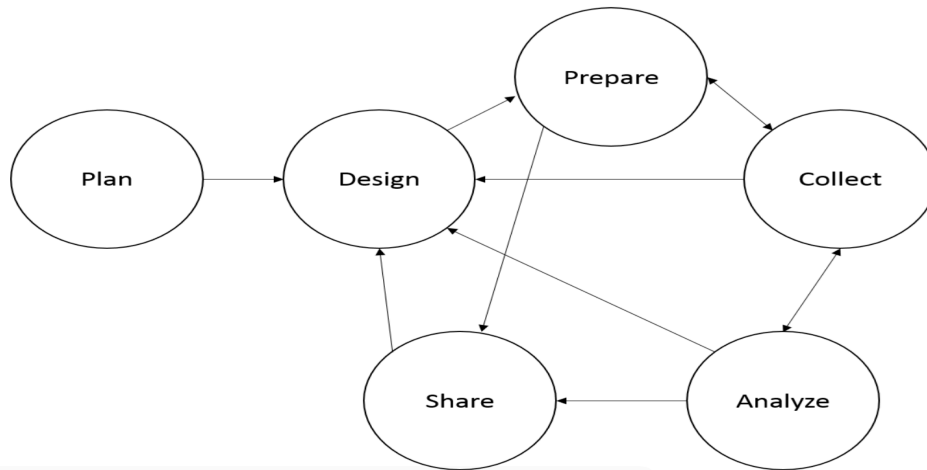


Figure 2: Case study research process model (Yin, 2009)

Information flows and knowledge sharing in the customer support process form the unit of analysis (UoA) in this study. The UoA was chosen to offer unambiguous data of the online activity from past to diminish researcher bias. Information flows from advice network messaging and helpdesk call records were quantified into SNA metrics to conduct correlation analysis and draw sociogram visualizations.

### 3.1 Research approach

This thesis is a single case study that employs mixed methods research paradigm. According to Mills et al. (2009, p. 561), the paradigm combines specific positivistic elements of quantitative research methods with specific constructivist elements of qualitative research methods. Mixed research methods used together to investigate the same phenomenon, gives better coverage and understanding on how information flows are spread between personnel through the customer support process.

Mixed methods research works particularly well for case study research as it allows the researcher to take the rich empirical data yielded from case studies and apply either quantitative or qualitative methods or quantitative and qualitative methods to the data (Mills et al., 2009, p. 562). Case studies are appropriate for qualitative evaluations, as they deal with the intensive study of one or few examples of certain phenomenon. To extend the validity of the research, quantitative data can be used to account for occurrences of actions and relate them with the general scheme (Martinez et al., 2003).

In this study, the data collection was performed using quantitative methods where the number of messages and their direction was formed. In general, SNA generates numerical data on social relations by using quantitative methods like surveys and maps (Carrington, Scott, & Wasserman, 2005). On contrast to qualitative approaches, quantitative data collection methods are able to measure certain aspects of social relations in a systematic and precise fashion (Edwards, 2010). Sociograms drawn from the precise data are used to conduct qualitative analysis on information flows and their progress over time.

The principles of qualitative analysis constitute a good framework towards the integration of SNA methods in the evaluation of learning through the KM processes taking place in IT systems (Jiménez-Jiménez & Sanz-Valle, 2011). This approach draws naturalistic research methods able to deal with the subjective and complex nature of the studied phenomenon. Case studies performed under this perspective are based on the analysis of interactions of the participants in the contexts where these customer support actions take place. These studies use messaging data to account for the occurrence of actions or events, and relate them with the qualitative categories. This way, the quantitative data becomes an additional input in the overall qualitative approach.

### 3.2 Researcher's role

While being at the same employed as a part of technical staff by the firm under study and also a participant in the collected data, an analytical autoethnography was adopted to provide insights for analysis. Walliman (2001, p. 10) distinguishes research from experience and reasoning with the following: "Gaining experience is an uncontrolled and haphazard activity, while research is systematic and controlled." Unless being analytical and rigor when conducting a study, this research method can easily deteriorate into "uncontrolled and haphazard activity". Against such criticism on this methodology, Anderson (2006) proposes five key features of analytic autoethnography: 1) Complete member researcher (CMR) status, 2) analytic reflexivity, 3) narrative visibility of researcher's self, 4) dialogue with informants beyond the self, and 5) commitment to theoretical analysis.

Considering my CMR status in this publication is an opportunistic type, because I was a member of the group under study before this research took place. By being directly involved in the customer support process with others, I maintained analytical reflexivity and narrative visibility necessary to document and expose the effects of the research on attitudes, beliefs, and actions. Dialogue with others occurred naturally in coffee-table conversations and other informal situations, avoiding "the potential for self-absorption" (Anderson, 2006). Extensive literature



review involved me into theoretical analysis. With analytical control in autoethnography imposed by Anderson (2006), the approach gave insight, intuition and triangulation for results derived from the analysis.

Analytical autoethnography was a logical choice for methodology also for Chapter 5. As stated in Hedman (2015), reflexivity demands questioning own assumptions since we all have thoughts how things should be handled. It is important to acknowledge that those thoughts and assumptions only become real when they are presented to others. Perception in nature of interaction in which we react to world around us is the core of reflexivity. In the “Process of Study” chapter, I describe the process of authoring a conference paper and presenting the results of this study to a broader examination.

Although the SNA results were the main objectives of this project, the applied paradigm does not demand positivistic “undebatable conclusions” (Anderson, 2006). As defined by the purpose to conduct a triangulation of the results, this thesis presents an ostensible autobiographical anecdote in the memoirs of a researcher to broaden the view towards the SNA findings. Therefore, I was focusing on explaining findings from the social network and sociogram analysis in my own professional perspective.

While the data collection was done using quantitative methods, the analysis was conducted with mixed methods from both approaches. Combining quantitative SNA and qualitative research arises out of studies, which have mixed quantitative and qualitative methods at both the level of data collection and analysis (Edwards, 2010). Mixed method research is so powerful because it allows the “gaps” in qualitative research methodologies to be filled or overlapped by quantitative methodologies and techniques and vice versa (Mills et al., 2009, p. 563). In this study, those methods vary from qualitative autoethnography to quantitative correlation analysis. This methodological approach helps to understand and manage interdepartmental knowledge management processes and to provide answers for research questions.

### 3.3 Operational environment

The firm under study has 12 employees locating in Finland. It has had € 3.9 million turnover in 2015 with average annual growth of 27% in period 2013-2015. The firm’s core business is to develop and sell industry specific accountant software for construction and maintenance-service sector and to provide hosting and end-user support for over 2500 users. The firm is a subsidiary of a major financial and HR service conglomerate operating in seven countries.

There are mainly three departments in to the firm: 1) helpdesk (telephone assistance personnel), 2) technical staff (developers and service administrators), and 3) sales. This study concentrates on helpdesk and technical staff, because they represent 97% of total communication

taking place in the team collaboration tool. A group “Sales & other” contains only scarce participation to conversations and therefore is left out from the scope of this study.

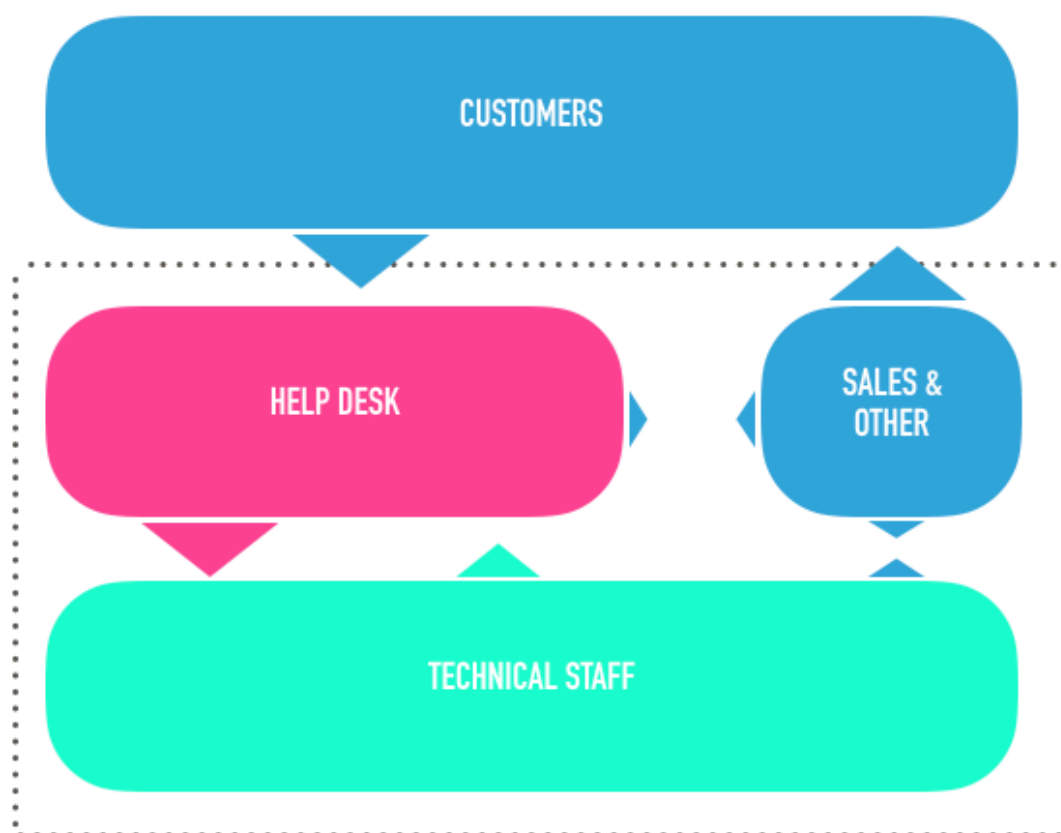


Figure 3: Organizational chart of information flows

The firm’s organizational chart relating to customer complaints and support operations is shown in Figure 3. Vast majority of support requests is made to helpdesk through three channels: telephone, email and live online chat installed on the firm’s homepage. Helpdesk and technical staff have a tight relationship on everyday communication while the rest only participate occasionally. Because the team collaboration tool is available to the whole firm, help requests vary a lot. This study measures only message quantities sent periodically and does take not validate their content whether it belongs to end-user support or not.

### 3.4 Data Collection and Analysis

This study focuses on helpdesk (n=6) and technical staff (n=4) who contribute the most of the customer support operations. The gender rate among the respondents is following: All except one of helpdesk persons were female and the whole technical staff department is male, resulting ratio of 50% female and 50% male. The company has a relatively flat organizational structure resulting that also executives contribute to customer support process along with other staff.

Describing a clear path from data collection to analyzed results increases reliability and validity of the research (Dubé & Paré, 2003, p. 612). This study contains a nine-month period of customer support conversations taking place in Flowdock team collaboration tool. Flowdock provides an API for programmers to fetch team members messaging history, which was used to collect data for this study.

Data collection started with writing a Linux shell script to fetch messages of a given period. Flowdock supports a threaded messaging model, similar to the online discussion forums, meaning that when an employee started a new thread with a specific subject, coworkers usually write their responses inside this thread. In this sense, all messages form a pair of advice-giving and advice-receiving party, which the script adds up and outputs into a CSV file as own lines (n=5063). Number of messages collected weekly during the research period illustrated in Figure 4.

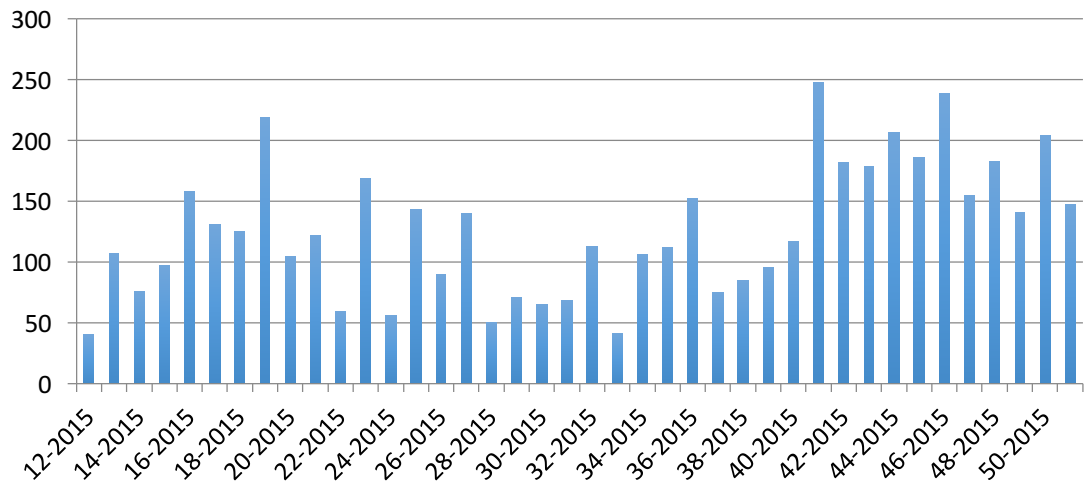


Figure 4: Weekly messaging in Flowdock

A weighted degree centrality matrix between source (advice-giving, in-degree) and target (advice-receiving, out-degree) was calculated from the data and is shown in Table 3. Degree centrality is defined as the number of links incident upon a node and it determines the relative importance of a vertex within the graph (Passmore, 2011). Weighted out-degree declared in rows is the number of messages in conversations initiated by the advice-receiving party. Respectively, columns indicate weighted in-degree value meaning how many times an advice-giving party has responded to threaded topics initiated by advice-receivers (for example a node “T1” received 74 comments to conversations initially started and contributed with 738 comments to conversations other nodes started). As noted earlier, there was also messaging entities from group “Sales & other” in raw data, but they were omitted from the overall dataset.

Label	Degree	In-degree	Out-degree	Contribution ratio
A1	1330	153	1177	0.12
A2	1354	246	1108	0.18
A3	1419	246	1173	0.17
A4	2	1	1	0.50
A5	927	402	525	0.43
A6	338	36	302	0.11
T1	812	738	74	0.91
T2	445	305	140	0.69
T3	741	699	42	0.94
T4	2483	2136	347	0.86

Table 3: Calculated degrees for actors

The generated CSV file was imported to Gephi, which is an SNA tool to visualize the structure of quantified data (Bastian, Heymann, & Jacomy, 2009). After importing edges from CSV, the network visualization was enhanced with Fruchterman-Reingold (1991) algorithm to distribute the vertices evenly in the frame, minimize edge crossings, uniform edge lengths, reflect to inherent symmetry, and conform the graph into the frame. Actor nodes were colored according to their departments as follows: Helpdesk into red and technical staff into blue. Nodes diameter reflects the degree centrality of how many people they have been in direct contact with. Thickness of the edges is drawn based on the weighted out-degree value and they are curved as clockwise arcs from source (advice-giver) to target (advice-receiver). According to Holten & van Wijk (2009), bi-directional edges between dyads can be drawn as arcs to express their direction.

In order to analyze efficiency of the team collaboration tool in work performance, end-user support call duration and number of calls was collected from the same period as messages. To enable comparison between different datasets, sampling is grouped by weekly basis. Everyone else except a node A6 were already staff members when the collecting period started. Node A6 started as a new employee in week 42, so the period collected for that node was only 10 weeks long. The other members spent a few week vacation during the 40-week long observation period diminishing their number of measured weeks. Moreover, we used all measured weeks ( $n=158$ ) to perform a descriptive statistical analysis with PSPP (a free SPSS alternative) to the dataset.

### 3.5 Research attributes

The case study rationale is based on the interpretation of the data and evidence of real social phenomena and is therefore a valid methodology for software engineering research (Runeson & Höst, 2009). For that reason, the research strategy is strict and demands skill and sensitivity from the researcher to ensure that the validity and reliability requirements are met so that the results of the study are accompanied by methodological rigor and accepted by the scientific

community (Marques, Camacho, & Alcantara, Caio Cesar Violin de, 2015, p. 28). In this study, to obtain a scientific basis for rigor in research, a subset of case study attributes (Dubé & Paré, 2003, p. 606) is represented in Table 4.

Title of study	Studies on advice networks on work performance
Research questions	1) Who is involved in the customer support process, 2) how active the participants are, 3) how the participation varies between departments, and 4) how the online activity influences on work performance?
Research agreement	The company under study approved the study agreement and presentation of results
Unit of analysis	Information flows among the members of the customer support process
Importance of study	Strategic knowledge generation is important to SME's to build competitive advantage. Increased knowledge sharing help decision-making and problem solving, and ultimately improves work performance.
Methodological focus	Case Study Research (Eisenhardt, 1989; Runeson & Höst, 2009; Yin, 2009) with the research guidelines (Runeson & Höst, 2009; Yin, 2013)
Form of analysis	Mixed methods used in analysis
Nature of study	Exploratory study on information flows among customer support personnel
Research approach	Exploratory study with descriptive statistics and autoethnography
Specification of constructs	Social network analysis on information flows correlation on work performance in advice network
Theoretical approaches	Organizational learning and knowledge creation, Knowledge based view of the firm, Social Capital and Social Networks
Theoretical literature	(Alavi & Leidner, 2001; Brown, 1996; Granovetter, 1973; I. Nonaka et al., 1996; Wiig et al., 1997)
First research target	To understand and depict how information flows are spread among team members with in the customer support process in KMS
Second research target	To conduct a correlation analysis on information flows impact on work performance

Research design	From quality of collecting data point of view, is considered as exploratory, because it tries to obtain required information of current position. Also in terms of time period, it is cross sectional and from view of data type is quantitative.
Data collection	Support personnel team chat messaging and telephone assistance records in nine months period in 2015.
Logic of evidence	Internal validity mainly through long study period (9 months), large number of data points (158) and conversations with managers.
Coding and reliability	Participants were encoded in results to preserve the anonymity. Reliability was reached through listing data collection procedures and using a large enough dataset for analysis.
Main results	The studied network is dense and most actions are inter-departmental. Tenure correlates positive to advice-giving, and work performance to advice-receiving.
Role description	Researcher is employed by the studied company and encoded into results. Accordingly, the data collected was dated before the study begun.

Table 4: Research attributes of this study

### 3.6 Triangulation of study

According to Yin (2010), research involves many variables of interest. Therefore, research relies on multiple sources of evidence and data, which should converge triangularly and present theoretical propositions to guide data collection and data analysis. Triangulation is important to increase the precision and strengthen the validity of empirical research (Runeson & Höst, 2009, p. 15). By taking multiple perspectives towards the studied object, it provides a broader picture of the studied phenomenon. According to Patton (Patton, 1999), triangulation may be applied in four different types: 1) Triangulation of qualitative sources, 2) mixed qualitative - quantitative methods, 3) analyst, and 4) theory/perspective triangulation.

In this study, the triangulation of qualitative sources was achieved by conducting an analytical autoethnography (Anderson, 2006). It helps examining the consistency of different sources within the same method. Mixed methods analysis with bivariate correlation was conducted to data to reach confirmation to findings revealed in the qualitative study of sociograms (Carrington, Scott, & Wasserman, 2005; Edwards, 2010). At the end, the triangulation of theory was achieved with a comprehensive literature review in Chapter 2. Furthermore, the findings of the

study that were discovered from SNA sociograms were triangulated against descriptive statistics and agreed in informal conversations with the managers .

#### 4 Results

The discovery of ideas and insights are presented in exploratory design as opposed to collecting statistically accurate data. In addition to that, descriptive statistics was used to find bivariate correlations between different variables fetched from the collected dataset. The SNA results are used to describe the knowledge management processes as they took place within the advice network context. The quantitative nature of the data was used to make comparisons, in relative terms, but not for inferential purposes.

The density values show that the overall connection between the participants is especially high on both, directed 90.3% and undirected 100%, which suggests that the respondents are closely collaborating on their task. This result shows how tightly knit this community is; no one is left out completely and mostly participants are involved in daily communication. Because the team collaboration tool presents a key role in the customer support process and the network size is rather small, the high density was expected.

##### 4.1 Sociogram of individual involvement and activity

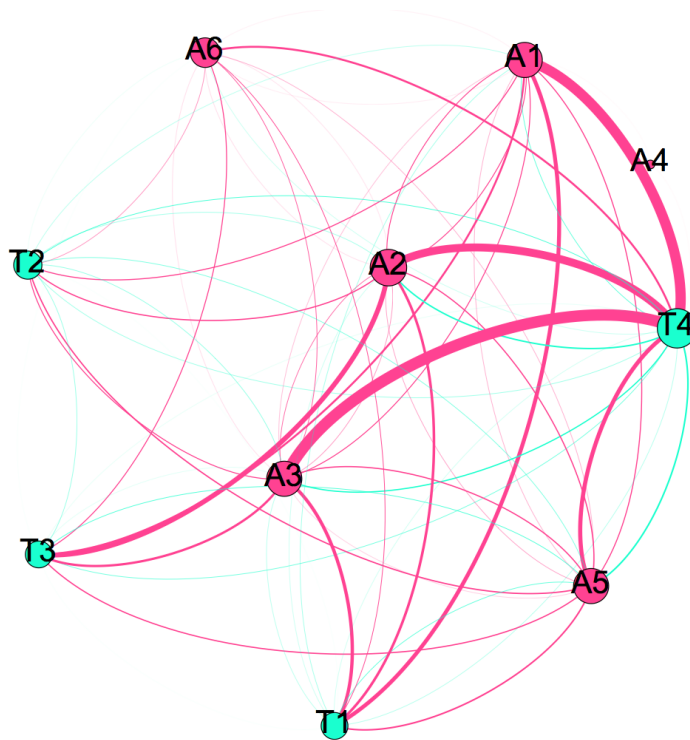


Figure 5: The respondent collaboration activity, edges colored by source

According del Campo, Sánchez de Pablo González et al. (2008) the in-degree of a vertex is number of arcs it receives; it represents the percentage of workers within the organization who receive advice from person in reference to total employees. Figure 5 shows the participation balance as clockwise arcs' width illustrates the out-degree measures. Thick red arcs in the illustration indicate that communication is dominated by helpdesk personnel and technical staff can be seen as contributor of knowledge.

The answer for the second research question (How active the participants are?) can be deducted by viewing the thickness of the lines. The most active contributor seems to be node T4 who has relatively thick counter-clockwise red lines curving towards A1, A2 and A3 nodes. As opposite, A1, A2 and A3 are the most active to start new conversations and seek for knowledge. It is clear that T4 is a hub node whose contribution (43% of overall advice-giving activity) is far beyond others. Company management should take a closer look at the actor's position and evaluate the risks it poses to the whole network.

The least active is node A4 with contributing only one opening and comment line in a nine-months period. To understand the inactivity of the node, one should know that it is one of the company owners whose main contribution is to arrange training sessions and acquire new customers. However, many management principles stress that the company managers should lead by example and be more interested in their staff daily activities.



#### 4.2 Exploration to interdepartmental knowledge sharing

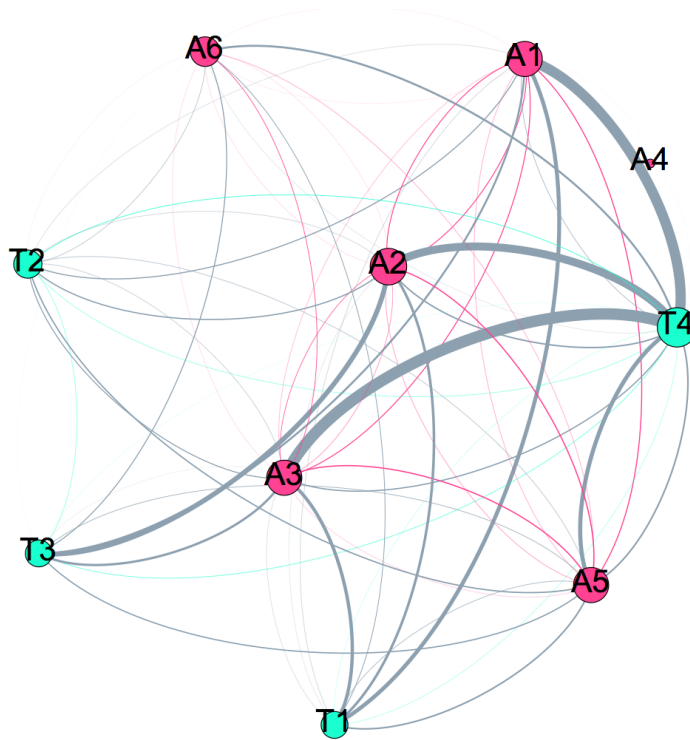


Figure 6: The department collaboration activity, edges with mixed colors

Edges between the nodes working in same departments are colored with same color while interdepartmental edges are colored grey. This shows that there are thicker arcs between departments, usually directed same way from helpdesk to technical staff. There are only thin lines between nodes that belong to same department. This totally reflects the purpose of the team collaboration tool as being technical support for helpdesk.

It is also notable that the most of the helpdesk personnel locate in same premises. This easily enhances physical collaboration to the detriment of virtual conversations. These finding supports the proposition denoted in other studies (del Campo, Sánchez de Pablo González et al., 2008; Skerlavaj & Dimovski, 2006) that physical proximity augments the probability that co-workers will learn from each other.

#### 4.3 Correlation analysis of work performance

Descriptive statistics with correlations among the variables are presented in Table 5. Generally, the bivariate correlational analysis revealed that variables were parallel with the study assumptions. In the table, the Sig. 2-tailed level marked with an asterisk when  $p \leq .001$  means significant correlation denoting that as one variable goes up or down so will the other one. Mean and standard deviation (SD) are count from the total number of weekly quantities ( $n=158$ ) of

helpdesk personnel (n=5). Tenure, presented in years, is taken at the end of the research period. Duration of calls is in minutes per week by one person.

Scale	Mean	SD	1	2	3	4	5	6
1. Tenure	3.43	3.72	1.00					
2. In-degree	6.27	7.23	0.30*	1.00				
3. Out-degree	26.86	20.13	-0.36*	0.02	1.00			
4. Contribution ratio	0.20	0.22	0.58*	0.75*	-0.39*	1.00		
5. Duration of calls	562.68	214.63	-0.04	0.06	0.26*	-0.04	1.00	
6. Number of calls	68.91	27.24	-0.33*	-0.02	0.42*	-0.25*	0.79*	1.00
N = 158								
* $p \leq .001$ two-tailed								

Table 5: Descriptive statistics and correlations

Contribution ratio was positively and significantly associated with advice-giving ( $r = .75$ ,  $p \leq .001$ ). The positive correlations between contribution ratio and tenure ( $r = .58$ ,  $p \leq .001$ ), and advice-giving (in-degree) and tenure ( $r = .30$ ,  $p \leq .001$ ) are also significant resulting that members with greater experience shared more knowledge. We also found that tenure and advice-receiving (out-degree) were significantly and negatively related ( $r = -.36$ ,  $p \leq .001$ ), indicating that employees became less active to seek help the longer they remained a member. The statistical analysis is in parallel with analytical autoethnography and my personal insights of working environment where I have discovered a correlation between tenure and knowledge sharing in the team collaboration tool. In addition to that, similar results were derived from Zagenczyk and Murrell (2009) while studying the bivariate correlation between tenure and advice-giving.

The correlations between number of calls and advice-receiving ( $r = .42$ ,  $p \leq .001$ ) and between duration of calls and advice-receiving ( $r = .26$ ,  $p \leq .001$ ) are, as expected, significant and positive. The negative relationship between job tenure and number of phone calls may occur because employees with longer job tenure were also those who frequently provided advice to others within the team ( $r = -.33$ ,  $p \leq .001$ ). The same negative correlation is also indicated between contribution ratio and number of calls ( $r = -.25$ ,  $p \leq .001$ ). In addition, the high positive correlation ( $r = .79$ ,  $p \leq .001$ ) between duration and number of calls indicate that mean call lengths stayed constant during the observation period.

To answer, “How the online activity influences on work performance?”, a descriptive statistical analysis was conducted. The results show that while the main purpose of Flowdock for helpdesk is advice-receiving (80% of the cases), also a significant and positive correlation between job tenure and contribution ratio ( $r = .75$ ) exists. This finding indicates that the workers with

greater experience are willing to share knowledge to inexperienced coworkers. Furthermore, the analysis reveals a significant positive correlation ( $r = .42$ ,  $p \leq .001$ ) between advice-receiving (out-degree) and the quantity of phone calls made weekly. It is also notable, that there is neither adequate correlation with advice-giving (in-degree) nor duration ( $r = .06$ ,  $p = .432$ ) and number of phone calls ( $r = .02$ ,  $p = .767$ ), which means that helping others does not systematically effect on work performance. This indicates that the team collaboration tool is not a distraction but provides an efficient resource for helpdesk to practice end-user support.

#### 4.4 Analysis of reflexive research

As working for the company, to widen the perspective, a reflexive research of my own subjective views was conducted. On everyday life, knowing people working for the company and understanding the organizational culture and climate, it enables a method of reflexive research. Concluding analytical autoethnography, I present some own thoughts of the studied advice network to confirm presented results as follows: 1) Physical communication of telephone assistance personnel, and 2) contents of messaging in collaboration tool.

First, the whole telephone assistance team locates in same premises. This leads to many real-life conversations and peer support sessions that are not shown in the collected messaging data. Especially, harder customer complainment issues are solved in teams and it's possible that most communication takes place in physical form. During this study, the observation was only based on the results gained from the team collaboration tool messaging and therefore it must be understood that the style of communication varies between environment, cases and situations.

Second, there are a few alternative approaches on how to use the team collaboration tool and how the contents of the message affect in reachability of others. In addition to that, I have noticed that those with less experience are willing to ask peer support from ones with longer job tenure. These efforts are not shown in the results of this study and therefore imply negative on work performance. This view should also be taken into account when managers make decisions.

### 5 Process of Study

In this chapter the process of the study is shortly described. This includes conclusions made in the first version of the article "Towards employee based knowledge interactions to facilitate group learning within a team collaboration tool: An exploratory case study analysis", the main points raised in reviews of the article, the author's response to those points, and finally important lessons learned in the review process. The chapter concludes with the main points and conclusions of the final version of the article (Kaisti & Pirinen, 2016) that was submitted to The 26th International Conference on Information Modelling and Knowledge Bases, EJC 2016.

The aim of the conference is to bring together experts from different areas of computer science and other disciplines who have a common interest in understanding, solving problems and study new areas on information modelling and knowledge bases, as well as applying the results of research to practice. Philosophy and logic, cognitive science, knowledge management, linguistics and management science are relevant areas, too. In the conference, there will be three categories of presentations: full papers, short papers and position papers. (Tampere University of Technology, 2016.)

Based on that description, our inquiry of modeling Flowdock information flows to study cognitive learning in organization fits well to the scope of the conference.

### 5.1 Study I: The first version of the paper

In the conference paper (Kaisti & Pirinen, 2016), the results imply that the participant activity patterns change over time. That is why it is important to use methodology that reveals the patterns of interactions between the participants. First, the urgency of the study rises from the objective that job-hopping has become a common phenomenon in information technology companies. Those with high employee turnover face problems on passing professional knowledge to new employees and spreading the remaining work burden to old ones. Many companies fail on adequate knowledge management by not observing information flows and their impact on learning. Therefore, knowledge management is an increasingly imperative shared resource of collaborative and rationale advantages. It is a key to success in hi-tech organizations bolstering the collective and shared expertise of its employees, actors and partners.

Based on the literature review, our study premised on the assumption that the members of the advice network learn the most from most experienced and competent co-workers. The research data was obtained from Flowdock with a period of 9 months in 2015. The data was analyzed using the SNA approach and analyzed with sociograms drawn with appropriate tools.

As a finding of the study (Kaisti & Pirinen, 2016), we found that the social network analysis reveals some insights regarding to the research question on how learning within the advice networks occur. In addition to that, an exploratory case study on how a team collaboration system facilitates learning and knowledge sharing in a small Finnish IT firm was conducted.

According to Skerlavaj and Dimovski (2006), a practice-oriented perspective of social network analysis applied in learning context, can provide a strong management tool to find and reward central employees in organization, to develop the fit between formal and informal organizational structure, to support reward system renewal, to help understand organizational culture

within the company, to help organize education and training programs. In conjunction with other studies, our paper states that the members with the highest advice-giving degree are people who are the most experienced in the firm. Therefore, those employees who are the most often seen as a source of learning have the most accumulated knowledge and situation awareness.

Despite the fact that job-hopping creates new challenges to IT companies, they must adapt the new situation and develop means to leverage learning through organization. Deploying a knowledge management system to improve collaboration, locate knowledge sources and increase situation awareness help achieving the premises but requires proper consideration and careful planning. One of the key factors to successful KMS assimilation is to champion management at all levels (Hecht, Maier, Seeber, & Waldhart, 2011). By engaging the management to KMS, ensures the organization operates to meet its objectives. Most important, observation of information flows becomes a natural way to conduct managerial activities.

The contribution of the paper (Kaisti & Pirinen, 2016) is showing that using SNA to analyze historical group chat data of customer support activities between telephone assistance personnel and technical staff increase the organizational know-how based on the understanding of knowledge flows. Moreover, the overall patterns of communication illustrate the social nature of learning and sharing knowledge. These assumptions are in-line with the learning theory that it is no longer an individualistic activity but more an interdependent process (Siemens, 2005). Other studies (del Campo, Sánchez de Pablo González et al., 2008; Skerlavaj & Dimovski, 2006) propose similar implications for executives to focus in order to organize their employees and foster learning.

## 5.2 Study II: Changing the article based on the reviews

The article was submitted to EJC 2016 as a "position paper" (see Appendix 1) to illustrate innovative concepts, theories, prototypes, or experiences. The program committee makes a decision of acceptance on the basis of the review report and scrutiny. Acceptance is based on the originality of work, on the suitability of the topic to the conference, and on the overall quality of the submission. An international publisher IOS Press publishes the full papers and short papers in the book after the conference (Image 1). Position papers will be published in the pre-print of the conference.



Image 1: EJC book publications along the years

The committee accepted the paper right on the first round without obligatory corrections required. Nevertheless, the reviewers paid particular attention to a few things in the article: first, both reviewers found the dataset relatively small to perform a comprehensive interpretation of results. I admit the dataset is small to conduct tangible assumptions of learning patterns and to generalize the results on large scale. Therefore, along with other shortages of the study, I put more effort to explain that the results apply only to communities in a specific setting at a given moment. Moreover, the exploratory case study is an empirical inquiry that investigates a contemporary phenomenon with its real-life context (Yin, 2009).

Second, according to one reviewer, the originality of the paper was compromised by "weak reject". After analyzing the originality with the co-author, I decided to add a chapter to underline more the unique environment of team collaboration tool information flows in Finnish IT firm. In addition, to expose the described scope to organizational learning theories, the paper applied SNA to analyze the historical chat data.

One reviewer claimed: "It was difficult to judge the availability of the discovered information flow because this paper ignored all of the chat contents". The availability of the message content is a shortage to denote. Therefore, I added a notion in "Conclusions and discussions" chapter that the content analysis was left undone since the vast amount messages. Also, revealing

the contents of firm's internal chat compromises trade secrets and confidential customer information.

As a result to additional explanations, a few paragraphs were removed from the paper. Because the comprehensive explanation of the selection of Gephi setting styles was not in the core of the results, it was removed from the final paper. Also, a chapter describing the SNA methodology in more detail was diminished, because there was already another chapter addressing the same topic.

### 5.3 Study III: Conference presentation

The series of the European - Japanese Conference on Information Modelling and Knowledge Bases (EJC) originally started as a co-operation initiative between Japan and Finland in 1982. Since started, geographical scope has expanded to cover Europe and also other countries. Because of that "International" replaced "European Japanese" in the title of the conference in 2014. The conference has limited number of participants (n=50) and papers (n=30) to have time enough for presentations and discussions. (Tampere University of Technology, 2016.)

According to the working principles of the conference, the authors must present their papers in the conference proceedings (Image 2). To be able to present the paper, the conference also requires a registration fee from authors. Fortunately, Laurea covers financial expenses of registration and accommodation in favor of the presentation at the conference.



Image 2: EJC 2016 proceedings presentation



All participants were chosen to present their papers in the Appetizer sessions, which took place in the first conference day. The presentation was a brief introduction to each paper and authors were given a three minutes slot to promote findings and raise expectations for discussions. For discussions, the issues relating to practical implications of SNA and usability of team collaboration tools were presented (Kaisti, 2016).

Conference members' professional backgrounds varied a lot. PhD students gave most of the presentations as part of their studies. A few, including myself, were studying master's degree and at least one was studying bachelor's degree. There were also a few professors presenting papers on behalf of their research groups. In addition to that, each conference day morning started with "an invited talk" of recognized speakers who introduced their works and achievements in a one-hour session. Those speakers were highly respected by the academic community and their presentations covered currently trending topics in IT industry. Most topics were related to university projects but there was also a few, including our paper that was focusing on business cases.

My presentation was on the fourth conference day in early afternoon. The given slot was set for 15 minutes and the presentation was concluded with a short questions section. Speakers were able to use own tools and I prepared a multimedia slideshow presentation with Apple Keynote. In my opinion, my presentation went well compared to others. Actually, the biggest concern of giving the presentation in English vanished in first days when hearing the level of other speakers. Only concern was to understand the possible audience questions after the presentation, but fortunately the previous speaker went overtime and the host hurried my presentation and skipped questions from the audience. Overall, the conference was a success and gave a lot of new knowledge on academic world and increased self-confidence on my own skills.

## 6 Discussion

In this paper, we have argued that if we want to understand how knowledge sharing is being done in the customer support process in the context applied theories, we need to ask important questions, such as: 1) Who is involved in the customer support process, 2) how active the participants are, 3) how the participation varies between departments, and 4) how the online activity influences on work performance?

### 6.1 Contribution to research questions

This paper argues that the participant activity patterns vary between employees and time. That is why it is important to use methodology that reveals the patterns of interactions between the participants. To achieve results, this paper not only illustrates figures based on interactions



between employees in team collaboration tool, but also argues that a contribution ratio provides a valid unit to measure work performance.

Social network analysis provides a valid tool to answer for the research first question “Who is involved in the customer support process?” It aims to explore network activity and reveal the interaction patterns that develop in collaborative group work. It is a promising method to assist researches to explore properties of advice networks. In order to explore this argument, the paper is divided into two sections. First, we provided a general account of SNA, and how it may be used to analyze conversations made available through Flowdock history data. Second, a brief example was provided how SNA approach can be used in combination with other analytical techniques.

To answer the second research question on “How active the participants are?” the results indicate that the group density is very high and only one research participant was inactive during the examined period. These findings reveal that the level of connectivity is distributed evenly and increase group cohesion. The research of social network of the firm indicates that employees sustain productive relationships over time without being sidelined by more dominant personalities.

By selecting a nine-month measurement period, before this study was even planned, the independence and validity of data was achieved. Therefore, the author’s role neither affected on the overall results that were derived from the historical messaging data. The study results showed high consistency with one-to-one conversations with company executives and were aligned with management’s preliminary assumptions. As SNA is a widely adopted methodology for studying organizational networks, a reliability of this study is considered high.

A Pearson product-moment correlation coefficient was computed to assess the relationship between tenure, advice giving and receiving, and duration and number of phone calls. Overall, there was a strong, positive correlation between advice-receiving and phone calls. Variation in advice-receiving degree was correlating with the resolved support issues. In addition to that, there was a significant negative correlation between job tenure and number of phone calls. From these results, it’s evident that members with greater experience were also those who frequently provided advice to inexperienced coworkers. Moreover, informal discussions with other employees and reflexive research conclude that those with longer job tenure in the firm are the ones who are more often being asked help from. Especially on situations, where new employees start in the company, it seems to be common understanding among the staff that questions are being asked from the more experienced employees while the rest continue to work with their dedicated tasks. In conversations, more experienced also consider themselves

more willing to help younger ones. As the social capital theory suggests, when a common interest is shared among employees, they are more likely to be mobilized towards one common goal.

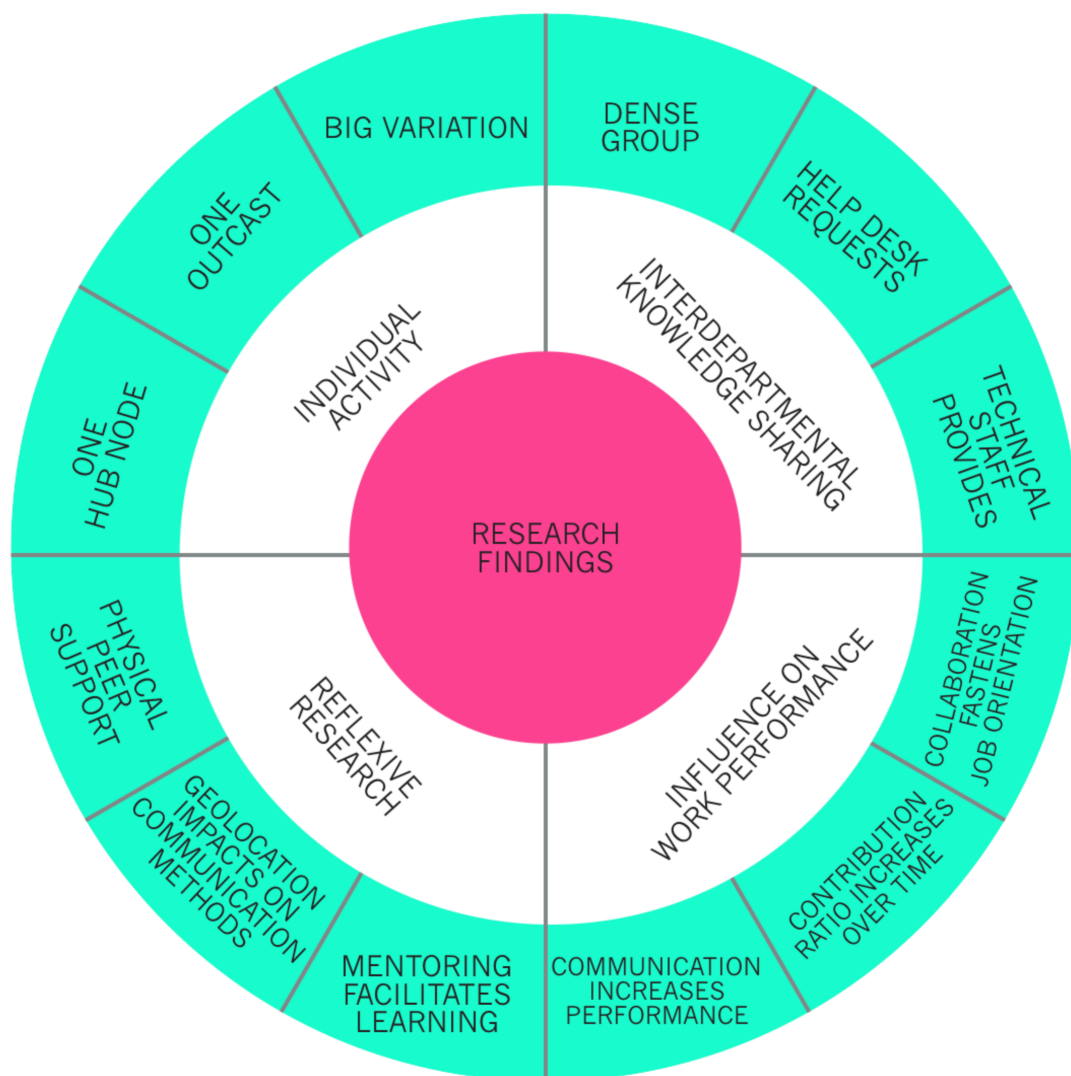


Figure 7: Wheel of Research Findings

To summarize the research findings, 12 conclusions are derived from the proposed research questions. These conclusions are illustrated in Figure 7 and they present the main results of the research. Every company differs from each other, but same methods can be used to study various environments. These findings only apply in the described context at a given time, and are very subjective to the studied company. However, these results help to design actions to establish more innovative organization culture, increase staff involvement and yield competitive advantage.

## 6.2 Implications

There are several implications that arise from the study results. In practical perspective, the workplace learning problems often arise when the design does not take knowledge sharing into account. The results from this research imply that paying attention to knowledge management as a part of the system development process leverages work performance.

The theoretical implications are consistent with the literature review. The KBV of the firm theory suggests that increased collaboration and knowledge sharing help problem solving and ultimately improves work performance. Through relations with coworkers and clients come the opportunities to transfer social capital into profit. Advice networks provide open and trustworthy relationship between personnel and establish an innovative organization culture and climate. Free interdepartmental information flows improve knowledge sharing and integrity thus generating competitive advantage for companies. This conclusion can be derived from the positive correlation between Flowdock advice-receiving activity and the number of phone calls.

Managerial implications show that involvement of executives is a key driver for implementing knowledge management and team collaboration systems for advice networks. Managers make decisions about tools and processes being used by their staff and can therefore greatly leverage work performance. These implications can also lead to better information flows where knowledge is shared in more effective manner.

The implications for the operational level indicate that taking the user and communication better into account when designing knowledge management systems or improving existing ones is vital for the success of the company. Using team collaboration environment such as Flowdock could help in learning more about the information flows in the customer support process, and in using the learned things when implementing more productive methods to provide end-user support. The methods in which communication between departments are taken into the support process have shown improved work performance. Also the active team collaboration environment provides better learning capabilities and increases involvement of employees to company.

Implications for the society and industry can be seen as whole. The working culture is going towards more openness, and barriers between departments, work units and teams are collapsing. Not only the staff becomes more unite, but also customers are involved in the decision-making process and their feedback is highly valued. Because the quantity of information has increased in digital era, it is important to understand how information is being identified, created, represented, distributed and enabled in organizational processes. In this context, this thesis finds SNA as a valid tool to understand the relationships between departments and individual and how they affect on work performance.

### 6.3 Validity and reliability

As in all qualitative studies, the researcher must address the concepts of reliability and validity (Yin 2014). For this study to be externally valid, results should be similar to other inquiries and adopt a research agenda outlined in this thesis. De Laat, Lally, Lipponen, & Simons (2007) present a general overview of how SNA is applied in advice networks. That overview aims to use SNA to illustrate the nature of interaction patterns within a networked community and how knowledge is shared over time. In addition, del Campo, Sánchez de Pablo González et al. (2008) demonstrates an exploratory analysis of the importance of industry experience and job tenure as a common dominator of most central employees within advice networks.

Using various methodological techniques to avoid researcher bias increases internal validity of the study. In general, two types of threats exist: 1) Those related to the passage of time, and 2) those related to the groups being studied. Passage of time is countered by using a long study period sliced into multiple smaller time range units. Also, the period was chosen from past to avoid participants conscious behavior to influence on results. By choosing all the employees who belong to helpdesk and technical staff, the study avoids threads adverse to internal validity. With the described measures, the internal validity is adequately covered.

To confirm the reliability of the study, a detailed narrative of data collection process is described. Also, an extensive review to literature is addressed to apply relevant theories to closer examination. In addition to that, obtaining the rigor in scientific study, the list of research attributes is shown in Table 4: Research attributes of this study. To further increase the reliability of the study, there are being used four different types of triangulation: 1) Triangulation of qualitative sources, 2) mixed qualitative - quantitative methods, 3) analyst and 4) theory/perspective triangulation (Patton, 1999).

### 6.4 Limitations and shortages

Despite the good overall validity of the study, there are still a few shortages to denote. First, three out of four of employees with the shortest tenure belong to helpdesk, which has low tendency to provide support but to focus on telephone assistance to end-users. Secondly, most of members with the greatest experience were technical staff whose main job is to answer questions resulted a very high contribution ratio. Third, a contents analysis was left undone due to vast amount of messages. Therefore, part of messaging does not provide any useful information in case of learning but are more likely to be just interjections and hesitation fillers typical in spoken language. Fourth, because the number of studied employees is small, the interpretation of these results only applies on the described context. However, the descriptive statistics denote that there is a correlation between tenure, information sharing and job performance. These findings are also supported by recent studies (del Campo, Sánchez de Pablo

González et al., 2008, p. 267; Skerlavaj & Dimovski, 2006, p. 93) that propose the greater the experience of an employee in a certain field, the bigger the probability that coworkers will seek to learn from this person.

For triangulation, I selected a controversial qualitative methodological approach coined analytical autoethnography. The main critique of autoethnography comes from the traditional social science methods that emphasize the objectivity. In this critique, autoethnography is called “unscientific”, “full of bias” and “essentially lazy” (Delamont, 2007; Denzin, 2000). Despite the criticism, autoethnography is becoming more widely accepted as a method to study organization and the relationship between the individuals (Parry & Boyle, 2009). Therefore, I used the analytical approach (Anderson, 2006) to present my personal insights and observations in this study.

## 7 Conclusion

In summary, the overall patterns of communication illustrate the social nature of customer support process. This also indicates reciprocity, trust, and cooperation as suggested by social capital theory. The figures presented in this paper show how people connect between the other members in the network, the activity of their collaboration and the involvement of individual participants. By using a time line analysis when studying the subject, this paper shows how participants become gradually more responsive to contribute knowledge to their community.

First, this study contributes to the advice network and knowledge management by demonstrating the mediating role of tenure, advice network activity and job performance metrics. Second, it highlights the importance of the direction of information flow by indicating that there exists a positive correlation between advice-receiving (out-degree) and the number of phone calls (support tasks completed). Third, it adds to the growing literature on demonstrating that social networks may be important determinant of managerial tasks as decision-making.

As seen in results, there is a significant correlation between online activity and work performance. People who are more active to seek advice turn more productive by the numbers and vice versa. As a development proposal, those who are less active members of the team should be more integrated in the customer support process and encourage them to be more active to seek advice. Also, some kind of surveillance tool or reporting system where managers can observe the team activity in real time would be a good development proposal for future.

To conclude, SNA is a valuable method to foster understandings of the processes occurring in advice networks. SNA provides a useful presentation for company executives to see how employees act as a group. This information can be utilized to reflect strategically on their collec-

tive performance. This study proposes similar implications and findings as other studies. Skerlavaj & Dimovski (2006) and del Campo et al. (2008) conclude that executives should focus on employees to foster the KBV of the firm. Surata et al. (2016) found SNA to be an effective, accurate and powerful tool to evaluate social capital in terms of network cohesion and structure. Zagenczyk & Murrell (2009) argue that tenure and advice-giving were significantly and positively related indicating similar results with this thesis. Regts-Walters (2013) studied the correlation between advice-receiving (in-degree workflow network centrality) and job performance. His findings show positive correlation of variables and are in-line with the results demonstrated by this research.

More studies in this field need to be conducted to find additional support for the provided results. Valuable insights would come from similar analyses in companies of various sizes, different industries and other countries. These results apply only to communities in a specific setting, while to allow for a generalization of implications further research is required.

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## Figures

Figure 1: SEM analysis result on the influence of Social Capital in KMS success (Chen, 2009)	15
Figure 2: Case study research process model (Yin, 2009)	19
Figure 3: Organizational chart of information flows	22
Figure 4: Weekly messaging in Flowdock	23
Figure 5: The respondent collaboration activity, edges colored by source	27
Figure 6: The department collaboration activity, edges with mixed colors	29
Figure 7: Wheel of Research Findings	38

## Tables

Table 1: Two Types of Knowledge (I. Nonaka & Takeuchi, 1995, p. 61)	9
Table 2: Summary of Knowledge management activities identified in the literature (Holsapple & Joshi, 1999)	11
Table 3: Calculated degrees for actors	24
Table 4: Research attributes of this study	26
Table 5: Descriptive statistics and correlations	30

## Appendices

Appendix 1: Abstract of the EJC2016 position paper (Kaisti & Pirinen, 2016)	49
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Appendix 1: Abstract of the EJC2016 position paper (Kaisti & Pirinen, 2016)

# Towards employee based knowledge interactions to facilitate group learning within a team collaboration tool: An exploratory case study analysis

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**Abstract.** The indent of this study is on a case study analysis of organizational knowledge nexus and related collective learning in customer support operations of a high-tech company. The unit of analysis was an existing information flow as knowledge related interaction within a customer support process. The study was focused to organizational learning targets as strengthening of effectiveness of the organization's knowledge building and management. The exploratory social network analysis denotes that experience and tenure within the company is a common denominator of key personnel. In addition, employees' contribution ratio to community progress over time as they gradually shift from learners to mentors. The findings derived from the social network analysis of a team collaboration tool needs be further researched in conformity studies.

**Keywords.** Social Network Analysis, Organizational Learning, Case Study