

T.C ATILIM UNIVERSITY
GRADUATE SCHOOL OF SOCIAL SCIENCES
BUSINESS ADMINISTRATION/ ADMINISTRATION
BUSINESS ADMINISTRATION MASTER'S PROGRAM

**SHARED LEADERSHIP THEORY: AN EXAMINATION OF SHARED
LEADERHSIP DIMENSIONS IN SOCIAL NETWORK THEORY TOWARD
NETWORK INNOVATION**

Master's Thesis

Aymen MaarooF

Ankara 2021

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Ankara 2021

ACCEPTANCE AND APPROVAL

This is to certify that this thesis titled “an examination of shared leadership dimensions toward network innovation: a social network approach” and prepared by Aymen Maarooft meets with the committee’s approval unanimously as Master’s Thesis in the field of business administration following the successful defense of the thesis conducted in 8/2/2021.

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ETHICS DECLARATION

I hereby declare that;

I prepared this thesis in accordance with Atılım University Graduate School of Social Sciences Thesis Writing Directive,

I prepared this thesis within the framework of academic and ethics rules,

I presented all information, documents, evaluations and findings in accordance with scientific ethical and moral principles,

I cited all sources to which I made reference in my thesis,

The work of art in this thesis is original,

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ÖZ

Maarroof Aymen. Paylaşılan liderlik teorisi: Sosyal ağ teorisinde ağ yeniliğine yönelik paylaşılan liderlik boyutlarının incelenmesi, Yüksek Lisans Tezi, Ankara, 2021.

Çalışmanın amacı, sosyal ağ teorisindeki paylaşılan liderlik boyutlarını ağ yeniliğine doğru incelemek ve incelemektir. Bu çalışma, paylaşılan liderlik teorisini ve sosyal ağ teorisindeki boyutlarını görselleştirir. Boyutların rolleri yalnızca paylaşılan liderlikte değil, aynı zamanda sosyal ağ teorisinde de çok önemlidir. Boyutlar 1) görev koordinasyonu 2) kişisel destek ve 3) bilgi paylaşımıdır. Boyutlar, sosyal ağ teorisindeki ağ yeniliğinin özellikleridir. Karmaşık liderlik teorisi, paylaşılan liderliğin kökü ve kökenidir. Paylaşılan liderlik, karmaşık liderlik teorisindeki pencerelerden biridir. Karmaşık liderlik teorisi, paylaşılan liderlik hakkında net bir vizyon sağlamak için tartışılmıştır. Sonuçlar sosyal ağ analizi UCINET yazılımı kullanılarak bulundu. Sosyal ağ analizi, bu evrendeki örneklerden veri toplamak için geleneksel bir yaklaşım ve metodoloji değil, sınırlı örneklerde (98 katılımcılar) ağdaki her boyuta (değişkene) göre veri toplamak ve üyeler arasındaki ilişkileri anlamak içindir. Sonuçlar bulundu ve her ağ için yoğunluğun düşük olması dışında çalışmayı destekliyor, ancak her ağ için küme yoğunluğu yüksek. Bu durum, kümeler inovasyon ağına katıldığı için olumsuz bir sonuç olarak tanımlanamaz. Ancak, tüm ağı yenileyen kümelerden desteklendiği için olumsuz açıklama olmaksızın düşük yoğunluk olarak tanımlanabilir. Her boyut, istatistiksel açıklamasını, ağ modelini ve zayıf ve güçlü bağlarını temsil eder. Görev koordinasyonu, kişisel destek ve bilgi paylaşımı, istatistiksel açıklama, ağ yapısı ve zayıf ve güçlü bağlarla tartışıldı ve incelendi. Daha fazla ayrıntı ilgili bölümlerde tartışıldı.

Anahtar kelimeler: paylaşılan liderlik teorisi, paylaşılan liderlik boyutları, sosyal ağ teorisi, sosyal ağ analizi ve ağ yeniliği.

ABSTRACT

Maarroof Aymen. Shared leadership theory: An examination of shared leadership dimensions in social network theory toward network innovation, Master's Thesis, Ankara, 2021.

The aim of the study is to study and examine the shared leadership dimensions in social network theory toward network innovation. This study visualizes shared leadership theory and its dimensions in social network theory. The roles of the dimensions are not important only in shared leadership, but they are crucial in social network theory. The dimensions are 1) task coordination 2) personal support, and 3) information sharing. The dimensions are the characteristics of network innovation in social network theory. Complexity leadership theory is the root and the origin of shared leadership. Shared leadership is one of the windows in complexity leadership theory. Complexity leadership theory has been discussed in order to provide a clear vision about shared leadership. The results were found via using social network analysis UCINET software. Social network analysis is not a traditional approach and methodology for collecting data from the samples in this universe, but it is for collecting data and understanding the relationships among members according to each dimension (variable) in the network in bounded samples or 98 participants. The results were found and they support the study except for the density was low for each network, but the density of clusters was high for each network. This case cannot be described as a negative result because clusters participated to innovate network. Only it can be described as a low density without negative description because it was supported from the clusters that

innovate the whole network. Each dimension represents its statistical description, network pattern, and weak and strong ties. Task coordination, personal support, and information sharing were discussed and examined via statistical description, network pattern, and weak and strong ties. The more details were discussed in related sections.

Keywords: shared leadership theory, shared leadership dimensions, social network theory, social network analysis, and network innovation.

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INTRODUCTION

Introduction to the Study

The organizations depend on self-leadership teams or individuals in their work (Wang, Han, Fisher & Pan, 2017). Self-leadership helps individuals to learn how to operate without the need for a hierarchy approach (Wang, Han, fisher & Pan, 2017) and (Barnett & Weidenfeller, 2016). Researchers indicate shared leadership “a dynamic, interactive influence process among individuals for which the objective is to lead one another to the achievement of the organization” (Kock, Mayfield, Mayfield, Sexton & De La Graza, 2019: 218-219) and (Barnett & Weidenfeller, 2016: 335-336).

Return to the previous views, scholars stated that the traditional approaches are not adequate to adapt to current and complex realities in leadership (Lewin, 1999) and (Plowman & Duchon, 2008). In other words, insufficient adaptation needs paradigm shifts toward new insight that become a framework for leadership as a dynamic process to adapt to new visions. Researchers seek to utilize the term of distribution to evolve a new framework for building a theory about shared leadership in a complex environment (Bryman Collinson, Grint, Jackson & Uhi-Bien, 2011).

Fausing, Joensson, Lewandowski & Bligh, (2015) stated that it is important to teach members how to work mutually and develop their skills. It is necessary to enhance their interdependence and knowledge sharing that creates a consistent network. Leadership is a *distributed* process that does not depend on specific individuals, but instead of that, it is an interactive power among members at different times (Brown & Gioia, 2002) and (Gronn, 2002). Shared leadership is a fundamental dimension of complexity leadership theory. The fundamental dimension reflects leadership as a distributed process that led to an adaptive organizational response, in other words, the flexible response in an organization (Clarke, 2013).

Returning to the back, Based on Wheatley (1992, 1999), in his book, complexity has elaborated as a concept for developing leadership insight and principle. Development facilitates the operation of network systems “complex adaptive system”. In other words, it is a rational process to adapt complexity of networks system. Wheatley, 1992 stated that leadership within the complexity term recognizes the deep correlation among individuals. Additionally, Wheatley, 1999 asserted that complexity leadership theory is not narrowed about single control-and-direction, but rather in sharing leadership that catalyzes relationships for adaptability network. In other words, leadership does not depend on a single structure or level, but it depends on the internal connections between individuals through exchanging dialogue *coordination, information, and support*. Leaders and individuals must take into account having an ability to coordinate, sharing and support interaction among members (Wang et al, 2017), (Szilagyi, 2017) and (Kock et al, 2019).

Arena & Uhi-Bien (2016) stated that shared leadership provides an interest among members and gives a coherent sharing in a complex environment. Geer-Frazier (2014), Hazy & Uhi-Bien (2015) viewed that when individuals participate, the network will be innovated successfully between actors.

Social network theory recognizes the social relationships in the network. It focuses on the individual's relationships and activities among them (Liu, 2017). Together, shared leadership and social networks affirm the interconnectedness among individuals (Uhi-Bien, 2006) and (Liu, 2017).

Problem Statement

The interest in shared leadership has created an urgent problem. The issue aims to understand shared leadership. The aim is to understand the influential dimensions that show the size and strength of leadership among individuals. Understanding shared leadership and its dimensions is an important issue that is essential in the organization, especially in a complex environment. Besides, understanding shared leadership and its dimensions prove itself with the social network approach and their role in studying relationships between individuals. In this study, reviewing and discussion of the traditional approaches have been discussed. Besides, the important dimensions of shared leadership will be discussed in order to detect positive results.

Purpose of the Study

The purpose of the study is to investigate shared leadership and its dimensions. Dimensions play a role to determine the range of leadership in networks. They recognize relationships among members within the complex environment. The most important in shared leadership its role in individuals and interactions among them. Shared leadership and social network theory select the innovation that occurs among individuals by examining the influential dimensions.

Research Question

Questions of the study have been formulated based on the idea that in shared leadership dimensions and social network perspective. The questions are the basis of the idea and principle of the study:

Q1: What is the degree of task coordination toward the network innovation?

Q2: What is the degree of information sharing toward the network innovation?

Q3: What is the degree of personal support toward the network innovation?

Theoretical and Conceptual Background:

Shared leadership theory

Shared leadership is relational interaction among individuals within a team or individuals level, and it refers to leading from a set of members rather than from a single person (Shu, 2018). It occurs and works at any level in the organization. It can be contributed to any stage in the scope of an organization. Besides, it does not only pertain to a specific level or single stage. Shared leadership can be in and around levels. Several dimensions facilitate shared leadership *task coordination, sharing information, and personal support* in an organization to facilitate interconnectedness between individuals (Pearce & Congne, 2003), (Clarke, 2013) and (Barnett and Weidenfeller, 2016). Mendez and Busenbark (2015) stated that shared leadership in a team occurs through the interaction among individuals in a complex environment. Through information sharing helps members to achieve their goals. Task coordination provides participation and working together unanimously. Personal support builds a coherent relationship between members. Shared leadership is a fundamental dimension of complexity leadership theory that leads to a quick and flexible response in the organization. *Complexity leadership theory*: The essence of its perspective is a leadership arises through the relational interdependence and connection of individuals that stimulate an organization in accomplishing common outcomes (Liechtenstein, Uhi-Bien, Marion, Seers, Ortan, & Schreiber, 2006). In other words, adaptive outcomes emerge as strategies, systems, and events that reflect required innovation. Uhi-Bien et al (2006) and Simpson (2018) asserted that leadership has been built as a concept from the application of complexity insights. When leadership emerges in complexity theory insights, it leads to shared

leadership in a complex environment. The complex environments are considered as a network of interconnected individuals with overlapping interactions hierarchies that associate together to prevent problems and find a solution for them (Uhi-Bien et al, 2006). Marion and Gonzales (2013:3) stated that “complexity shall require you to perform or practice leadership from a dramatically different view than you are used”.

Network innovation

It refers to the members who participate in the development and creativity in a workplace within a network (Kodama, 2015). The interesting things are individuals intrinsically enthusiastic and interact in a consistent network (Xie, Fang & Zeng, 2016). Network innovation can exist in the virtual systems or interactions in real. Network innovation characteristics are the internal handling of *information, coordination, and support* with others without the need for the system of hierarchy or top-down (Xie et al, 2016).

Social network theory

Social network theory focuses on the role of members in correlations and relationships through which networks are formed between members in the organization. Then, study and understanding the essence of relationships through influencing transmitting information, coordination, and support among mutual communications *distributed relationships* between members (Liu, 2017). Social network theory is important to conceptualize the interactions among individuals (Sweetman, 2010) and (Blackwell, 2014). Social network theory includes the most important and pervasive way to understand the correlations like *degree centrality, degree density, the degree of weak and strong ties* (Mayo, Meindl & Pastor, 2002).

Significance of the Study

The important thing is that the continuous growth of the leadership in our present time has taken a deep place in the organization and the complex environment. The study of shared leadership and social network reveals the importance of the relationships between members within a network. The importance of the relationships lies in a set of variables that determine that select the size of a relationship and includes studying aspects of each variable between individuals in order to achieve the innovation that can be occurred through individuals.

Assumptions

I assume that the participant (sample) will be completely relaxed and satisfied. Also, reassured in terms of information, positions, age only will be shown and known to the researcher. Additionally, it will be hidden and it shall be symbols only. This case will create relaxed circumstances that facilitate the process of collecting data and the response of individuals. In summary, details will be hidden and privacy shall be considered. It is only known and shown to the researchers a scope and it will be as symbols only in the scope of research. The second assumption is that individuals will participate and fill lists that belong to them. Also, they provide awareness about lists in order to fill them properly for the study

CHAPTER 1: THE LITERATURE REVIEW

1.1 Shared Leadership Theory:

Barnett and Weidenfeller, 2016 described shared leadership as a dynamic activity or dynamic property that occurs in individuals. Barnett and Weidenfeller (2016) additionally stated that it is a distributed leadership rather than only controlling skills, and restricted them to only one leader or person. Shared leadership is distinguished from traditional leadership in emphasizing the importance of the nature of relations between individuals. More accurately, shared leadership comparing to traditional leadership is radically different in dimensions and influencing (Hackman & Wageman, 2005) and (D'Innocezno, Mathieu & Kukenberger, 2014).

Shared leadership is distinguished in the relational phenomenon which is an important basis. It is a feature that distinguishes shared leadership from traditional leadership phenomenon (Nicolades, Laport, Chen, Tomassetti, Weis, Zaccaro & Cortina, 2014). Accordingly, Shu (2018) stated that shared leadership is the interactive power between individuals in a team. The influence is from one to another toward unified goals. Shared leadership arises from a set of individuals rather than being based on one individual.

Mendez and Busenbark (2015) mentioned that the team can be created as a result of the influence of distributed leadership process in an organization. Hoch (2014) pointed out that shared leadership is a set of characteristics that are combined with each other and represented in the engagement of individuals and strong cognitive towards

interdependence from one to another. Also, Shu (2018) confirmed that shared leadership is created from the engagement of the individuals.

Although shared leadership previously was explained that it emphasizes the interactions between individuals, some aspects that cannot be shared in the organization. Drescher, Korsgaard, Welpe, Picot & Wingland (2014) stated that some aspects cannot be shared, and they found that it seems not all functions in leadership in a workplace may equally be shared or distributed among individuals. Scholars stated that not all functions of leadership can be shared. Barnett and Weidenfeller (2016) viewed that the leadership cannot fully share all duties and responsibilities in the organization between individuals. For instance, selecting, establishment, and direction cannot be shared. Although shared leadership cannot be shared in all levels. Barnett and Weidenfeller (2016) and Morgeson (2010) stated that shared leadership can be distributed in the internal domain of a team. Besides, accordingly, Morgeson (2005) demonstrated that how external leaders can impact and assist team members. Especially, in the area of the challenges facing them in their workplace, the functions, knowledge, and information can be shared with them.

Carson, Tesluk & Marrone (2007) pointed that the critical importance of external sources that help individuals is called sharing knowledge among interactive individuals. Fausing et al (2015) also agreed with (Carson et al, 2007) that the positive effect of resources on individuals will improve their ability and trust value among them under shared leadership. Fausing et al (2015) recommend that Teaching team members how to work mutually and develop their skills to enhance their interdependence.

Seers, Keller & Wilkerson (2003) and Ensari, Riggio, Christian, & Carslaw (2011) pointed that the differences of individuals in responsibilities, duties, roles, and other functions are related to shared leadership *distributed* process. The differences are like sources that develop the organizational performance and innovate networks among members. Wang, Waldman & Zhang (2014), D’Innocenzo et al (2016), and Bligh (2006) demonstrated more that the members in the organization need relevant resources and information in order to participate in the shared leadership although their differences of duties and responsibilities as team members in a workplace, and *self-leadership* a term that indicates an individual’s ability to participate and share knowledge within the organization in a workplace under shared leadership process.

Several studies have shown the importance of the context of leadership being a *shared* process in the organization. Shared leadership emphasizes the value of interaction and interdependence among individuals. Studies demonstrated the positive contribution of shared leadership to individuals and organizational networks. In several researchers, scholars used several numbers of empirical methods in order to accomplish the required results.

Hoch and Kozlowsk (2014) studied leadership and team performance. They examined virtual teams and their number 101 teams. Each virtual team consists of 575 individuals. Hoch and Kozlowski’s study was conducted by the geographic survey, electronic conversation, and cultural variations. Results showed that the correlation between leadership is a *shared* process and team performance is positive. Shared

leadership and team performance were present strongly in their relationships regarding the virtual level and system.

Accordingly, the study of team proactivity and shared leadership has been examined by (Erkutlu, 2012). In the study of Erkutlu (2012), the shared leadership and team proactivity have been examined by conducting 105 of teamwork in commercial banks in Turkey. Erkutlu (2012) has stated that shared leadership impact and relate to team proactivity in the organization. Results showed that in the study that a positive relationship between leadership is a *shared* process and team proactivity.

The study of shared leadership and team effectiveness has been examined by (Wang et al, 2014). Wang et al (2014) conducted their study by meta-analysis approach. They found that in their results that the shared leadership correlates to team effectiveness. A positive relationship exists among them in the organization. Besides, Wang et al (2014) have conducted a comparison among traditional models and shared leadership. They found that leadership being a shared process is more compatible and flexible than traditional models. Wang et al (2014) have stated that shared leadership is a *new genre*. Besides, they pointed that this study highlights shared leadership success and team effectiveness. Fausing et al (2013) emphasized the importance of shared leadership in the organization. Fausing, Jeppesen, Jonsson, Lewandowski & Bligh (2013) stated that shared leadership is *pronounced* and strength to team performance and effectiveness. Shared leadership provides the ability to adapt, which is more appropriate

than traditional leadership in the organization. It was observed that shared leadership influences team members and builds a compatible power in order to achieve goals in the organization and quick response in a complex area.

Morgeson (2005) studied adaptability and the importance of diversity for team development. He discussed that the diversity in features and distributing them properly may enhance the team performance. Besides, shared leadership supports the team as the resource force that develops the team members. It improves the individual's skills in the organization. Morgeson (2005) showed that in his study that sharing skills, or distributing them among team members in the workplace led to team development and rapid response.

Individuals need moral and informational support in order to respond to conditions and achieve gains. Carson et al (2007) explained that in finding, individuals able to perform their duties and tasks in light of the existence of shared leadership that provide the possibility for them in the organizational workplace. In other contexts, individuals need supportive power and materials that reinforce them to nurture their skills and perform their duties. Shared leadership or simply distributed leadership process confirms the knowledge sharing and exchanging benefits among individuals, also managing resources and supportive leadership for them. It was observed by Hoch and Kozlowsk (2014), Erkutlu (2012), Wang et al (2014), Morgeson (2005), and Carson et al (2007) that the shared leadership consensually and positively influences individuals. Besides, it supports Teams in the organization, relationships, information,

diversity, and adaptability. They agree that the shared leadership or distributed leadership process positively influences the team members in the organization.

Barnett and Weidenfeller (2016) pointed out that shared leadership is a new genre or another meaning is that a complex genre. Also, Barnett and Weidenfeller (2016) stated that shared leadership is an infancy study. Therefore that is a reason to highlight on it and examine its role to individuals and organizations.

Several studies have revealed that vertical or simply hierarchical organization and shared leadership influences individuals or team members in the workplace (Burke, Stagl, Klien, Goodwin, Salas, & Halpin, 2006), (Hoch, 2013), (Pearce & Sims, 2002). For instance, Pearce and Sims (2002) discussed the finding of their study that is the vertical system and shared aversive, and leadership *directive* process negatively impact team performance and effectiveness. Pearce and Sims (2002) stated that when this type of leadership presents in the organization, it should be avoided or prevented and de-emphasized in order to the success of shared leadership, and this study has been supported and advocated by (Boies, 2010).

Accordingly, shared leadership is a phenomenon and relational approach, and *reciprocated* team that describes the core nature of shared leadership. Burke et al (2006) studied and analyzed the shared leadership regarding the interconnection and interdependence tasks. Burkey revealed that as a result that shared leadership is better and compatible and relates to team performance and effectiveness. This result is the opposite of what is a single and directive approach. Shared leadership development

through learning individuals that how to exchange and interact constructively in the workplace (Pearce & Sims, 2002) and (Burke et al, 2006). Nicolades et al (2014) revealed that the stronger the bonds that exist between individuals, the shared leadership degree will be high. Interconnectedness among individuals is a core aspect of the success of shared leadership.

In the context of trust, shared leadership creates and increases the phenomenon of trust between individuals within an organization. Drescher et al (2014) studied and examined shared leadership with team members, as well as trust. They have conducted their study in two cycles with 3289 members and it was divided into 142 teams contributing in the first cycle. The second cycle was 849 members are divided into 86 teams contributing in the second cycle. Participants have completed the team's rating and trust level. The results revealed that shared leadership has a prominent role in supporting and developing trust between team members. Also, shared leadership has a positive correlation to a team's performance and effectiveness by increasing the level of trust. Most important of all, Drescher et al stated that the positive results of shared leadership to team performance and trust do not appear only after completion of tasks results, but appear anytime.

In the context of sharing and disseminating knowledge and decision making in the organization, Nazir and Shah (2014) studied and examined knowledge sharing and contribution to decision making, and their effects as a variable or element in the organization. Nazir and Shah have conducted their study on 300 individuals and provided a questionnaire that relevant to their focus and variables. 245 individuals

completed their questionnaires and return their questionnaires. In their study, they revealed that the results that sharing knowledge is positively related to organizational effectiveness and performance. Sharing knowledge in a leadership process is a crucial component that impacts the decision in order to accomplish a high level of performance.

Similar to the previous study the context of teamwork collectivism a term that describes harmony, coordinated, and cohesive team, openness, and trust were analyzed and examined by (Small & Retsch, 2010). Small and Retsch in their study found that there is a positive correlation to shared leadership in the organization. Small and Retsch pointed that collectivism and trust and, other terms are individual variables in teamwork in the organization. They affect organizational outcomes and team members. Accordingly, Drescher et al (2014), Nazir and Shah (2014), and Small and Retsch (2010) indicated the single mass that brings individuals together with confidence, knowledge exchange in a group, and decision-making. They emphasized the importance of shared leadership and its impact in the field of trust, collectivism, knowledge, and achievement of goals.

In the context of shared leadership and knowledge and decision making, it has been examined and the result showed the organizational ambidexterity. Mihalache, Jansen, Van den Bosch & Volberda (2014) have studied the shared leadership team on organizational connections. They conducted a sample of 202 organizations in their study. Mihalache et al (2014) studied and focused on ambidexterity (the ability to exploit successes while also earning opportunity), this includes making the correct decisions, sharing knowledge, information, and skills among individuals. The results

revealed that shared leadership has an encouragement to ambidexterity by empowering in making-decision, a collectivism approach that includes sharing knowledge and information among individuals. In other words, the high degree of shared leadership by management teams means a high level of ambidexterity. This study clarified that shared leadership reinforce organization to quick respond and adapt to rapid challenges and changes.

Haremans, Den Hartog, Keegan & UhlBien (2015) examined leadership and ambidexterity. They discussed leadership and how it achieves ambidexterity. They conducted their study using qualitative methodologies. They examined data through 42 interviews that are related to leadership and ambidexterity in the organization. Secondly, in this part, they have collected information and data from 11 semi-structured interviews in respect of specific issues, and how to adapt and handled these issues. Finding was that quick in handling and responding to changes, as well as adaptation to challenges, and sharing leadership is the basis of the ambidexterity resulting through correct leadership that is shared. They have confirmed the ambidexterity in the organization with (Mihalache, Jansen, Van den Bosch, & Volberda, 2014). They indicated that shared leadership encourages the behaviors that led to ambidexterity such as quick responses, knowledge sharing, decision-making, and adaptation. Haremans et al (2015) and Mihalache et al (2014), their studies align in ambidexterity context in the organization.

In leadership and individuals as social capital, Joo, Lim & Kim (2016) examined the relationship among leadership and how it can affect individuals. In their study, they focused on improving individuals in the organization, support skills, and features in order to handle a workplace like teamwork. Joo et al (2016) found that recognizing individuals and their skills as social capital in a workplace is a core idea of achieving goals. Leaders must support the correlations with individuals and among them to enhance their cognitive in order to accomplish their required goals in the organization. Also, Zhang and Cheng (2015) stated that social capital can be a reason to accomplish sharing leadership and skills among individuals, interconnectedness among them, and collaboration between them as well. Zhang and Cheng (2015) emphasized that sharing leadership within the teamwork of individuals enhances the trust and cooperation between members. Moore, Payne, Autry, & Griffis (2018) have revealed and showed that the organization and complex project are concerning the project results or outcomes and performance. In other words, this correlation is based on the ability of members as social capital and their interaction in the workplace. Joo et al (2016), Zhang and Cheng (2015) and, Moore et al (2016) referred that social capital is the essence of shared leadership. Social capital or simply the individuals in the organization are the power to build a coherent network and build the teams through their relationships and interdependence.

In the innovation of shared leadership and innovation of behavior in the organization, Hoch (2013) conducted a study by examining 184 employee and their leaders from two different companies as a sample. Hoch conducted a study on shared

leadership and its role in the innovation of behavior in the workplace. Findings showed that shared leadership process positively correlates to the innovative behavior of members in the workplace. Shared leadership is an influential component of empowering and developing individuals as teams in the organization. Hoch (2013) and Ensley, Hmieleski & Pearce (2006) recommend that adaptation power is a basic aspect in the shared leadership process.

In the context of teams and knowledge sharing, it has been revealed to increase the level of outcomes Dong, Korsgaard, Welpe, Picot & Wingland (2017). Dong et al have examined the correlation between managers and the team of individuals in team in the organization. Also, they analyzed the skills, creativity, and knowledge. To get the result, they have compared the team leadership and individual leadership in the organization. Dong et al conducted 171 individuals in the study from 8 different companies or organizations and they divided into 43 teams for the aim of the study participations. The study was conducted by questionnaires and observations and supervisors. The results revealed that individual leadership is influenced through individuals and skills, but team leadership is influenced through team creativity and knowledge sharing.

Finally, shared leadership revealed the importance of individuals, team development, and leadership. Shared leadership is a new vision and principle compared to traditional leadership. Shared leadership is a complex approach that involves

complexity leadership, and emphasized the connectedness between individuals. Studies have been conducted in this section and they confirmed the essential role of distributed leadership or shared leadership and its effects on the behaviors, flow of information, quick response, collaborations, sharing knowledge, and relationships in the organization. In the table below, the brief discussions of each study and the findings that were found:

| | |
|--|--|
| <ul style="list-style-type: none"> Virtual teams were examined and their number 101 teams. The study was conducted via geographic survey, electronic conversation and cultural variations. They found that the relationship among Shared leadership and team performance were present strongly <p>Hoch (2014) (as cited in Shu,2018)</p> | <p>Shu,F."Shared leadership and team diversity from a social network perspective" A dissertation published by Proquest.</p> <p>Hoch, J. E. & Kozlowski, S. W.(2014)" Leading virtual teams: Hierarchical leadership, structural support, and shared team leadership". <i>Journal of applied psychologicgy</i>,99, 390-403.</p> |
| <ul style="list-style-type: none"> Shared leadership and team proactivity were examined by conducting 105 of teamwork in commercial bank in Turkey. The finding showed the positive relationship among shared leadership and team proactivity <p>Erkutlu (2012)</p> | <p>Erkute, H. (2012). The impact of organizational culture on the relationship between shared leadership and team proactivity. <i>Team performance management</i>,18, 102-119.</p> |
| <ul style="list-style-type: none"> Shared leadership and team effectiveness were conducted by using meta-analysis approach. The finding was that shared leadership correlates to team effectiveness and the positive link exists among them in the organization <p>Wang et al (2014) (as cited in Shu,2018)</p> | <p>Shu,F. (2018). Shared leadership and team diversity from a social network perspective <i>A dissertation published by Proquest.</i></p> |
| <ul style="list-style-type: none"> Diversity in futures and distributing them were discussed and the finding showed that sharing skills and distributing them between team members led to team development and rapid response <p>Morgeson (2005)</p> | <p>Morgeson, F. P. (2005). The external leadership of self-managing teams: Intervening in the context of novel and disruptive events. <i>Journal of Applied Psychology</i>, 90, 497-508.</p> |
| <ul style="list-style-type: none"> Shared leadership regarding interconnection and interdependence tasks were analyzed. The finding showed that shared leadership is better and compatible to team performance. This finding is the opposite of what single directive said <p>Burke et al (2006)</p> | <p>Burke, C. S., Stagl, K. C., Klien, C., Goodwin, G. F., Salas, E., & Halpin, S. M. (2006). What type of leadership behaviors are functional in teams? A meta-analysis. <i>The Leadership Quarterly</i>, 17, 288-307.</p> |
| <ul style="list-style-type: none"> Shared leadership and teams were examined with trust. The finding showed the shared leadership has a prominent role in developing trust among members and shared leadership has a positive link to team performance. <p>Drescher et al (2014)</p> | <p>Drescher, M. A., Korsgaard, M. A., Welpe, I. M., Picot, A., & Wingland, R. T. (2014). The dynamics of shared leadership: Building trust and enhancing performance. <i>Journal of Applied Psychology</i>, 99, 771-783.</p> |

| | |
|---|--|
| <ul style="list-style-type: none"> Knowledge sharing and decision making and their effect as variables in the organization were examined. The finding demonstrated that knowledge sharing is positively related to organizational effectiveness and performance and decision making. <p>Nazir and Shah (2014)</p> | <p>Nazir, T., & Shah, S. F. H. (2014). Mediating effect of knowledge sharing between participative decision making, transformational leadership and organization performance. <i>Journal of Management Info</i>, 1(1), 1-12.</p> |
| <ul style="list-style-type: none"> Collectivism that describes harmony team, openness, and trust were analyzed. Findings showed that collectivism and other variables impact organizational outcomes and team members regarding shared leadership <p>Small and Retsch (2010)</p> | <p>Small, E., & Rentsch, J. R. (2010). Shared leadership in teams: A matter of distribution. <i>Journal of Personnel Psychology</i>, 9(4), 203–211.</p> |
| <ul style="list-style-type: none"> Shared leadership team on organizational connections was examined. Findings showed the shared leadership has a role to ambidexterity by empowering in making-decision, collectivism approach and information among members <p>Mihalache et al (2014) (as cited in Simpson, 2018)</p> | <p>Simpon, M. (2018). Complexity theory of leadership and management information. Walden University. <i>Published by Proquest 10977225</i>.</p> |
| <ul style="list-style-type: none"> Leadership and ambidexterity were conducted in the organization. Findings showed that quick in handling and responding to changes, as well as adaptation to challenges, and leadership sharing is the basis of the ambidexterity resulting through correct leadership <p>Haremans et al (2015) (as cited in Simpson,2018)</p> | <p>Simpon, M. (2018). Complexity theory of leadership and management information. Walden University. <i>Published by Proquest 10977225</i>.</p> |
| <ul style="list-style-type: none"> Leadership and individuals as social capital were examined and how it can impact members. Findings showed that recognizing members and skills as the social capital in a workplace is a core idea of achieving goals. Leader must support correlations with members and among them and enhancing their cognitive to accomplish goals. <p>Joo et al (2016)</p> | <p>Joo, B. K., Lim, D. H., Kim, S. (2016). Enhancing work engagement: The roles of psychological capital, authentic leadership, and work empowerment. <i>Leadership & Organization Development Journal</i>, 37, 1117-1134.</p> |
| <ul style="list-style-type: none"> Leadership and social capital were conducted in the organization. The findings emphasized that leadership sharing within the team of members enhances the trust and cooperation among members. <p>Zhang and Cheng (2015) (as cited in Simpson, 2018)</p> | <p>Simpon, M. (2018). Complexity theory of leadership and management information. Walden University. <i>Published by Proquest 10977225</i>.</p> |

| | |
|---|--|
| <ul style="list-style-type: none"> • Organization and complex project were examined. The findings show that the organization and complex project are in relation. This correlation is based on the ability of members as social capital and their interaction in the work place <p>Moore et al (2016) (as cited in Simpson, 2018)</p> | <p>Simpon, M. (2018). Complexity theory of leadership and management information. Walden University. <i>Published by Proquest 10977225.</i></p> |
| <ul style="list-style-type: none"> • Leadership and innovation of behavior in the organization were examined. This study was conducted from two different companies as samples. The findings showed that the leadership sharing process positively correlates to the innovative behavior of members in the work place. Shared leadership is an influential component of developing members as teams in the organization <p>Hoch (2013)</p> | <p>Hoch, J. E. (2013). Shared leadership and innovation: The role of vertical leadership and employee integrity. <i>Journal of Business and Psychology, 28(2), 159-174.</i></p> |
| <ul style="list-style-type: none"> • Teams and knowledge sharing were examined in the organization. Skills, creativity and knowledge were analyzed by questionnaire and observations. The findings showed that individual leadership influenced through individuals and skills, but team leadership is influenced through creativity and knowledge sharing. <p>Dong et al (2017)</p> | <p>Dong, Y., Bartol, K. M., Zhang, Z. X., & Li, C. (2017). Enhancing employee creativity via individual skill development and team knowledge sharing: Influences of dualfocused transformational leadership. <i>Journal of Organizational Behavior, 38, 439-458.</i></p> |

1.1.1 The traditional ways:

Traditional leadership includes single leadership or individual leadership process and vision. Also, there are followers and have a deficient or non-positive role in the organization and restrict the decision at the top of the hierarchy (Imperial, Ospina, Johnston, O'Leary, Thomsen, Williams & Johson, 2016). Today, organizations are not compatible with the narrow and limited confines of traditional leadership. Challenges and rapid fluctuations require a fundamental change in the organization, as well as quick response and adaptation. Imperial et al (2016) have compared the workplace that is full of sharing and participation, and traditional leadership in a workplace. They found that traditional leadership is less efficient and performer than shared leadership in a workplace among individuals in a complex area.

Arena and Uhi-Bien (2016) stated that there are influential factors that play a prominent role in individuals and their interactions, such as distributed leadership or simply *shared* leadership process between them, this contradicts do not correspond to traditional leadership. Today, good leadership is to lead collectively and jointly rather than exclusively in leadership and control of individuals, also facilitate to others to be active and act as leaders. Today, organizations require shared leadership and networks rather than single and exclusive leadership.

1.1.2 Contemporary approaches:

Today, organizations are not compatible with the narrow and limited confines of traditional leadership. Challenges and rapid fluctuations require a fundamental change in the organization, as well as quick response and adaptation (Imperial et al, 2016).

1.1.2.1 Complexity leadership approach:

The challenges of the 21st century of leadership are unmatched and stable in the complexity and uncertainty. The complexity aims to organize and manage the social issues, enterprise, and how to share leadership in a complex area (Yawson, 2013). Leaders have to seek to change in complexity (Jonson-Kanda & Yawson, 2018). The past ideas and solutions are no longer beneficial today in challenges and sensitive times. In complexity, leaders have to adapt their methods and use a flexible approach to leadership. The traditional approaches of leadership seek to control and driving. This is a classic issue and problem of a relational space (Holland, 2014). In the end, Rosenhead, Franco, Grint, & Friedland (2019: 3-6), Dick, Faems & Harley (2017) stated “The science of complexity is the phenomenon that emerges from a collection of interacting objects”.

The collective leadership approach looks at a different level of analysis than the traditional approaches of leadership. It looks at the human and groups in the level of analysis. Network level and recognize that leadership can include more than one individual (Dionne, Gupta, Sotak, Shirreffs, Serban, Hao & Yammarino, 2014). Dinh, Lord, Gardner, Meuser, Liden & Hu (2014) and Dionne et al (2014) stated that

Leadership can include multiple levels and can produce both top-down or higher-lower levels of leadership and analysis. Denis, Langley & Sergi (2012), Rosenhead et al (2019), and Avolio, Walumbwa, & Weber (2009) seek to bring the two concepts which are complexity and leadership. They stated that this phenomenon is *complexity and leadership in the plural*. They indicate paramount sub-categories like shared leadership in order to expand and create leadership through connections and interaction. Leadership it is not about control and leading or using authority, is about connection and participation collectively that produce a collectivistic direction (Rosenhead et al, 2019).

Sholman and Sullvian (2014) asserted that complex leadership gives importance to links and focus on communication. In this sense, complexity leadership theory emphasizes the context of an individual's relationships that are a component of the success of networks in the organization today.

Anderson and Meyer (2015) and Cicmil, Cooke-Davies, Crawford & Richardson (2017) stated that in their study that all parts of the organization, individuals are the core phenomenon that influences each other and interact in the network. It led to adopt and create solutions to solve problems and adapt to changes.

In the context of traditional approaches, Shoup (2016) explained that the differences between complexity leadership today and the traditional model. Shoup noted that traditional approaches are used in specific cases as *narrow and rigid phenomena*, but complexity leadership asserts the complex interdependence and relationships as an organizational phenomenon in a whole network.

Simpson (2018) explained the adaptive outcomes are plans, decisions, strategies that generate innovation and creativity in the organization. Shoup (2016) also viewed that the traditional approaches did not fully take into consideration the changes and challenges forces that face the organization, but complexity leadership theory provides approaches and the ability to adapt and deal with challenges facing the organization.

Simpson (2018) indicated that the complexity leadership theory is a new paradigm that supports the process of merging and unified interaction in a complex network. Accordingly, Geer-Frazier (2014) and Hazy and Uhi-Bien (2013) pointed that the complexity emphasizes leadership as a force involving individuals or groups in the workplace that simplify and facilitate the strength of response that stemming from the resonance of individuals.

In the context of dimensions that are considered as the principles of complexity leadership theory are four eminent dimensions are network conditions, shared leadership, organizational learning, and leader skill and knowledge (Clarke, 2013). Such dimensions are important and can play a prominent role in the success of the organization.

Arena and Uhi-Bien (2016) asserted that connected ideas as sources in order to support innovation. Besides, Simpson (2018) confirmed that the relationships and sharing knowledge among individuals able to generate new idea and quick response in the organization, also these relationships as sources to empower the organizational network. The complexity leadership has been indicated that the distribution of

information and knowledge and interaction such as *boiling water* is the correct destination instead of the exclusivity in leadership and control. Geer-Frazier (2014) confirmed that with Simpson (2018) that the position and vision of the theory is eminent regarding adapt and sharing leadership among individuals rather than controlling singly and isolated leadership.

Baltaci and Balci (2017) have been depicted and indicated in their study that the complexity leadership theory emphasized knowledge sharing and learning to the success. Baltaci and Balci (2017) also have referred that complexity may arise through the technological development of the organizational system. Complexity leadership theory has confirmed the urgent need for relationships and sharing ideas in order to adapt and deal with challenges and quick changes.

Thomson, Fazio, Kustra, Patrick, and Stanley (2016) have examined in their paper the complexity leadership theory in the framework of health services. This aspect contains little scientific attention in complexity leadership theory. As a result, Thompson et al made progress in 44 related studies, 27 of them were qualitative, 14 of them were quantitative and 3 of them were mixed methodologies. Thompson et al (2016) pointed that shared leadership and diversity are the influencing complexity leadership theory that is utilized in health services and settings. Relationships that consist of diversity in ideas and visibilities are the most eminent key aspect eminent key aspects that impact complexity leadership theory. Complexity leadership theory also has emphasized the notable role of connectedness among individuals within the organization.

Another study by Geer-Frazier (2014) referred to the use of complexity leadership in order to adapt to the complex circumstances and challenges facing individuals. Geer-Frazier has examined his study to create or simply generate an effective condition in order to quick response. This study has been emphasized the interconnectedness of teams or the individuals in the organization and network and the shared process between them. Individuals are the best sources to accomplish an excellent response and high performance regarding their work and correlation with other individuals (Brenes, Ciravegna & Woodside, 2017) and (Geer-Frazier, 2014). It is notable point that all the studies pour in the nature of relationships and interdependence in the organization among individuals. They confirm the role of team members or individuals in the organization as a power to perform their activities in the complex networks according to their connections.

The study of Curral, Marques-Quinterio, Gomes & Linda (2016) studied and examined the role of the complexity theory in the competence, efficiency of team, and decision making in light of the shared leadership. Several graduate students are 200 attending a single university, they participate in the study and they are divided into 40 groups of five. Individuals have completed a 30-minute trial simulating tasks which utilizing simply 4 and based on tasks regarding real circumstances in life decision. In their study, they have made a comparison, and their result showed that the complexity theory empowers and increase efficiency in the team members and decision making.

The study of Ng (2015) studied and examined a unique method or approach toward complexity leadership. Ng (2015) has indicated that how it can flow in the field of education. In Singapore, schools have become more complex and an urgent need for a dynamic theory, complexity leadership. Ng (2015) has collected data involving observations, reports, and interviews. The result of Ng's study showed that the process should be driven by the student, and the process will enable participants or individuals to generate knowledge. In other words, the education program should take place through the participation and sharing duties of students instead of faculty. Besides, it emphasized that the process should be at all levels and not only following traditional vision. In the current period, innovation is created through the strength of individuals stemming from strong interactions, interdependence, competence, and decision making in the workplace and environment as discussed by (Curren et al, 2016) and (Ng, 2015), not only in one leader or simply in one person according to the traditional model.

In complexity leadership theory, leaders should create an environment to embrace interconnectedness among all individuals. Complexity leadership theory contains shared leadership as a notable dimension that plays an eminent role to generate an adaptive organizational response. Without a shared leadership process, adaptation to complex circumstances will be difficult (Clarke, 2013) and (Rosenhead et al, 2019). In the table below, the brief discussions of each study and the findings that were found:

| | |
|---|---|
| <ul style="list-style-type: none"> Complexity leadership theory in the framework of health services was examined. In the result, they made progress in 44 related studies, 27 of them were qualitative, 14 of them were quantitative, and 3 of them were mixed methodologies. They pointed that shared leadership and diversity are influencing complexity leadership theory that is utilized in health services and setting. Relationships that consist of diversity are the most eminent key aspect that impact complexity leadership theory <p>Thomson et al (2016)</p> | <p>Thompson, D. S., Fazio, X., Kustra, E., Patrick, L., & Stanley, D. (2016). Scoping review of complexity theory in health services research. <i>BMC Health Services Research</i>, 16, 1-16.</p> |
| <ul style="list-style-type: none"> The study referred to complexity leadership to adapt complex circumstances and challenges facing members. The finding emphasized the interconnectedness of teams or members un the organization and network. Members are the best sources to achieve goals and response in high performance) <p>Geer-Frazier (2014) (as cited in Simpson, 2018)</p> | <p>Simpon, M. (2018). Complexity theory of leadership and management information. Walden University. Published by Proquest 10977225.</p> |
| <ul style="list-style-type: none"> The role of complexity theory in the competence, efficiency of the team, and decision making in light of shared leadership. The finding showed that the complexity theory empowers and increases efficiency in members and decision making <p>Currall et al (2016)</p> | <p>Currall, L., Marques-Quinteiro, P., Gomes, C., & Lind, P. G. (2016). Leadership as an emergent feature in social organizations: Insights from a laboratory simulation experiment. <i>PloS One</i>, 11(12), 1-16.</p> |
| <ul style="list-style-type: none"> Complexity leadership theory in field of the education in Singapore was conducted. The finding was that the process should be driven by students and the process will enable participants to generate knowledge. the education program should take place through the participation and sharing duties of students <p>Ng (2015)</p> | <p>Ng, F.S. D. (2015). Leadership learning for complex organizations. <i>Cogent Education</i>, 2,1-20.</p> |

1.1.3 Shared leadership dimensions:

Barnett and Weidenfeller (2016) stated several testable propositions including information sharing, task coordination, and personal support in shared leadership. The dimensions in shared leadership can be the most influential in studying the bonds between individuals, shared leadership contains three dimensions and they can develop individuals to achieve innovation, and such dimensions can be influenced between individuals because each of the dimensions can create a special relationship in a network (Barnett and Weidenfeller, 2016). Through the dimensions, shared leadership can be developed more and understood:

Task coordination:

It refers to the connection and communication in tasks. Individuals conduct together and having relationships that gather them around a common vision, and this dimension requires coordination between roles and manners (Wang et al, 2017). In shared leadership, coordination is a key that influences the strength of the network through interdependence and consistent relationships. Task coordination helps members to learn how to keep correlations in order to accomplish a common goal in a team or as individuals. If there is no coordination, members are not able to work collectively because they do not have relationships that link them around a common task (Wang et al, 2017).

Information sharing

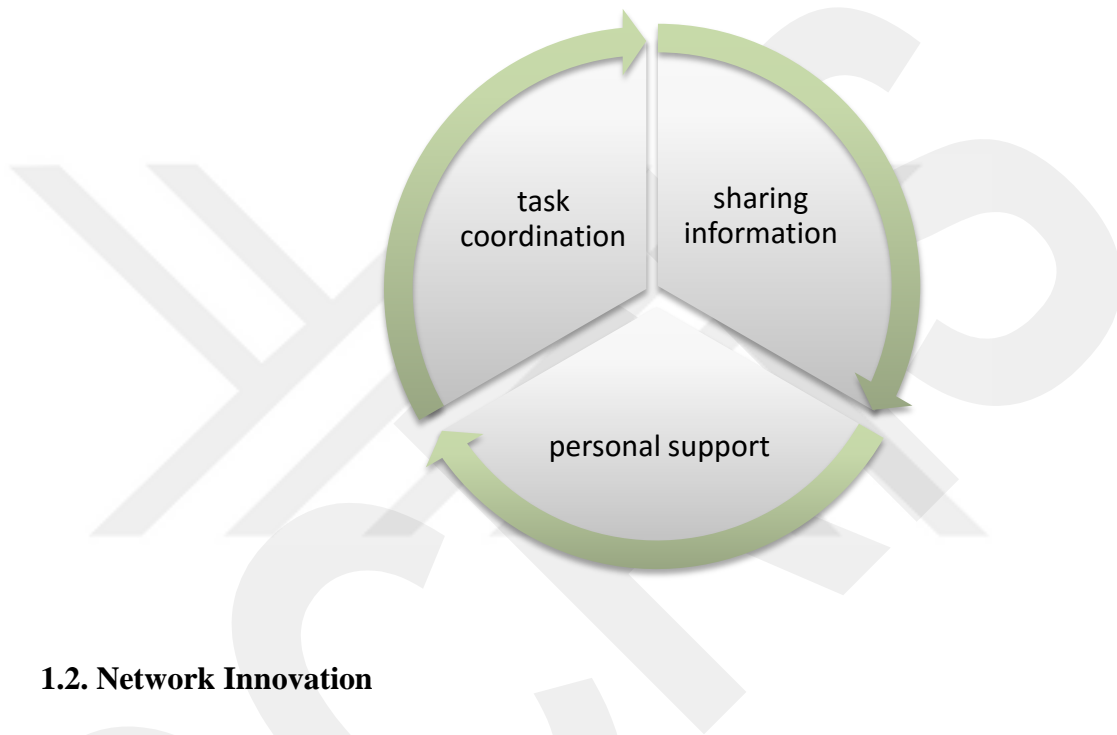
Information plays a key role in the organization and it is one of the important resources. The information must be transferred or handled between members in order to have a wide range of knowledge. Sharing information occurs between partnerships in shared leadership when members collaborate in transmitting information between partners in groups or individuals (Szilagyi, 2017). This correlation creates a consistent network and wide scope of knowledge and prevents weakness in response. The information provides an opportunity for members to participate in implementing tasks and learning how to create decisions without the need for a top-down system (Szilagyi, 2017).

Personal support

It refers to the support that provides a better understanding and response regarding the information, tasks, and enhancing the weak powers. Personal support refers to the development of leadership which provides an opportunity to sophisticate the concern, response, and motivation in members. This dimension focuses on the efforts of individuals (Kock et al, 2019). Values of loyalty and sincerity in the workplace help to spread support among network partnerships. This dimension promotes the level of correlations in the organization and prevents a weakness because the weakness in shared leadership will not reach the required level of leadership. Individuals support each other and provide a supportive environment to keep knowledge between members. Personal

support in shared leadership builds a strong network to prevent any default in tasks and information (Kock et al, 2019). The following figure 1 is made by me:

Shared leadership dimensions:



1.2. Network Innovation

It focuses on individuals who contribute towards the development and creation in the workplace within a network (Kodama, 2015). In-network innovation, unified work occurs in all levels and aspects of the network. Baer and Evans (2015) stated that in more detail the network innovation is a kind of communication between individuals and sharing information without the need for hierarchy. It is a correlation, and it increases the performance, additionally, enhancing weak aspects that impact individuals toward better results (Baer and Evans, 2015).

Network innovation is a collaboration and communication among members regarding the tasks and sharing visions towards a common goal (Xie et al, 2016). The interesting aspect that is the members are collaborated intrinsically and communicate in a consistent network (Xie et al, 2016). Ferraro and Lovanella, (2015) indicated the embeddedness and homophily are the key meaning of network innovation. Ferraro and Lovanella, (2015) said that the network becomes more strong in response when correlations among individuals are pervasive embedded, and homophily between members.

Xie et al (2016) Network innovation characteristics are the internal handing of information, coordination, and support between members without the need for hierarchy. Sharing information, coordination, and support each other occur intrinsically in order to make advancement in their innovation:

Information sharing

It indicates the information being distributed among individuals. Sharing information enables individuals to have knowledge and makes them interconnected like *tissue* in the network. This case will develop the innovation in the network when members have the knowledge and solve problems, and learning from knowledge regarding their tasks and decisions. Members during their work and must have a network including information in order to feed weakness in members if they are in a team or individually.

Task coordination

It indicates the decentralization and emphasis coordination between individuals, and the distribution of centralization to each person without a monopoly in order to achieve innovation in a network. Coordination can build an interactive relationship to solve and perform tasks in a group or individuals with another because coordination promotes links between each member in one vision. Therefore, innovation occurs between each member because they share their skills, and work toward common goals.

Personal support

It indicates support individuals. Members work accordingly to an ethical code that states principles and rules in order to build a network. Personal support includes an ethical relationship between individuals in order to prevent weakness and work in a team or individually with other partners. Members support one another in technical issues etc.

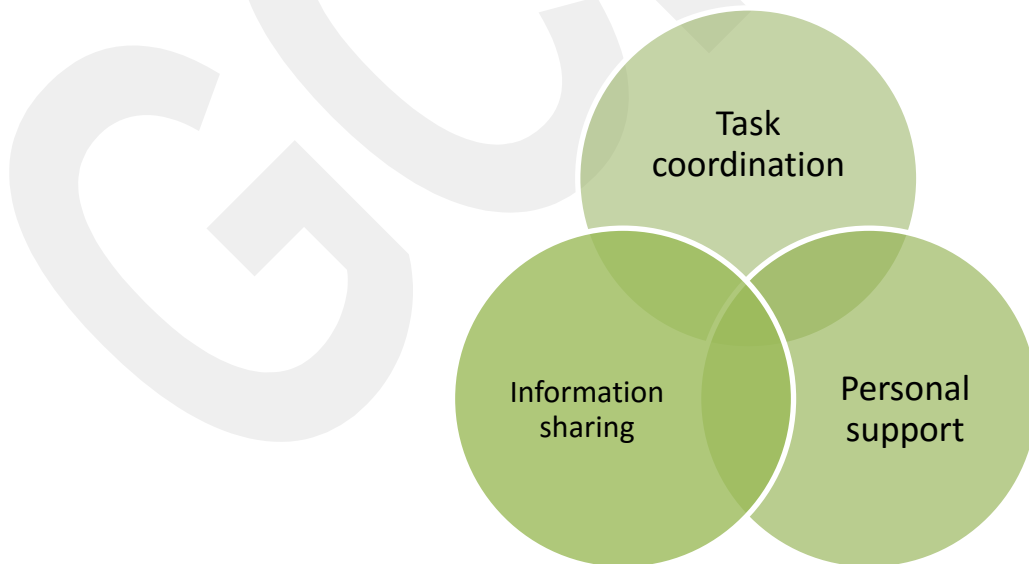


Figure 2 made by me (the characteristics of network innovation).

1.2.1 Social network theory:

The social network is a collection of members with an established pattern of interconnection personally in a network, and it is an interaction and contact among individuals (Mayo et al, 2002). The relationships present in information sharing, task coordination, and personal support between members (Mayo et al, 2002). Social network theory focuses on the role of social correlations in handling knowledge through information, coordination, and support between members in a network (Liu, 2017).

Social network theory is interested in the pattern of social relationships that can be existed among members in a social network (Daly et al, 2014). Social network includes the correlation that consisting of information sharing, task coordination, and personal support among members (Susandy and Prasetyo, 2019). Social network theory does not rely on the relationships or links, but it includes the method that makes a deep understanding of individuals and their movement in a social network (Daly et al, 2014). Social network includes most pervasive characteristics which can describe the strength of the relationships in the pattern of a network:

Centrality:

It indicates the number of relationships that a member has with other members in a network. A person who has more links, he/she has a high degree of centrality and maybe this person becomes a brokerage that links relationships among others. The degree centrality depends on the links between individuals consisting of in-degree and

out-degree (Mayo et al, 2002). In-degree means the links are reported by others, and out-degree means the links are reported by a focal person (Mayo et al, 2002).

Density:

It indicates the current amount of links among members in the network and subgroups (clusters) divided by the total amount of links in a network (Small, 2007).

Weak and strong ties:

The ties can be described by two descriptions *weak tie and strong tie*. Weak ties refer to the weak relationship or weak link from A to B and it may be strong from B to A. strong ties refer to the strong relationship or link from A to B and it may be weak from B to A. the influencing tie maybe existed from one side, and weak tie as well. In many cases, strong ties existed from two sides and week tie exists from two sides as well. It depends on the members in their positions in a network (Small, 2007).

1.2.2 Social network theory and shared leadership theory:

According to the details that were in the previous chapter, shared leadership theory and social network theory were demonstrated and defined the foundations based on them. The discussion of the relationships between shared leadership theory and social network theory from the theoretical side and the methodological sides is demonstrated in the following section.

1.2.2.1 Correlations between social network perspective and shared leadership:

The social network perspective aligned with shared leadership (Carter, 2015). Studying social network theory and shared leadership provides a deep understanding about relationships that exist among members in the network (Carter, 2015).

Besides, the social network highlights the relationships that present among individuals. Shared leadership concerned with the social correlations that exist through its dimensions.

The social network perspective focuses on the social ties between members that occur in shared leadership and affirms strength/weakness in the nature of the relationship (Shu, 2018).

Shu (2018) and Hanneman and Riddle (2005) stated a social network is a group of individuals (actors) in the network who have a correlation with one another in the workplace. Susandy and Prasetyo (2019), Blackwell (2014) stated for more details that the connections between individuals in a workplace consist of coordination, sharing

information, and support in the framework of the network. Therefore, the relationships occur under shared leadership and within a pattern of a social network.

The social network perspective concerned with the pattern of social relationships between members (Daly et al, 2014). The primary focus is on the connections that members have with each other (Hanneman & Riddle, 2005). The relations are *the basic building block of social networks* (Blackwell, 2014). Here, it is clear that relationships are the basis of a network, as confirmed by shared leadership in this regard. Besides, shared leadership and social network affirm that teams or individuals are the links in the network (Daly et al, 2014).

A social network perspective focuses on the information regarding the relational interactions between actors in the networks (Small, 2007). In other words, social network explains the relationships that consist of transmitting information, coordination, and support between members, and focuses on the nature of links among members. Some of the members are interactive and effective than others in a network. The social network does not focus on relationships only, but it consists of the method that creates a clear pattern of a network and understanding the movements of the individual (Liu, 2017). Additionally, the dimensions of shared leadership select the pattern of the network. They select the pattern according to their natures of dimensions, For instance, information sharing, coordination, and personal support (Barnett & Weidenfeller, 2017) and (Cullen-Lester, Maupin & Carter, 2017).

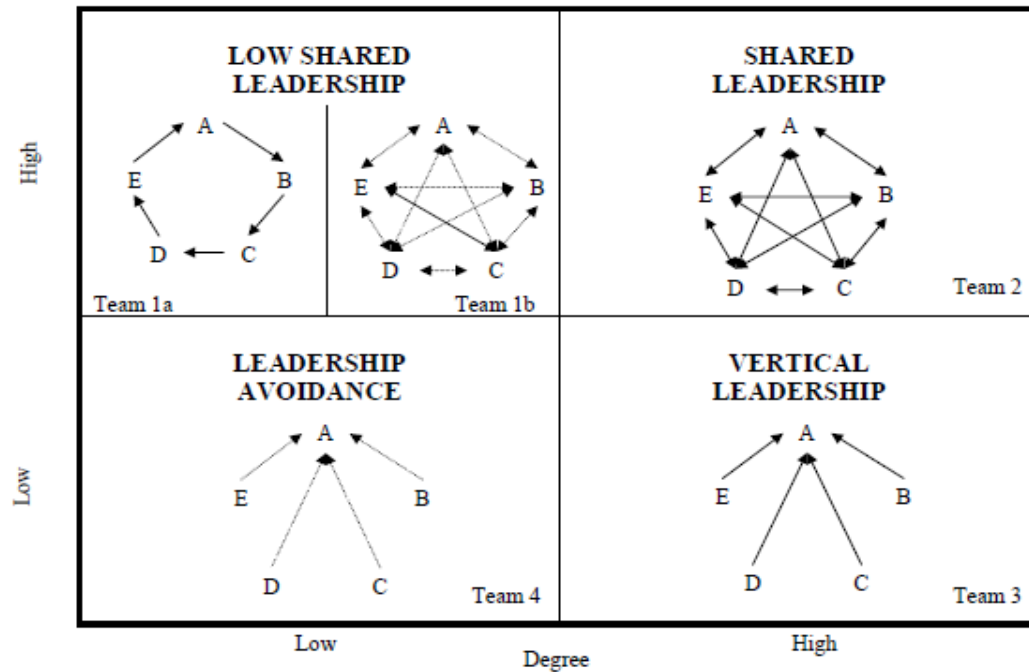


Figure 3, Small (2007) stated that in figure 1 that is shown shared leadership is successfully occurs or not in the organization. In team 1a and team 1b, it is shown that the teams have a low shared leadership. In team 2, shared leadership is shown that successfully. In team 3, there is vertical leadership. There is no shared leadership. In team 4 there is avoidance in leadership and it is weak leadership. This example above shows the relationships between individuals, and how relationships can successfully innovate the network among members.

1.2.2.2 Theoretical and practical literature in social network and shared leadership:

In the context of literature, studies that were conducted regarding the social network perspective and shared leadership in the organization and all achieved notable results. The studies will be discussed in order to understand the aspects that have been conducted to obtain the required goals.

Carson et al (2007) studied that leadership is a shared process and team performance is related shared leadership. Carson et al have conducted their study in 59 students consulting. They found that shared leadership has a positive relationship with team performance. Team performance is based on the existence of shared leadership in the organization. Supporting the internal of teams empowers the shared leadership process inside the team toward required performance and outcomes. They have conducted their study via centrality and density that is an approach of social network analysis. They recommend and emphasized the importance of the internal side of teams and supporting the interaction between team members to achieve shared leadership and social network in higher levels.

Accordingly, Small and Rentsch (2010) indicated that there is the positive correlation between shared leadership processes and team sales revenue. Small and Rentsch examined their study in 60 student teams. They conducted their study via social network analysis and used the centralization approach in order to understand the level of correlation among shared leadership and team sales revenue. Small and Rentsch (2010) affirmed that the harmony in team and trust are notable aspects of the organization.

Nicolades et al (2014) conducted and reveal that shared leadership has vigorous correlation to team performance. They found that social network analysis is an appropriate method to obtain information and data. Social network analysis is appropriate than other approaches to shared leadership. Nicolades et al (2014) stated that measuring via social networks is more effective and stronger in order to reveal the results. Nicolades et al (2014) stated that task interdependence is a crucial power in the organization. When task interdependence is high, shared leadership is high. Task interdependence is an aspect of shared leadership and it has an influence in a workplace among individuals.

D’Innocenzo et al (2014) made a comparison to shared leadership that is measured by density and centrality and other approaches. They revealed that utilizing either of these (density and centrality), shared leadership and team performance that noticeably greater magnitude than using other approaches to shared leadership. It reveals details, as well as, it is accurate than other approaches. Carson et al (2007), Deposit, Tillman, Boy, & McKee (2013), Small and Rentsch (2010), Nicolades et al (2014), and D’Innocenzo et al (2014) indicated that the social network perspective is the appropriate approach to understand among individuals in a network. They also compared the social network perspective with other approaches and revealed that social networks more flexible and accurate. In the table below, the brief discussions of each study and the findings in the following table:

| | |
|---|--|
| <ul style="list-style-type: none"> Shared leadership and team performance were examined by using social network analysis in density and centrality as approaches. The finding showed that shared leadership has a positive link with team performance. Team performance is based on the existence of shared leadership in the organization <p>Carson et al (2007) (as cited in Robert et al,2016)</p> | <p>Robert c. Barnnet and Nancy K. Weidenfeller.(2016). "Shared leadership and team performance" advances in developing human resources. Vol. 18(3) 334-351. SAGE</p> <p>Carson, J. B., Tesluk, P. E., & Marrone, J. A. (2007). "Shared leadership in teams: An investigation of antecedent conditions and performance". <i>Academy of Management Journal</i>, 50, 1217-1234.</p> |
| <ul style="list-style-type: none"> Shared leadership process and team sales revenue were conducted via social network analysis and used centralization approach. They affirmed that the harmony in team and trust are notable aspects of the organization <p>Small and Rentsch (2010) (as cited in Robert,2016)</p> | <p>Robert c. Barnnet and Nancy K. Weidenfeller.(2016). "Shared leadership and team performance. <i>Advances in developing human resources</i>. Vol. 18(3) 334-351. SAGE</p> <p>Small, E. E., & Rentsch, J. R. (2010). Shared leadership in teams: A matter of distribution. <i>Journal of Personnel Psychology</i>, 9, 203-211.</p> |
| <ul style="list-style-type: none"> Shared leadership and team performance were conducted and there is a correlation among them. Social network analysis is an appropriate method to determine information and data <p>Nicolades et al (2014) (as cited in Robert et al, 2016)</p> | <p>Robert c. Barnnet and Nancy K. Weidenfeller.(2016). Shared leadership and team performance. <i>Advances in developing human resources</i>. Vol. 18(3) 334-351. SAGE</p> <p>Nicolaides, V. C., LaPort, K. A., Chen, T. R., Tomassetti, A. J., Weis, E. J., Zaccaro, S. J., & Cortina, J. M. (2014). The shared leadership of teams: A meta-analysis of proximal, distal, and moderating relationships. <i>The Leadership Quarterly</i>, 25, 923-942.</p> |
| <ul style="list-style-type: none"> Shared leadership was measured via density and centrality and other approaches. The finding was that density and centrality is better for measuring shared leadership and its relationship toward team performance than other approaches <p>D'Innocenzo et al (2014)</p> | <p>D'Innocenzo, L., Mathieu, J. E., & Kukenburger, M. R. (2014). A meta-analysis of different forms of shared leadership-team performance relations. <i>Journal of Management. Advance</i></p> |

1.3 Hypotheses:

Formulation of hypotheses based on two unified theories. They are mentioned in previous section. The hypothesis consists of two components, which is the variable that builds the hypothesis on two important foundations are *shared leadership theory and social network theory*.

In the first *hypothesis*, task coordination refers to the decentralization between members. Task coordination is a different type of correlation, and this hypothesis refers to *who coordinates with whom* that will creates knowledge within a network. If individuals do not coordinate, they will face challenges without solutions. Therefore, coordination motivates members to work together in a network and having one vision for each goal (Susandy and Prasetyo, 2019). Task coordination provides opportunities to members to participate in a task, and decision making. Individuals participate in a team to help some members because they are lack of knowledge in specific cases (Wang et al, 2017). This hypothesis has been formulated according to the task coordination as a dimension of shared leadership. It helps to understand the strength of coordination that occurs between individuals, and who is strong in coordination. It clarifies who is weak with whom according to their positions. Finding will show that coordination among individuals provides strong relationship. Therefore, the strength of individuals consists of cooperation around coordination in tasks, and making decisions for a common goal. Additionally, the finding will show the strength of each member within a network, and understanding the movement of members. Therefore network innovation exists when task coordination successfully occurs between members and clusters in a network. The

hypotheses below are formulated according to the first question (what is the degree of task coordination toward the network innovation?):

Hypothesis 1a: Individuals in the task coordination have a medium or low percentage of degree centrality in a social network and in their units or departments.

Hypothesis 1b: The social network of the task coordination has a high percentage of degree density in the network as a whole and in units or departments.

Hypothesis 1c: Strong ties have higher percentage in the task coordination network than weak ties between individuals.

Second *hypothesis* refers to the personal support among members in a network. Personal support is a dimension of shared leadership. Organizations strive to achieve the ideal community where the correlations between members are to be cooperative and coherent *who supports whom and who supports one another* (Susandy and Praesty, 2019). Personal support in a network shows that for us the relationship between individuals is not only in regard of tasks, but it shows that members try to link on another to prevent weak points (Kock, 2019). Personal support shows a deep link between individuals. It explains the strength of relationships among individuals in the pattern of the network, and the movements of members *who support whom and who support one another* in a network (Susandy and Praesty, 2019). Finding of this hypothesis shows who is strong in support and who is central in a network and who is equal with the other one. Additionally, it shows the strength and weaknesses of each person in a team or individuals in a network. Personal support as a dimension of shared

leadership needs a deep value of interactions that can occur between members. Therefore, network innovation exists when personal support successfully occurs among members and clusters. This hypothesis below is formulated according to the third question of the study (what is the degree of personal support toward the network innovation?):

Hypothesis 2a: Individuals in the personal support have a medium or low percentage of degree centrality in a social network and in their units or departments.

Hypothesis 2b: The social network of the personal support has a high percentage of degree density in the network as a whole and in units or departments.

Hypothesis 2c: Strong ties have a higher percentage in the personal support network than weak ties between individuals.

Third *hypothesis* refers to information sharing in a network. This dimension of indicates the flow of knowledge among individuals, and understanding *who shares with whom* in a network (Susandy and Prasetyo, 2019). Sharing information makes a deep understanding of who has strength in information sharing, and who is weak. Additionally, the dimension of shared leadership makes us understand who is central or equal, who transfers, who receives, and sender. This dimension provides a network about the movements of members within a team or individuals (Szilagyi, 2017). The finding of this hypothesis will show that information sharing plays a deep role between individuals, and it will provide a clear pattern of the network about their interaction under shared leadership. Besides, it will explain the strength of each individual *who*

shares with whom. It will explain the weakness that may occurs among members according to their positions. Therefore, network innovation exists when sharing information exists in majority of members and among clusters in a network. Information sharing provides a high capacity for individuals to interact with others without the lack of relationship. This hypothesis below has been formulated according to the second question in the study (what is the degree of sharing information toward the network innovation?):

Hypothesis 3a: Individuals in the information sharing have a medium or low percentage of degree centrality in a social network and units or departments.

Hypothesis 3b: The social network of the information sharing has a high percentage of degree density in the network as a whole and in units or departments.

Hypothesis 3c: Strong ties have a higher percentage in the information sharing network than weak ties between individuals

CHAPTER 2: METHODOLOGY

2.1 Social Network Analysis:

Social network analysis is a method to analyze interconnections between individuals (actors) together within the network in the organization Wasseman and Faust (1994). Social network is an approach according to (Sweetman, 2010). Sweetman (2010) has pointed that it is a method for analyzing and examining the nature of interaction and relationship among individuals. Besides, it provides a recipe for describing the relationship between nodes (actors) and the strength of ties among them.

Advantages of social network analysis able to covers behaviors and other characteristics that represent interactions and connections between actors. Besides, advantages that it is able to evaluate the level of interconnectedness between actors (Shu, 2018). (Small, 2007) stated that social network aligns with shared leadership theory. Both affirm the nature of interactions and connections among actors as a core purpose for describing and understanding the complex network in leadership that is shared.

Social network analysis is the most appropriate method for shared leadership. Network analysis helps to obtain rich information, while other approaches may lose information. In our study, network analysis is the approach we have taken to measure and understand shared leadership in a network.

2.2 Measurement:

Centrality: degree centrality indicates the degree of relationships among individuals. Hanneman and Riddle (2005) and Sparrowe et al (2001) have stated that a (high degree of centrality= low shared leadership, and a low degree of centrality= high shared leadership). Whenever there is a high centrality confined to a small number of individuals, it means that the shared leadership is low. Whenever there is centralization, but it is not confined to a small number of individuals and it is a medium or less, it means that the shared leadership is high. Degree centrality reveals the strength in the relationships between members according to the nature of the relationship in a network. Brokerages also play a role to distribute centrality and mediate relationships among members. It is a source for distribution and centrality.

Density: degree density is another type of network analysis measurements. Density explains the number of current ties in the whole network and subgroups (clusters) and it is divided by the total amount of ties in the network (Sozen, 2012) and (Small; 2007). Small (2007) and Mayo et al (2003) pointed that density represents the total amount of the whole network. It represents the size of leadership that is presented or simply exhibited by members in teamwork.

$$\text{Density} = \frac{\text{Current ties}}{\text{The total number of ties}}$$

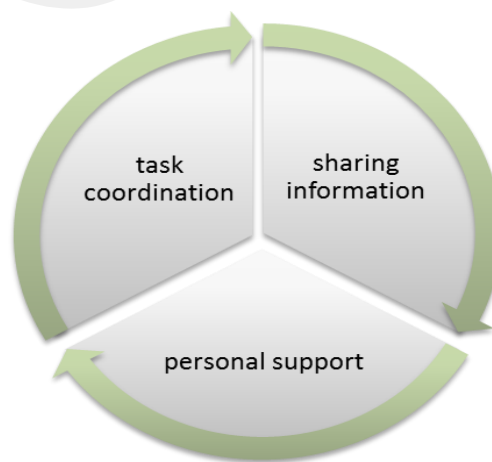
Weak and strong ties: the ties can be divided into two descriptions *weak tie and strong tie*. Weak ties indicate the weak relationship or weak link from A to B and it may be strong from B to A. strong ties indicate a strong relationships from A to B and maybe it is weak from B to A. the influencing tie may be existed from one side, and weak tie as well. Strong ties may exist from two sides and week ties exist from two sides as well. It depends on the members in their positions in a network (Small, 2007).

2.3 Variables:

The variables that play a role in the study are information sharing, task coordination, and personal support and they are shared leadership dimensions. Variables are statistically examined and created a network according to variables *dimensions of the shared leadership and characteristics of network innovation*. They are examined and controlled in degree centrality, density, weak, and strong ties.

Figure 4 made by me.

Shared leadership dimensions (variables)



2.4 Design and procedures:

Design:

At the beginning, individuals are studied specifically and focus on them, especially those related to the topic. The reason is that shared leadership theory focuses on individuals collectively and specifically within a specific limits. Edlund and Nichils (2019:330,331) stated that “there are two main methods to design the collection of network data. First, researchers collect data about specific actors, and this way of data collection is suitable for research that focuses on members and their relationships. Second way is that data collection in all actors within a bounded population and this method is wider and complicated for research”. For this reason, first method of research was considered. The method of data collection was in electronic form. Data were collected from organization A. Privacy was taken into account in the matter. Privacy was not shared and it remains in the form of symbols or numbers. The private information is hidden to keep the privacy of members. Privacy of the data in the questionnaire, and the organization was considered. It is taken into consideration that a questionnaire is made for all selected participants in the study in order to understand every variables among members within the network. *The questionnaire contains three questions and each question contains a variable. Numbers that select the strength of relationships weekly are provided next to the each question from 0 to 5. Numbers represent connections weekly if it is 2, it means it is 2 days in a week. Each variable innovates a group (cluster) and then it links with others to innovate the full network that will show the nature of the relationships and the strength of links among members.*

Questions are 1) which of your partners do you coordinate tasks with him/her regarding the work? 2) which of your partners do you exchange information with him/her in a workplace? 3) Which of your partners do you get personal support or advice with him/her regarding the work?

Procedures:

One of the important stages in the study is the procedures that determine the findings of the study. After the questionnaire has been prepared, sharing the questionnaire among members to collect data. From the methodology of the study *social network analysis*, using the UCINET as a program in order to data analysis and network pattern identification (Brogatti, Everett, and Johnson, 2013). Each network will show the relationships among individuals based on the degree of centrality, density, weak and strong ties in a network (Sweetman, 2010). In each network, the degree of centrality between each member is shown. Therefore, less centrality means a positive result and high centrality means a negative result. Density selects the size of the relationships in the subgroups and the whole network. Weak and strong ties select the strength of ties among members and measuring the ratio of them. Weak and strong ties show that who has a weak out-degree and in-degree, and vice versa. Finally, taking into consideration the questionnaires must be completed successfully. If any questionnaire has a mistake and any missing survey, it will not be considered.

2.5 participants:

Fundamentally, the study consisted of 130 participants. This study is characterized by the inclusion of all selected members within the organization. As a result, this does not mean that all individuals can participate because the study does not include those who are within the organization, but whose presence is outside the network. Therefore, participants were reduced to 98 members to participate in the study from the organization A. Network data were gathered from 98 participants in 9 departments. Some participants are either missing or incorrect. This is the reason that reduced the participation as well.

The network data were gathered from 98 participants who have different roles in the organization. Members are distributed in positions according to the specialty. The data were gathered according to the questions including variables in order to examine the study.

The data were gathered from 9 departments. They are Management department (1), assistant of management (1), secretary department (3), finance department (10), human resources and personal affairs (18), managerial department (28), maintenance and information systems (18), auditing and review department (14), and research and development department (5).

Participants' ages range between 26 and 50. The gender is 52% for female and 58% for male. The ratio of experience was between 2 and 13 years.

The abbreviations of departments are:

- 1- Management (M)
- 2- Assistant of management (AM)
- 3- Secretary (S)
- 4- Finance department (FD)
- 5- Human resources and personal affairs (HRD)
- 6- Managerial employees departments (MED)
- 7- Maintenance and information systems (MIS)
- 8- Auditing and review department (ARD)
- 9- Accurate Researches and development department (ARD)

CHAPTER 3: FINDINGS

3.1 Statistical Description, Network Pattern and Hypotheses:

The statistical description is an important section of the study as the results are described in numerical form. The computational description provides an accurate understanding of each element of the study and its role in the organization. As for the network pattern, it shows the relationships visually to understand the relationship pattern among members. It shows the links among individuals from and to, as well as the density of the network as a whole or in part for each team in the network.

Hypotheses are the goal of the study to reach to the desired results. Examining hypotheses is done by studying statistical results and networks. Each hypothesis has a goal whether positive or negative, is recognized through the outcome of both the statistics and the networks. Degree centrality, density, weak and strong ties select the outcome of each hypothesis whether it is required or negative (null).

The statistical and network descriptions are complementary to each other in order to obtain a correct understanding of the results in digital and visual forms. At the end of each study related to a specific variable, the result is revealed whether it is required or null for each hypothesis after the examination.

3.2 Task Coordination:

Task coordination is one of the dimensions of shared leadership. At the same time, it is one of the characteristics of network innovation. This variable was conducted by network analysis statistically and network. Through the statistical description, it was found that the task coordination was positive. Degree centrality in task coordination was 13.70%. This degree is lower than medium according to the hypothesis, but this degree expresses that it is positive because whenever the degree centrality was medium or less, it means that it is a positive degree especially in shared leadership theory. Whenever the degree centrality is high, it means that it is negative because shared leadership theory requires medium or less degree. Degree centrality 13.70% is low. This ratio shows that the task coordination in shared leadership is surrounded by the network. Especially, it surrounded the members inside the clusters and in the whole network. This ratio is important and the question that can be generated is *why it is important?* Degree centrality 13.70% is important due to the high ratio if it was more than 50%, the network becomes *invalid* because high centrality reduces the percentage of task coordination. Therefore, 13.70% in task coordination can be described as an *excellent rate* in the network and among members. Even, the heterogeneity is 1.15%. It means that it is positive because low heterogeneity supports the result of centrality. The normalized is 0.13%. It means that the percentage of normalized is low, and it means that the *abnormal continuous movements of members are continuous and not stable*. If it is stable, means that it is *stagnant*. Therefore, task coordination is weak. In this finding, the movement of members is continuous, low heterogeneity supports the degree centrality,

low normalized ratio supports the low centrality. All of the heterogeneity and normalized ratio support the centrality because *high centrality will not be supported by heterogeneity and normalized ratio.*

The strongest first three nodes were 34DMED, 35SDMED, 36ADMED their degree was 32.000 and NrmDegree 32.653, and their share was 0.017. The 34DMED is the director of the managerial employees department, 35SDMED is the secretary of the MD, and 36ADMED is the assistant of the director of the MED. The 34 as a director was the strongest because he was in the center of the department and the majority of the coordination was coordinated through 34 as a director. The 35S secretary of the director was close, and it is the reason to make the secretary the second one. The 36 as an assistant of the director was the third one because he was close to the director and secretary. The director 34DMED has the highest degree 32.000, the share was 0.017, and the most central member. The first three were the strongest brokerages among their cluster MED and the main cluster (M management, AM assistant management, and S secretary of management). The vice versa were 95ADARD, 96EARD, 97EARD and 98EARD their degree was 4.0, and their share was 4.082 and NrmDegree were 0.002. The ARD is the research and development department. The 95 as a director of ARD was the weakest with his members because they were few in number and they connect with the main cluster in red color and MIS maintenance and information system. Their task is specific and that is the reason to make them the lowest in the degree especially in share and degree. The 94DARD has 12.0 degree and share 0.006 and is the strongest in ARD because 94 is the director of ARD and it plays a role with 95 as an assistant in the

coordination among the cluster and main cluster (M, AM, and S). *The most important ratio is the degree and share because they select the main role of each member in the network.*

The following statistical schedule provides a precise description to understand each member in task coordination and the strength of relationships among individuals, as well as, provides a rate of centrality at the end of the statistical description. In the first statistics schedule data treated as symmetric shows the role of each member from strongest to weakest in the organization.

Data treated as symmetric:

| | | 1 | 2 | 3 |
|----|---------|--------|-----------|-------|
| | | Degree | NrmDegree | Share |
| 34 | 34DMED | 32.000 | 32.653 | 0.017 |
| 35 | 35SDMED | 32.000 | 32.653 | 0.017 |
| 36 | 36ADMED | 32.000 | 32.653 | 0.017 |
| 49 | 49EMD | 27.000 | 27.551 | 0.015 |
| 51 | 51EMD | 27.000 | 27.551 | 0.015 |
| 52 | 52EMD | 27.000 | 27.551 | 0.015 |
| 56 | 56EMD | 27.000 | 27.551 | 0.015 |
| 57 | 57EMD | 27.000 | 27.551 | 0.015 |
| 58 | 58EMD | 27.000 | 27.551 | 0.015 |
| 53 | 53EMD | 27.000 | 27.551 | 0.015 |
| 54 | 54EMD | 27.000 | 27.551 | 0.015 |
| 55 | 55EMD | 27.000 | 27.551 | 0.015 |
| 37 | 37EMD | 27.000 | 27.551 | 0.015 |
| 38 | 38EMD | 27.000 | 27.551 | 0.015 |
| 39 | 39EMD | 27.000 | 27.551 | 0.015 |
| 46 | 56EMD | 27.000 | 27.551 | 0.015 |
| 41 | 41EMD | 27.000 | 27.551 | 0.015 |
| 48 | 48EMD | 27.000 | 27.551 | 0.015 |

| | | | | |
|----|---------|--------|--------|-------|
| 43 | 43EMD | 27.000 | 27.551 | 0.015 |
| 44 | 44EMD | 27.000 | 27.551 | 0.015 |
| 45 | 45EMD | 27.000 | 27.551 | 0.015 |
| 59 | 59EMD | 27.000 | 27.551 | 0.015 |
| 60 | 60EMD | 27.000 | 27.551 | 0.015 |
| 61 | 61EMD | 27.000 | 27.551 | 0.015 |
| 50 | 50EMD | 26.000 | 26.531 | 0.014 |
| 47 | 47EMD | 26.000 | 26.531 | 0.014 |
| 42 | 42EMD | 26.000 | 26.531 | 0.014 |
| 40 | 40EMD | 26.000 | 26.531 | 0.014 |
| 63 | 63ADMIS | 23.000 | 23.469 | 0.012 |
| 64 | 64SDIMS | 23.000 | 23.469 | 0.012 |
| 62 | 62DMIS | 23.000 | 23.469 | 0.012 |
| 17 | 17SDHR | 22.000 | 22.449 | 0.012 |
| 18 | 18ADHR | 22.000 | 22.449 | 0.012 |
| 16 | 16DHR | 22.000 | 22.449 | 0.012 |
| 81 | 81ADARD | 21.000 | 21.429 | 0.011 |
| 82 | 82SDARD | 21.000 | 21.429 | 0.011 |
| 80 | 80DARD | 21.000 | 21.429 | 0.011 |
| 1 | 1M | 20.000 | 20.408 | 0.011 |
| 2 | 2S | 20.000 | 20.408 | 0.011 |
| 3 | 3S | 20.000 | 20.408 | 0.011 |
| 4 | 4S | 20.000 | 20.408 | 0.011 |
| 5 | 5AM | 20.000 | 20.408 | 0.011 |
| 19 | 19EHR | 17.000 | 17.347 | 0.009 |
| 20 | 20EHR | 17.000 | 17.347 | 0.009 |
| 21 | 21EHR | 17.000 | 17.347 | 0.009 |
| 22 | 22EHR | 17.000 | 17.347 | 0.009 |
| 23 | 23EHR | 17.000 | 17.347 | 0.009 |
| 24 | 24EHR | 17.000 | 17.347 | 0.009 |
| 25 | 25EHR | 17.000 | 17.347 | 0.009 |
| 26 | 26EHR | 17.000 | 17.347 | 0.009 |
| 27 | 27EHR | 17.000 | 17.347 | 0.009 |
| 28 | 28EHR | 17.000 | 17.347 | 0.009 |
| 29 | 29EHR | 17.000 | 17.347 | 0.009 |
| 30 | 30EHR | 17.000 | 17.347 | 0.009 |
| 6 | 6DFD | 17.000 | 17.347 | 0.009 |
| 7 | 7ADFD | 17.000 | 17.347 | 0.009 |

| | | | | |
|----|--------|--------|--------|-------|
| 8 | 8SDFD | 17.000 | 17.347 | 0.009 |
| 33 | 33EHR | 17.000 | 17.347 | 0.009 |
| 71 | 71EMIS | 17.000 | 17.347 | 0.009 |
| 72 | 72EMIS | 17.000 | 17.347 | 0.009 |
| 73 | 73EMIS | 17.000 | 17.347 | 0.009 |
| 74 | 74EMIS | 17.000 | 17.347 | 0.009 |
| 75 | 75EMIS | 17.000 | 17.347 | 0.009 |
| 76 | 76EMIS | 17.000 | 17.347 | 0.009 |
| 65 | 65EMIS | 17.000 | 17.347 | 0.009 |
| 66 | 66EMIS | 17.000 | 17.347 | 0.009 |
| 67 | 67EMIS | 17.000 | 17.347 | 0.009 |
| 68 | 68EMIS | 17.000 | 17.347 | 0.009 |
| 69 | 69EMIS | 17.000 | 17.347 | 0.009 |
| 70 | 70EMIS | 17.000 | 17.347 | 0.009 |
| 77 | 77EMIS | 17.000 | 17.347 | 0.009 |
| 78 | 78EMIS | 17.000 | 17.347 | 0.009 |
| 79 | 79EMIS | 17.000 | 17.347 | 0.009 |
| 31 | 31EHR | 17.000 | 17.347 | 0.009 |
| 32 | 32EHR | 17.000 | 17.347 | 0.009 |
| 88 | 88EARD | 13.000 | 13.265 | 0.007 |
| 83 | 83EARD | 13.000 | 13.265 | 0.007 |
| 84 | 84EARD | 13.000 | 13.265 | 0.007 |
| 85 | 85EARD | 13.000 | 13.265 | 0.007 |
| 86 | 86EARD | 13.000 | 13.265 | 0.007 |
| 87 | 87EARD | 13.000 | 13.265 | 0.007 |
| 91 | 91EARD | 13.000 | 13.265 | 0.007 |
| 89 | 89EARD | 13.000 | 13.265 | 0.007 |
| 90 | 90EARD | 13.000 | 13.265 | 0.007 |
| 92 | 92EARD | 13.000 | 13.265 | 0.007 |
| 93 | 93EARD | 13.000 | 13.265 | 0.007 |
| 94 | 94DARD | 12.000 | 12.245 | 0.006 |
| 15 | 15EFD | 9.000 | 9.184 | 0.005 |
| 10 | 10EFD | 9.000 | 9.184 | 0.005 |
| 11 | 11EFD | 9.000 | 9.184 | 0.005 |
| 12 | 12EFD | 9.000 | 9.184 | 0.005 |
| 13 | 13EFD | 9.000 | 9.184 | 0.005 |
| 14 | 14EFD | 9.000 | 9.184 | 0.005 |
| 9 | 9EFD | 9.000 | 9.184 | 0.005 |

| | | | | |
|----|---------|-------|-------|-------|
| 95 | 95ADARD | 4.000 | 4.082 | 0.002 |
| 96 | 96EARD | 4.000 | 4.082 | 0.002 |
| 97 | 97EARD | 4.000 | 4.082 | 0.002 |
| 98 | 98EARD | 4.000 | 4.082 | 0.002 |

| | | 1 | 2 | 3 |
|-------|----------|-----------|-----------|--------|
| | | Degree | NrmDegree | Share |
| ----- | | | | |
| 1 | Mean | 18.980 | 19.367 | 0.010 |
| 2 | Std Dev | 6.636 | 6.772 | 0.004 |
| 3 | Sum | 1860.000 | 1897.959 | 1.000 |
| 4 | Variance | 44.040 | 45.856 | 0.000 |
| 5 | SSQ | 39618.000 | 41251.563 | 0.011 |
| 6 | MCSSQ | 4315.959 | 4493.918 | 0.001 |
| 7 | Euc Norm | 199.043 | 203.105 | 0.107 |
| 8 | Minimum | 4.000 | 4.082 | 0.002 |
| 9 | Maximum | 32.000 | 32.653 | 0.017 |
| 10 | N of Obs | 98.000 | 98.000 | 98.000 |

Network Centralization = 13.70%

Blau Heterogeneity = 1.15%. Normalized (IQV) = 0.13%

The second statistical description includes the out-degree, in degree, NrmOutDeg, and NrmInDegree for each member in the schedule from the strongest to weakest member. The Out Degree of the first three strongest are 34DMED and 35SDMED were 32.000, and 36ADMED was 31.000. The In Degree of first three strongest are 34DMED, 35SDMED, and 36ADMED were 32.000. The 34 as a director of managerial employee department, 35 as a secretary, and 36 as an assistant of a director are the strongest. They have the highest out-degree in their cluster and the whole network. *They are the highest in the number of ties compared with other members because they play a role in the center of the department and they have the distribution of tasks among them and the main cluster that is in red color.* The Out Degree of the weakest were 95ADARD, 96EARD, 97EARD, and 98EARD were 4.0. The In Degree of the weakest are 95ADARD, 96EARD, 97EARD, and 98EARD were 4.0. The weakest members that are mentioned above 95, 96, 97, and 98 in the research and development department are the weakest in the degree of output and input *because their tasks are specific with the main cluster that is in red color and MIS maintenance and information system and they are few. That is a reason to make them the weakest because their connection is specific and narrowed.* Therefore, the degree centrality of Out Degree and In Degree were 13.973% in the whole network. This ratio can be described as an excellent rate because it is low and it supports the coordination that is shared among individuals around each cluster and the network. This ratio is different than that ratio of the whole network that is discussed with the heterogeneity and normalized because it shows the percentage of out-degree and in degree. *It has been mentioned only the*

degree of the first and second columns because they are most important for the measurement of the out and in degree. In the following schedule,

data treated as asymmetric:

| | | 1 | 2 | 3 | 4 |
|-------|---------|-----------|----------|-----------|----------|
| | | OutDegree | InDegree | NrmOutDeg | NrmInDeg |
| ----- | | | | | |
| 34 | 34DMED | 32.000 | 32.000 | 32.653 | 32.653 |
| 35 | 35SDMED | 32.000 | 32.000 | 32.653 | 32.653 |
| 36 | 36ADMED | 31.000 | 32.000 | 31.633 | 32.653 |
| 53 | 53EMD | 26.000 | 25.000 | 26.531 | 25.510 |
| 51 | 51EMD | 26.000 | 25.000 | 26.531 | 25.510 |
| 61 | 61EMD | 26.000 | 26.000 | 26.531 | 26.531 |
| 46 | 56EMD | 26.000 | 23.000 | 26.531 | 23.469 |
| 54 | 54EMD | 26.000 | 26.000 | 26.531 | 26.531 |
| 52 | 52EMD | 25.000 | 26.000 | 25.510 | 26.531 |
| 50 | 50EMD | 25.000 | 24.000 | 25.510 | 24.490 |
| 57 | 57EMD | 25.000 | 25.000 | 25.510 | 25.510 |
| 58 | 58EMD | 25.000 | 25.000 | 25.510 | 25.510 |
| 56 | 56EMD | 25.000 | 26.000 | 25.510 | 26.531 |
| 38 | 38EMD | 25.000 | 26.000 | 25.510 | 26.531 |
| 39 | 39EMD | 25.000 | 25.000 | 25.510 | 25.510 |
| 49 | 49EMD | 25.000 | 24.000 | 25.510 | 24.490 |
| 41 | 41EMD | 25.000 | 24.000 | 25.510 | 24.490 |
| 55 | 55EMD | 25.000 | 27.000 | 25.510 | 27.551 |
| 43 | 43EMD | 25.000 | 26.000 | 25.510 | 26.531 |
| 44 | 44EMD | 25.000 | 25.000 | 25.510 | 25.510 |
| 45 | 45EMD | 25.000 | 25.000 | 25.510 | 25.510 |
| 40 | 40EMD | 25.000 | 25.000 | 25.510 | 25.510 |
| 47 | 47EMD | 25.000 | 25.000 | 25.510 | 25.510 |
| 42 | 42EMD | 25.000 | 26.000 | 25.510 | 26.531 |
| 59 | 59EMD | 25.000 | 26.000 | 25.510 | 26.531 |
| 60 | 60EMD | 25.000 | 25.000 | 25.510 | 25.510 |
| 48 | 48EMD | 25.000 | 25.000 | 25.510 | 25.510 |
| 37 | 37EMD | 24.000 | 23.000 | 24.490 | 23.469 |

| | | | | | |
|----|---------|--------|--------|--------|--------|
| 63 | 63ADMIS | 23.000 | 23.000 | 23.469 | 23.469 |
| 64 | 64SDIMS | 23.000 | 23.000 | 23.469 | 23.469 |
| 62 | 62DMIS | 23.000 | 23.000 | 23.469 | 23.469 |
| 17 | 17SDHR | 22.000 | 22.000 | 22.449 | 22.449 |
| 18 | 18ADHR | 22.000 | 21.000 | 22.449 | 21.429 |
| 16 | 16DHR | 22.000 | 22.000 | 22.449 | 22.449 |
| 1 | 1M | 20.000 | 20.000 | 20.408 | 20.408 |
| 2 | 2S | 20.000 | 20.000 | 20.408 | 20.408 |
| 3 | 3S | 20.000 | 20.000 | 20.408 | 20.408 |
| 4 | 4S | 20.000 | 20.000 | 20.408 | 20.408 |
| 5 | 5AM | 20.000 | 20.000 | 20.408 | 20.408 |
| 80 | 80DARD | 18.000 | 21.000 | 18.367 | 21.429 |
| 81 | 81ADARD | 18.000 | 21.000 | 18.367 | 21.429 |
| 82 | 82SDARD | 18.000 | 21.000 | 18.367 | 21.429 |
| 68 | 68EMIS | 17.000 | 17.000 | 17.347 | 17.347 |
| 20 | 20EHR | 17.000 | 15.000 | 17.347 | 15.306 |
| 70 | 70EMIS | 17.000 | 17.000 | 17.347 | 17.347 |
| 22 | 22EHR | 17.000 | 16.000 | 17.347 | 16.327 |
| 23 | 23EHR | 17.000 | 15.000 | 17.347 | 15.306 |
| 24 | 24EHR | 17.000 | 14.000 | 17.347 | 14.286 |
| 25 | 25EHR | 17.000 | 17.000 | 17.347 | 17.347 |
| 75 | 75EMIS | 17.000 | 17.000 | 17.347 | 17.347 |
| 76 | 76EMIS | 17.000 | 17.000 | 17.347 | 17.347 |
| 77 | 77EMIS | 17.000 | 17.000 | 17.347 | 17.347 |
| 29 | 29EHR | 17.000 | 15.000 | 17.347 | 15.306 |
| 79 | 79EMIS | 17.000 | 17.000 | 17.347 | 17.347 |
| 6 | 6DFD | 17.000 | 14.000 | 17.347 | 14.286 |
| 7 | 7ADFD | 17.000 | 14.000 | 17.347 | 14.286 |
| 8 | 8SDFD | 17.000 | 14.000 | 17.347 | 14.286 |
| 33 | 33EHR | 17.000 | 17.000 | 17.347 | 17.347 |
| 71 | 71EMIS | 17.000 | 17.000 | 17.347 | 17.347 |
| 72 | 72EMIS | 17.000 | 17.000 | 17.347 | 17.347 |
| 73 | 73EMIS | 17.000 | 17.000 | 17.347 | 17.347 |
| 74 | 74EMIS | 17.000 | 17.000 | 17.347 | 17.347 |
| 69 | 69EMIS | 17.000 | 17.000 | 17.347 | 17.347 |
| 67 | 67EMIS | 17.000 | 17.000 | 17.347 | 17.347 |
| 65 | 65EMIS | 17.000 | 17.000 | 17.347 | 17.347 |
| 66 | 66EMIS | 17.000 | 17.000 | 17.347 | 17.347 |

| | | | | | |
|----|---------|--------|--------|--------|--------|
| 32 | 32EHR | 17.000 | 17.000 | 17.347 | 17.347 |
| 78 | 78EMIS | 17.000 | 17.000 | 17.347 | 17.347 |
| 27 | 27EHR | 15.000 | 15.000 | 15.306 | 15.306 |
| 19 | 19EHR | 15.000 | 17.000 | 15.306 | 17.347 |
| 21 | 21EHR | 15.000 | 17.000 | 15.306 | 17.347 |
| 28 | 28EHR | 15.000 | 17.000 | 15.306 | 17.347 |
| 30 | 30EHR | 15.000 | 17.000 | 15.306 | 17.347 |
| 31 | 31EHR | 15.000 | 17.000 | 15.306 | 17.347 |
| 26 | 26EHR | 15.000 | 16.000 | 15.306 | 16.327 |
| 88 | 88EARD | 13.000 | 13.000 | 13.265 | 13.265 |
| 83 | 83EARD | 13.000 | 13.000 | 13.265 | 13.265 |
| 84 | 84EARD | 13.000 | 13.000 | 13.265 | 13.265 |
| 85 | 85EARD | 13.000 | 13.000 | 13.265 | 13.265 |
| 86 | 86EARD | 13.000 | 13.000 | 13.265 | 13.265 |
| 87 | 87EARD | 13.000 | 13.000 | 13.265 | 13.265 |
| 91 | 91EARD | 13.000 | 13.000 | 13.265 | 13.265 |
| 89 | 89EARD | 13.000 | 13.000 | 13.265 | 13.265 |
| 90 | 90EARD | 13.000 | 13.000 | 13.265 | 13.265 |
| 92 | 92EARD | 13.000 | 13.000 | 13.265 | 13.265 |
| 93 | 93EARD | 13.000 | 13.000 | 13.265 | 13.265 |
| 94 | 94DARD | 12.000 | 12.000 | 12.245 | 12.245 |
| 15 | 15EFD | 9.000 | 9.000 | 9.184 | 9.184 |
| 10 | 10EFD | 9.000 | 9.000 | 9.184 | 9.184 |
| 11 | 11EFD | 9.000 | 9.000 | 9.184 | 9.184 |
| 12 | 12EFD | 9.000 | 9.000 | 9.184 | 9.184 |
| 13 | 13EFD | 9.000 | 9.000 | 9.184 | 9.184 |
| 14 | 14EFD | 9.000 | 9.000 | 9.184 | 9.184 |
| 9 | 9EFD | 9.000 | 9.000 | 9.184 | 9.184 |
| 95 | 95ADARD | 4.000 | 4.000 | 4.082 | 4.082 |
| 96 | 96EARD | 4.000 | 4.000 | 4.082 | 4.082 |
| 97 | 97EARD | 4.000 | 4.000 | 4.082 | 4.082 |
| 98 | 98EARD | 4.000 | 4.000 | 4.082 | 4.082 |

| | 1 | 2 | 3 | 4 |
|-------------|-----------|-----------|-----------|-----------|
| | OutDegree | InDegree | NrmOutDeg | NrmInDeg |
| 1 Mean | 18.306 | 18.306 | 18.680 | 18.680 |
| 2 Std Dev | 6.172 | 6.247 | 6.298 | 6.375 |
| 3 Sum | 1794.000 | 1794.000 | 1830.612 | 1830.612 |
| 4 Variance | 38.090 | 39.029 | 39.661 | 40.638 |
| 5 SSQ | 36574.000 | 36666.000 | 38082.051 | 38177.844 |
| 6 MCSSQ | 3732.816 | 3824.816 | 3886.731 | 3982.524 |
| 7 Euc Norm | 191.243 | 191.484 | 195.146 | 195.392 |
| 8 Minimum | 4.000 | 4.000 | 4.082 | 4.082 |
| 9 Maximum | 32.000 | 32.000 | 32.653 | 32.653 |
| 10 N of Obs | 98.000 | 98.000 | 98.000 | 98.000 |

Network Centralization (Outdegree) = 13.973%

Network Centralization (Indegree) = 13.973%

NOTE: the two different types of the statistical description means, 1) first calculation is based on the assumptions that each tie between nodes is symmetric. Symmetric relations mean that a relationship exists from A to B and B to A. 2) second calculation is based on asymmetric relationships meaning uniform or one-way ties between nodes.

3.2.1 Network pattern:

The network pattern clarifies the network and links in the simplest terms the role of individuals and the relationships among them through the ties that bind them in a network. As shown in the network, there are subgroups. Each group represents its role in the network. The groups are different in their size and role. According to task coordination, the network consisted of actors that interact with others. The current ties in the network are 1794 and the possible ties in the whole network are 9506. Therefore, the degree density of the whole network is 0.1887. This ratio means that the density in the whole network is low. Here, the question can be generated *why it is low?* The reason is that *the clusters work according to their task they collaborate with each other after the innovation of the clusters. In this case, the whole network can be innovated after the innovation of the clusters. That is a reason to make the density low because the clusters work with their members inside each cluster. Therefore, the density will be centered in the main cluster that is in red color and a few connections with other clusters according to the tasks and related work.* This ratio of the density is low, but the ratio of each cluster is high. This case supports the network. The clusters support the network after they innovate themselves. They link each other with the main cluster that is in red color because the main cluster is the center of the network and some clusters connect with other clusters according to the required task and relationships among members.

The measurement of density for each group (cluster) clarifies the size of each group in the interaction. The first cluster is HRD human resources department and the density is 0.9738, and this cluster is one of the strong groups of individuals inside the

network because it has a good number of members, it works perfectly inside the cluster and links with the main cluster. That is a reason to make HRD interactive. The second cluster is MED and the density is 0.9553. MED cluster is the managerial employees's department. The MED is one of the strong clusters because they have a good number of members and they have a large cluster in the network, and it connects with the main cluster that is in red color. The third cluster is MIS and the density is 1.0. MIS cluster is the maintenance and information system that has the best density because it links with the main cluster and RD cluster according to the tasks. MIS is responsible for information systems and that is the reason to make them the best cluster in the network. The fourth cluster is ARD and the density is 1.0. ARD is the auditing and review department that has a high density because the members are connected equally with themselves and have links with the main cluster and FD cluster. The fifth cluster is FD financial department and the density is 1.0 because they have links with two clusters as well as ARD and the main cluster that is in red color. That is a reason to make them one of the best. The sixth cluster is ARD research and development and the density is 1.0 because it has links with one of the best clusters MIS and the main cluster that is in red color. The seventh cluster is M, AM and, S and the density is 1.0. They are the red cluster stating from M management, AM assistant of management, and S secretary. They are connected with all the clusters. They are the main cluster that collects all the relationships in one cluster.

Members innovate the network among themselves (cluster) before innovating the network as a whole. The clusters innovate the network and they gather their efforts to build a whole network with other clusters.

Task coordination as a dimension of shared leadership *creates clusters among members according to the role of each cluster because clusters are the core for building any network, and then it innovated the network in the whole with other clusters.*

Figure five is shown on the previous page. It consists of 7 clusters. The clusters are 1) M, AM, S and they are the main cluster in red color. 2) FD financial department. 3) HRD cluster is the human resources and personal affairs department. 4) MED cluster is the managerial employees department. 5) MIS cluster is the maintenance and information systems. 6) ARD cluster is an auditing and review department. 7) ARD is the accurate research and development department. Each cluster has a specific task and goal. Clusters are shown in the network and each cluster contains their names in the network. clusters participated to build a team that collects themselves in it. Then, they correlate with others. For instance, MED cluster is the biggest team. They innovate their boundary and coordinated with themselves. Therefore, they participate with others or any unit in the network. Figure 5 shows the links among members and then each cluster toward the main cluster that is in red color. As is shown in the network, the big square means that the member has a high centrality and the small square means that the member has a low centrality. Each cluster as a group of individuals is innovated by the relationships of the members according to their tasks. Therefore, the clusters do not remain in one place. They must connect themselves with main clusters and other clusters. The red color is the main cluster that collects all clusters in one cluster. This process can be described as network innovation as well because the main cluster participates to link all clusters in the center point.

3.2.2 Weak and strong ties:

The ties are the path of the relationships between members. Each member links with others according to the position. For instance, the tie of B to A is strong. The tie of A is weak to B. The strength of B is higher than A. the relationships are not equal. They are different from A to B and B to A. *Each member has scores. The scores select the degree of each one by collecting each score in every tie. Then, the total result appears and shows the strength of each individual if it is the weak or strong degree (out-degree).*

The strongest member in a network is 35SDMED as a secretary in MED managerial employees department cluster has 110.500 points in OutDegree and share is 0.017. 35SDEMD is a member of the MED cluster and has the highest scores. The 35 as a member collected 110.500 scores because most of the ties are stronger than other members.

The majority of 35SDEMD ties are 3 and above. This score is the strength of each tie. 35 as a secretary member in MED participates with all members because 35SDEMD is close to the 1M that is the manager *in the main cluster*. That is the main reason to make 35SDMED has the highest score and the strongest ties. The Weakest member is 95ADARD in RD cluster has 12.0 points or scores in the OutDegree and share is 0.003, but 95ADARD is not the weakest in share points because 97EARD has 0.002 in share points and higher point in OutDegree 14.0. Therefore, there is competition among them. 95ADARD has the strongest ties because *whenever the scores of ties are strong or high, the member becomes stronger than other members regarding*

the strength of ties. 95ADARD is higher than other members in the same cluster. Besides, 95ADARD is the weakest in the whole network because the task of the ARD research and development department is specified with the main cluster and MIS.

The ratio of the strong ties compared to the weak ties is higher and it is 71%. The ratio of the strong ties among individuals in a network is higher than weak ties although there are weak members in a network. In this case, the majority is for strong ties compared with weak ties in the network and among members. This ratio shows that the network is more positive and interactive. The scores that select the strength of each member are important to measure the ratio of strong and weak ties among individuals.

In the following network, members innovated small networks (clusters) among each other according to the position before innovating the whole network although there are differences in the score of each tie in a cluster and network. Clusters innovated the whole network after they were innovating the subgroups (cluster) by themselves. Network innovation can be done when all clusters participate to link themselves in one point or several points in one main cluster.

Figure 6 is shown on the previous page. The clusters are clear how they connected themselves in order to create a team. In the network, it clarifies the strength of each tie. The tie is the relationships that link two nodes (actors). The number that represents the tie means the strength of the tie. For instance, if the tie has 2.5 or less, it means the tie is medium or weak. Figure 6 clarifies the clusters that participate in the connection of the whole network. Each member has ties with other members (out-degree). The ties are counted weekly. They mean the strength of the link from A to B as an example. For instance, 35SDMED as a secretary in the MED cluster has a 4 scores to 4S, but 4S as a secretary in the main cluster has 3 scores to 35SDMED. The strength can be in a variance situation. Therefore, they are connected with each other in order to innovate the network. Finally, the clusters participate to link with other clusters and the main cluster.

3.2.3 Summary of the results of the hypotheses:

Hypothesis 1A: Individuals in the task coordination have medium or low percentages of degree centrality in a social network and in their units or departments.

Findings were found for the task coordination in the network about degree centrality is 13.70%. The ratio of the centrality supports the study and the network with the low heterogeneity and normalized. The degree centrality of Out-Degree and In-Degree is 13.973%. This ratio is different than degree centrality in the whole network because it shows the differences among in and out-degree of relationships. The ratio of centrality in hypothesis 1A regarding task coordination is positive because in the

hypothesis it was expected it is medium, but the result was found it is less than medium.

The mentioned degree above supports the hypothesis 1A regarding task coordination

Hypothesis 1B: The social network of the task coordination has a high percentage of degree density in the network as a whole and in units or departments.

Findings were found for the task coordination in the network regard to degree density is low 0.1887 in the whole network. This percentage is lower than the expected rate. As it was discussed before, the density is low, but the Density in subgroups (cluster) HRD is 0.9738, MD is 0.9553, MIS is 1.0, ARD is 1.0, FD is 1.0, ARD is 1.0, and (M, AM, and S) is 1.0. The ratio of each cluster in the network is high and supports hypothesis 1B because task coordination of shared leadership theory determines divided roles among members according to the position. As the density in the whole network was discussed with the density of the clusters, briefly the density in the whole network is lower than the expected ratio. But, each cluster is high and supports the network.

Hypothesis 1C: strong ties have a higher percentage in the task coordination network than weak ties between individuals.

Findings were found for the task coordination in the network regard to weak and strong ties for the highest and strongest ties. 35SDMED has 110.500. The degree of 35SDMED is the total scores that were collected from each tie with others (out-degree). The lowest degree and weakest is 95ADARD has 12.0 and it is the highest in the cluster, but it is the weakest in the whole network. The degree of 95ADARD is the

total scores that were collected from each tie with others (out-degree). The ratio of strong ties is 71%. This ratio expresses the high percentage of strong ties in the whole network compared with weak ties. Strong ties are mostly higher than weak ties. This ratio is high and supports hypothesis 1C.

Hypothesis 1A, 1B, and 1C are supported from the findings that were found through the statistical description, network pattern, and weak and strong ties, but 1B is supported from clusters because they create links with others and it is not supported by the whole network regarding density. Density cannot be described as a negative because the network is supported by the clusters and this case participates to innovate network and build relationships with others according to the tasks. If the network weak and cannot be collected in one cluster (the main cluster), in that case, it can be described as a null or invalid network.

3.3 Personal support:

Personal support is one of the dimensions of shared leadership. At the same time, it is one of the characteristics of network innovation. This variable was examined by network analysis statistically and network. Through the statistical description, it was found that the personal support was positive. Degree centrality in personal support is 17.14%. This degree is lower than the medium according to the hypothesis, but this degree means that it is a positive degree especially in shared leadership theory. Whenever the degree centrality is high, it means that it is negative because shared leadership theory requires medium or less degree. Degree centrality in persona; support is 17.14%. This rate means that personal support as a dimension of shared leadership and characteristics of network innovation is pervasive in the network and clusters. This percentage generates an important question about it *why this ratio? Degree centrality in personal support is low and it is required in this dimension because it shows the effect of support is surrounded the members. For example, if the degree centrality is higher than an expected degree, the network becomes negative or null and it does not support the study because this case does not innovate the network and the network becomes weak.* Even, the heterogeneity is 1.17%. This ratio means that it is positive because low heterogeneity supports the degree of centrality. The normalized is 0.15%. It means that the rate of normalized is low. This case expresses that the *member's movement constantly is not stable.* If it is stable, means that it is *not active.* Therefore, personal support is weak. In the finding of personal support, the members are continuous in movement and connected constantly, low heterogeneity supports the degree centrality,

and low normalized ratio supports the degree centrality as well. All of the heterogeneity and normalized percentages low and align with degree centrality because *high centrality will not be aligned with heterogeneity and normalized in the network.*

The strongest first three nodes were 34DMED, 36ADMED was 32.0 and their share was 0.021, and the NrmDegree was 32.653. Finally, 35SDMED was 29.0 and the share was 0.019 and the NrmDegree was 29.592. The 34 as the director of MED managerial employees department, and 36 as the assistant of director in MED, They are the strongest because they are in the center of the relationships. 34 as a director plays the main role in the clusters and the majority of the connections are collected in 34DMED. The 36 is the assistant of the director and it is close to the director. 36ADMED plays a role to assist the director of the department in the cluster and has the second strongest role in the cluster. 35 as a secretary of the director close to the director and the assistant of the director. The 34DMED, 36ADMED, and SDMED are the most central in their cluster and they are connected with the main cluster that is in red color (M, AM, and S). They are like a *bridge* between the cluster and the main cluster that is in red color. They are the strongest brokerage among their cluster and main cluster (M, AM, and S). The vice versa 95ADARD, 96EARD, 97EARD, 98EARD were 4.0. The share was 0.003 and their NrmDegree was 4.082. 95ADRD was the weakest brokerage among its cluster and main cluster (M, AM, S). The 95 as an assistant of the director in ARD accurate research and development department with 96, 97, and 98 are the weakest. The two main reasons are 1) the ARD is specific in the network and it has a limited connection except for the main cluster that is in red color and MIS. 2) The ARD has a few individuals and their

tasks are sensitive and important. The director of the RD is 94DARD has 12.000 degrees and 0.008 shares. The director of the ARD cluster has the highest degree even 94 is not the weakest, but it is only for more detail in order to understand who is weak and strong in the network. The 94 as a director has a direct link with the main cluster. That is a reason to make 94 strong and out of the weakness list. *The most important rate is the degree and share because they select the main role of each member in the network.*

The following statistical description shows a precise ratio to understand each member in personal support and the strength of relationships among individuals, as well as, clarifies the rate of centrality in the end of the description. In the first statistics, schedule data treated as symmetric shows the role of each member from the strongest to the weakest in the organization.

Data treated as symmetric:

| | | 1 | 2 | 3 |
|-------|---------|--------|-----------|-------|
| | | Degree | NrmDegree | Share |
| ----- | | | | |
| 34 | 34DMED | 32.000 | 32.653 | 0.021 |
| 36 | 36ADMED | 32.000 | 32.653 | 0.021 |
| 35 | 35SDMED | 29.000 | 29.592 | 0.019 |
| 53 | 53EMD | 27.000 | 27.551 | 0.018 |
| 38 | 38EMD | 25.000 | 25.510 | 0.016 |
| 44 | 44EMD | 25.000 | 25.510 | 0.016 |
| 61 | 61EMD | 24.000 | 24.490 | 0.016 |
| 62 | 62DMIS | 23.000 | 23.469 | 0.015 |
| 58 | 58EMD | 23.000 | 23.469 | 0.015 |
| 16 | 16DHR | 22.000 | 22.449 | 0.014 |
| 64 | 64SDIMS | 22.000 | 22.449 | 0.014 |
| 40 | 40EMD | 22.000 | 22.449 | 0.014 |
| 81 | 81ADARD | 21.000 | 21.429 | 0.014 |

| | | | | |
|----|---------|--------|--------|-------|
| 52 | 52EMD | 21.000 | 21.429 | 0.014 |
| 56 | 56EMD | 21.000 | 21.429 | 0.014 |
| 55 | 55EMD | 21.000 | 21.429 | 0.014 |
| 37 | 37EMD | 21.000 | 21.429 | 0.014 |
| 45 | 45EMD | 21.000 | 21.429 | 0.014 |
| 80 | 80DARD | 21.000 | 21.429 | 0.014 |
| 18 | 18ADHR | 21.000 | 21.429 | 0.014 |
| 82 | 82SDARD | 21.000 | 21.429 | 0.014 |
| 5 | 5AM | 20.000 | 20.408 | 0.013 |
| 4 | 4S | 20.000 | 20.408 | 0.013 |
| 2 | 2S | 20.000 | 20.408 | 0.013 |
| 47 | 47EMD | 20.000 | 20.408 | 0.013 |
| 1 | 1M | 20.000 | 20.408 | 0.013 |
| 63 | 63ADMIS | 20.000 | 20.408 | 0.013 |
| 3 | 3S | 20.000 | 20.408 | 0.013 |
| 60 | 60EMD | 20.000 | 20.408 | 0.013 |
| 42 | 42EMD | 20.000 | 20.408 | 0.013 |
| 49 | 49EMD | 20.000 | 20.408 | 0.013 |
| 17 | 17SDHR | 19.000 | 19.388 | 0.012 |
| 39 | 39EMD | 19.000 | 19.388 | 0.012 |
| 59 | 59EMD | 19.000 | 19.388 | 0.012 |
| 41 | 41EMD | 19.000 | 19.388 | 0.012 |
| 48 | 48EMD | 18.000 | 18.367 | 0.012 |
| 43 | 43EMD | 18.000 | 18.367 | 0.012 |
| 51 | 51EMD | 18.000 | 18.367 | 0.012 |
| 8 | 8SDFD | 17.000 | 17.347 | 0.011 |
| 33 | 33EHR | 17.000 | 17.347 | 0.011 |
| 50 | 50EMD | 17.000 | 17.347 | 0.011 |
| 54 | 54EMD | 17.000 | 17.347 | 0.011 |
| 6 | 6DFD | 17.000 | 17.347 | 0.011 |
| 7 | 7ADFD | 17.000 | 17.347 | 0.011 |
| 25 | 25EHR | 17.000 | 17.347 | 0.011 |
| 74 | 74EMIS | 17.000 | 17.347 | 0.011 |
| 57 | 57EMD | 16.000 | 16.327 | 0.010 |
| 76 | 76EMIS | 16.000 | 16.327 | 0.010 |
| 46 | 46EMD | 16.000 | 16.327 | 0.010 |
| 78 | 78EMIS | 16.000 | 16.327 | 0.010 |
| 79 | 79EMIS | 15.000 | 15.306 | 0.010 |

| | | | | |
|----|--------|--------|--------|-------|
| 71 | 71EMIS | 15.000 | 15.306 | 0.010 |
| 31 | 31EHR | 15.000 | 15.306 | 0.010 |
| 32 | 32EHR | 15.000 | 15.306 | 0.010 |
| 19 | 19EHR | 14.000 | 14.286 | 0.009 |
| 23 | 23EHR | 14.000 | 14.286 | 0.009 |
| 21 | 21EHR | 14.000 | 14.286 | 0.009 |
| 28 | 28EHR | 14.000 | 14.286 | 0.009 |
| 67 | 67EMIS | 14.000 | 14.286 | 0.009 |
| 69 | 69EMIS | 13.000 | 13.265 | 0.008 |
| 24 | 24EHR | 13.000 | 13.265 | 0.008 |
| 68 | 68EMIS | 13.000 | 13.265 | 0.008 |
| 27 | 27EHR | 13.000 | 13.265 | 0.008 |
| 70 | 70EMIS | 13.000 | 13.265 | 0.008 |
| 72 | 72EMIS | 12.000 | 12.245 | 0.008 |
| 22 | 22EHR | 12.000 | 12.245 | 0.008 |
| 66 | 66EMIS | 12.000 | 12.245 | 0.008 |
| 65 | 65EMIS | 12.000 | 12.245 | 0.008 |
| 93 | 93EARD | 12.000 | 12.245 | 0.008 |
| 30 | 30EHR | 12.000 | 12.245 | 0.008 |
| 77 | 77EMIS | 12.000 | 12.245 | 0.008 |
| 88 | 88EARD | 12.000 | 12.245 | 0.008 |
| 94 | 94EARD | 12.000 | 12.245 | 0.008 |
| 29 | 29EHR | 11.000 | 11.224 | 0.007 |
| 26 | 26EHR | 11.000 | 11.224 | 0.007 |
| 75 | 75EMIS | 11.000 | 11.224 | 0.007 |
| 83 | 83EARD | 11.000 | 11.224 | 0.007 |
| 20 | 20EHR | 11.000 | 11.224 | 0.007 |
| 91 | 91EARD | 11.000 | 11.224 | 0.007 |
| 89 | 89EARD | 11.000 | 11.224 | 0.007 |
| 73 | 73EMIS | 10.000 | 10.204 | 0.006 |
| 86 | 86EARD | 10.000 | 10.204 | 0.006 |
| 84 | 84EARD | 9.000 | 9.184 | 0.006 |
| 87 | 87EARD | 9.000 | 9.184 | 0.006 |
| 85 | 85EARD | 9.000 | 9.184 | 0.006 |
| 92 | 92EARD | 9.000 | 9.184 | 0.006 |
| 15 | 15EFD | 9.000 | 9.184 | 0.006 |
| 10 | 10EFD | 9.000 | 9.184 | 0.006 |
| 90 | 90EARD | 8.000 | 8.163 | 0.005 |

| | | | | |
|----|---------|-------|-------|-------|
| 14 | 14EFD | 8.000 | 8.163 | 0.005 |
| 12 | 12EFD | 8.000 | 8.163 | 0.005 |
| 13 | 13EFD | 7.000 | 7.143 | 0.005 |
| 11 | 11EFD | 7.000 | 7.143 | 0.005 |
| 9 | 9EFD | 7.000 | 7.143 | 0.005 |
| 95 | 95ADARD | 4.000 | 4.082 | 0.003 |
| 96 | 96EARD | 4.000 | 4.082 | 0.003 |
| 97 | 97EARD | 4.000 | 4.082 | 0.003 |
| 98 | 98EARD | 4.000 | 4.082 | 0.003 |

| | 1 | 2 | 3 | |
|-------|----------|-----------|-----------|--------|
| | Degree | NrmDegree | Share | |
| ----- | | | | |
| 1 | Mean | 15.714 | 16.035 | 0.010 |
| 2 | Std Dev | 5.918 | 6.039 | 0.004 |
| 3 | Sum | 1540.000 | 1571.429 | 1.000 |
| 4 | Variance | 35.020 | 36.464 | 0.000 |
| 5 | SSQ | 27632.000 | 28771.346 | 0.012 |
| 6 | MCSSQ | 3432.000 | 3573.511 | 0.001 |
| 7 | Euc Norm | 166.229 | 169.621 | 0.108 |
| 8 | Minimum | 4.000 | 4.082 | 0.003 |
| 9 | Maximum | 32.000 | 32.653 | 0.021 |
| 10 | N of Obs | 98.000 | 98.000 | 98.000 |

Network Centralization = 17.14%

Blau Heterogeneity = 1.17%. Normalized (IQV) = 0.15%

The second statistical description includes the out-degree, in degree NrmOutDegree, and NrmInDegree for each member in the schedule from the strongest to the weakest. The Out Degree of the first three strongest was 53EMED was 26.0 and (38EMED and 44EMED) are 25.0. The In Degree of 53EMED is 15.0, 38EMED is 16.0, and 44EMED is 14.0. The first three strongest are from MED managerial employees department. 53, 38, and 44 are the members of the MED cluster. They are inside the cluster as the most interactive nodes inside their cluster because they are close to other members within the boundary of the cluster. That is a reason to make them the strongest members in their MED cluster. The out-degree of weakest are 95ADARD, 96EARD, 97EARD, and 98EARD are 4.0. The In degree is 4.0. The 94 as an assistant of the director, 96, and 97 as the members in the clusters are the weakest. As it was discussed before, the reason is that the ARD accurate research and development department is limited and specified only with the main cluster and MIS maintenance and information system. That is a reason to make them weak in the network. Therefore, degree centrality of Out Degree is 14.494% and degree centrality of In Degree is 20.616%. degree centrality in this case, is separated into two percentages. The first one expresses the centrality of out-degree and it is low. The second one expresses the in-degree and it is low as well. The percentages are lower than the medium and it supports the study and the network. As it was discussed, low centrality means a positive ratio. *It has been mentioned only the first and second column because they are most important for the measurement of the out and in degree.* In the following schedule, data treated as asymmetric:

| | | 1 | 2 | 3 | 4 |
|-------|---------|-----------|----------|-----------|----------|
| | | OutDegree | InDegree | NrmOutDeg | NrmInDeg |
| ----- | | | | | |
| 53 | 53EMED | 26.000 | 15.000 | 26.531 | 15.306 |
| 38 | 38EMED | 25.000 | 16.000 | 25.510 | 16.327 |
| 44 | 44EMED | 25.000 | 14.000 | 25.510 | 14.286 |
| 35 | 35SDMED | 22.000 | 20.000 | 22.449 | 20.408 |
| 3 | 3S | 20.000 | 20.000 | 20.408 | 20.408 |
| 1 | 1M | 20.000 | 20.000 | 20.408 | 20.408 |
| 36 | 36ADMED | 20.000 | 32.000 | 20.408 | 32.653 |
| 5 | 5AM | 20.000 | 20.000 | 20.408 | 20.408 |
| 2 | 2S | 20.000 | 20.000 | 20.408 | 20.408 |
| 4 | 4S | 20.000 | 20.000 | 20.408 | 20.408 |
| 34 | 34DMED | 18.000 | 32.000 | 18.367 | 32.653 |
| 61 | 61EMED | 18.000 | 18.000 | 18.367 | 18.367 |
| 63 | 63ADMIS | 18.000 | 16.000 | 18.367 | 16.327 |
| 25 | 25EHR | 17.000 | 8.000 | 17.347 | 8.163 |
| 74 | 74EMIS | 17.000 | 10.000 | 17.347 | 10.204 |
| 64 | 64SDIMS | 16.000 | 22.000 | 16.327 | 22.449 |
| 40 | 40EMED | 16.000 | 16.000 | 16.327 | 16.327 |
| 18 | 18ADHR | 16.000 | 20.000 | 16.327 | 20.408 |
| 56 | 56EMED | 15.000 | 17.000 | 15.306 | 17.347 |
| 76 | 76EMIS | 15.000 | 10.000 | 15.306 | 10.204 |
| 62 | 62DMIS | 15.000 | 23.000 | 15.306 | 23.469 |
| 17 | 17SDHR | 15.000 | 15.000 | 15.306 | 15.306 |
| 8 | 8SDFD | 15.000 | 11.000 | 15.306 | 11.224 |
| 58 | 58EMED | 14.000 | 13.000 | 14.286 | 13.265 |
| 16 | 16DHR | 14.000 | 22.000 | 14.286 | 22.449 |
| 6 | 6DFD | 14.000 | 14.000 | 14.286 | 14.286 |
| 43 | 43EMED | 14.000 | 10.000 | 14.286 | 10.204 |
| 54 | 54EMED | 14.000 | 11.000 | 14.286 | 11.224 |
| 49 | 49EMED | 14.000 | 15.000 | 14.286 | 15.306 |
| 47 | 47EMED | 14.000 | 14.000 | 14.286 | 14.286 |
| 7 | 7ADFD | 14.000 | 14.000 | 14.286 | 14.286 |
| 51 | 51EMED | 13.000 | 14.000 | 13.265 | 14.286 |
| 59 | 59EMED | 13.000 | 15.000 | 13.265 | 15.306 |
| 48 | 48EMED | 13.000 | 12.000 | 13.265 | 12.245 |
| 52 | 52EMED | 13.000 | 14.000 | 13.265 | 14.286 |

| | | | | | |
|----|---------|--------|--------|--------|--------|
| 80 | 80DARD | 13.000 | 21.000 | 13.265 | 21.429 |
| 60 | 60EMD | 13.000 | 12.000 | 13.265 | 12.245 |
| 41 | 41EMED | 13.000 | 15.000 | 13.265 | 15.306 |
| 45 | 45EMED | 12.000 | 16.000 | 12.245 | 16.327 |
| 33 | 33EHR | 12.000 | 15.000 | 12.245 | 15.306 |
| 94 | 94DARD | 12.000 | 12.000 | 12.245 | 12.245 |
| 42 | 42EMED | 12.000 | 16.000 | 12.245 | 16.327 |
| 55 | 55EMED | 12.000 | 13.000 | 12.245 | 13.265 |
| 81 | 81ADARD | 12.000 | 21.000 | 12.245 | 21.429 |
| 88 | 88EARD | 12.000 | 5.000 | 12.245 | 5.102 |
| 82 | 82SDARD | 12.000 | 21.000 | 12.245 | 21.429 |
| 78 | 78EMIS | 12.000 | 11.000 | 12.245 | 11.224 |
| 24 | 24EHR | 12.000 | 8.000 | 12.245 | 8.163 |
| 37 | 37EMD | 12.000 | 15.000 | 12.245 | 15.306 |
| 50 | 50EMD | 11.000 | 9.000 | 11.224 | 9.184 |
| 57 | 57EMD | 11.000 | 10.000 | 11.224 | 10.204 |
| 39 | 39EMD | 11.000 | 12.000 | 11.224 | 12.245 |
| 23 | 23EHR | 11.000 | 9.000 | 11.224 | 9.184 |
| 46 | 46EMD | 11.000 | 9.000 | 11.224 | 9.184 |
| 79 | 79EMIS | 10.000 | 10.000 | 10.204 | 10.204 |
| 31 | 31EHR | 10.000 | 12.000 | 10.204 | 12.245 |
| 21 | 21EHR | 10.000 | 9.000 | 10.204 | 9.184 |
| 27 | 27EHR | 10.000 | 8.000 | 10.204 | 8.163 |
| 26 | 26EHR | 10.000 | 6.000 | 10.204 | 6.122 |
| 29 | 29EHR | 10.000 | 6.000 | 10.204 | 6.122 |
| 71 | 71EMIS | 10.000 | 9.000 | 10.204 | 9.184 |
| 32 | 32EHR | 10.000 | 12.000 | 10.204 | 12.245 |
| 70 | 70EMIS | 10.000 | 8.000 | 10.204 | 8.163 |
| 22 | 22EHR | 9.000 | 10.000 | 9.184 | 10.204 |
| 65 | 65EMIS | 9.000 | 10.000 | 9.184 | 10.204 |
| 72 | 72EMIS | 9.000 | 7.000 | 9.184 | 7.143 |
| 19 | 19EHR | 9.000 | 13.000 | 9.184 | 13.265 |
| 20 | 20EHR | 9.000 | 7.000 | 9.184 | 7.143 |
| 69 | 69EMIS | 9.000 | 10.000 | 9.184 | 10.204 |
| 73 | 73EMIS | 9.000 | 8.000 | 9.184 | 8.163 |
| 86 | 86EARD | 9.000 | 7.000 | 9.184 | 7.143 |
| 67 | 67EMIS | 9.000 | 10.000 | 9.184 | 10.204 |
| 68 | 68EMIS | 9.000 | 9.000 | 9.184 | 9.184 |

| | | | | | |
|----|---------|-------|--------|-------|--------|
| 28 | 28EHR | 9.000 | 12.000 | 9.184 | 12.245 |
| 30 | 30EHR | 8.000 | 9.000 | 8.163 | 9.184 |
| 91 | 91EARD | 8.000 | 7.000 | 8.163 | 7.143 |
| 66 | 66EMIS | 7.000 | 8.000 | 7.143 | 8.163 |
| 75 | 75EMIS | 7.000 | 9.000 | 7.143 | 9.184 |
| 83 | 83EARD | 7.000 | 8.000 | 7.143 | 8.163 |
| 90 | 90EARD | 7.000 | 3.000 | 7.143 | 3.061 |
| 77 | 77EMIS | 7.000 | 8.000 | 7.143 | 8.163 |
| 93 | 93EARD | 7.000 | 9.000 | 7.143 | 9.184 |
| 92 | 92EARD | 7.000 | 4.000 | 7.143 | 4.082 |
| 12 | 12EFD | 7.000 | 4.000 | 7.143 | 4.082 |
| 15 | 15EFD | 7.000 | 8.000 | 7.143 | 8.163 |
| 85 | 85EARD | 7.000 | 4.000 | 7.143 | 4.082 |
| 11 | 11EFD | 6.000 | 4.000 | 6.122 | 4.082 |
| 89 | 89EARD | 6.000 | 7.000 | 6.122 | 7.143 |
| 14 | 14EFD | 6.000 | 4.000 | 6.122 | 4.082 |
| 13 | 13EFD | 6.000 | 5.000 | 6.122 | 5.102 |
| 84 | 84EARD | 6.000 | 5.000 | 6.122 | 5.102 |
| 87 | 87EARD | 6.000 | 6.000 | 6.122 | 6.122 |
| 10 | 10EFD | 5.000 | 9.000 | 5.102 | 9.184 |
| 9 | 9EFD | 5.000 | 3.000 | 5.102 | 3.061 |
| 95 | 95ADARD | 4.000 | 4.000 | 4.082 | 4.082 |
| 96 | 96EARD | 4.000 | 4.000 | 4.082 | 4.082 |
| 97 | 97EARD | 4.000 | 4.000 | 4.082 | 4.082 |
| 98 | 98EARD | 4.000 | 4.000 | 4.082 | 4.082 |

| | 1 | 2 | 3 | 4 |
|-------------|-----------|-----------|-----------|-----------|
| | OutDegree | InDegree | NrmOutDeg | NrmInDeg |
| ----- | | | | |
| 1 Mean | 11.796 | 11.796 | 12.037 | 12.037 |
| 2 Std Dev | 4.840 | 5.916 | 4.939 | 6.037 |
| 3 Sum | 1156.000 | 1156.000 | 1179.592 | 1179.592 |
| 4 Variance | 23.428 | 34.999 | 24.394 | 36.442 |
| 5 SSQ | 15932.000 | 17066.000 | 16588.922 | 17769.680 |
| 6 MCSSQ | 2295.918 | 3429.918 | 2390.586 | 3571.344 |
| 7 Euc Norm | 126.222 | 130.637 | 128.798 | 133.303 |
| 8 Minimum | 4.000 | 3.000 | 4.082 | 3.061 |
| 9 Maximum | 26.000 | 32.000 | 26.531 | 32.653 |
| 10 N of Obs | 98.000 | 98.000 | 98.000 | 98.000 |

Network Centralization (Outdegree) = 14.494%

Network Centralization (Indegree) = 20.616%

NOTE: the two different types of the statistical description means 1) first calculation is based on the assumptions that each tie between nodes is symmetric. Symmetric relations mean that a relationship exists from A to G and G to A. 2) second calculation is based on asymmetric relationships meaning uniform or one-way ties between nodes.

3.3.1 Network pattern:

The visual network demonstrates the network in clear terms the role of individuals and the relationships among them through the ties that link them in a network. Clusters are shown in the network. Each cluster or group represents its role in the network. The groups are different in their size and role. According to personal support, the network consisted of actors that interact with others. The current ties in the network are 1501 and the possible ties in the whole network are 9506. Therefore, the degree density of the whole network is 0.1579. The density is lower than the expected percentage. *The reason that makes density low is the clusters. The clusters have a high density because each cluster interacts inside itself and then they connect with other clusters and the main clusters. The clusters connect with each other according to their positions and tasks. The main cluster that is in red color participates to link all clusters in its point and only a few clusters link with others. This is the main reason that makes the density low because all clusters are connected with the main cluster and there is no high density among cluster. There is a high density inside the clusters. The density is centered in the main cluster that is in red color.* The clusters have a high density and this case supports the network after they innovate themselves. The clusters participate to innovate the network when they complete themselves and they connect to each other according to their position.

The measurement of density for each group (cluster) demonstrates the size of each cluster in the network. The first cluster is the HRD human resources department and the density is 0.8790. HRD has a good ratio of density because the members are

connected to each other inside and outside through the director of the cluster. The second cluster is the MED managerial employees department and the density is 0.7411. MED has a lower density than HRD because they are connected with each other inside the cluster according to the support that is provided inside the cluster. Some members are weak in the support that is a reason to make the density is lower than HRD. The third cluster is the MIS maintenance and information system and the density is 0.5163. MIS has the lowest density compared with other clusters, but it still higher than medium. The reason that makes MIS lower than others is the existing experience among members in the clusters that reduce the support but it is high in coordination. Fourth cluster is ARD auditing and review department and the density is 0.6923. The ARD has a good density because the members inside the cluster are more interactive. The fifth cluster is the FD financial department and the density is 0.8222. The density of FD is high and the members are connected to each other in regard to support. The sixth cluster is ARD accurate research and development department and the density is 1.0. The RD has the high and excellent density because it contains members that work and support each other because their position determines support and collaboration. The seventh cluster is M management, AM assistant of management, and S secretary and the density is 1.0. the ratio of the main cluster is high because they link all clusters in one point.

Members participate to innovate the network of their clusters before innovating the network as a whole. The clusters innovate the network and gather their efforts to build a whole network with other clusters. This process can be described as network innovation.

Personal support as a dimension of shared leadership and characteristics of the network innovation *creates clusters among individuals according to the role of each cluster because clusters that contain members play a deep role in the completion of the tasks and network. Then it innovates the whole network with other clusters and gathers in the main cluster.*

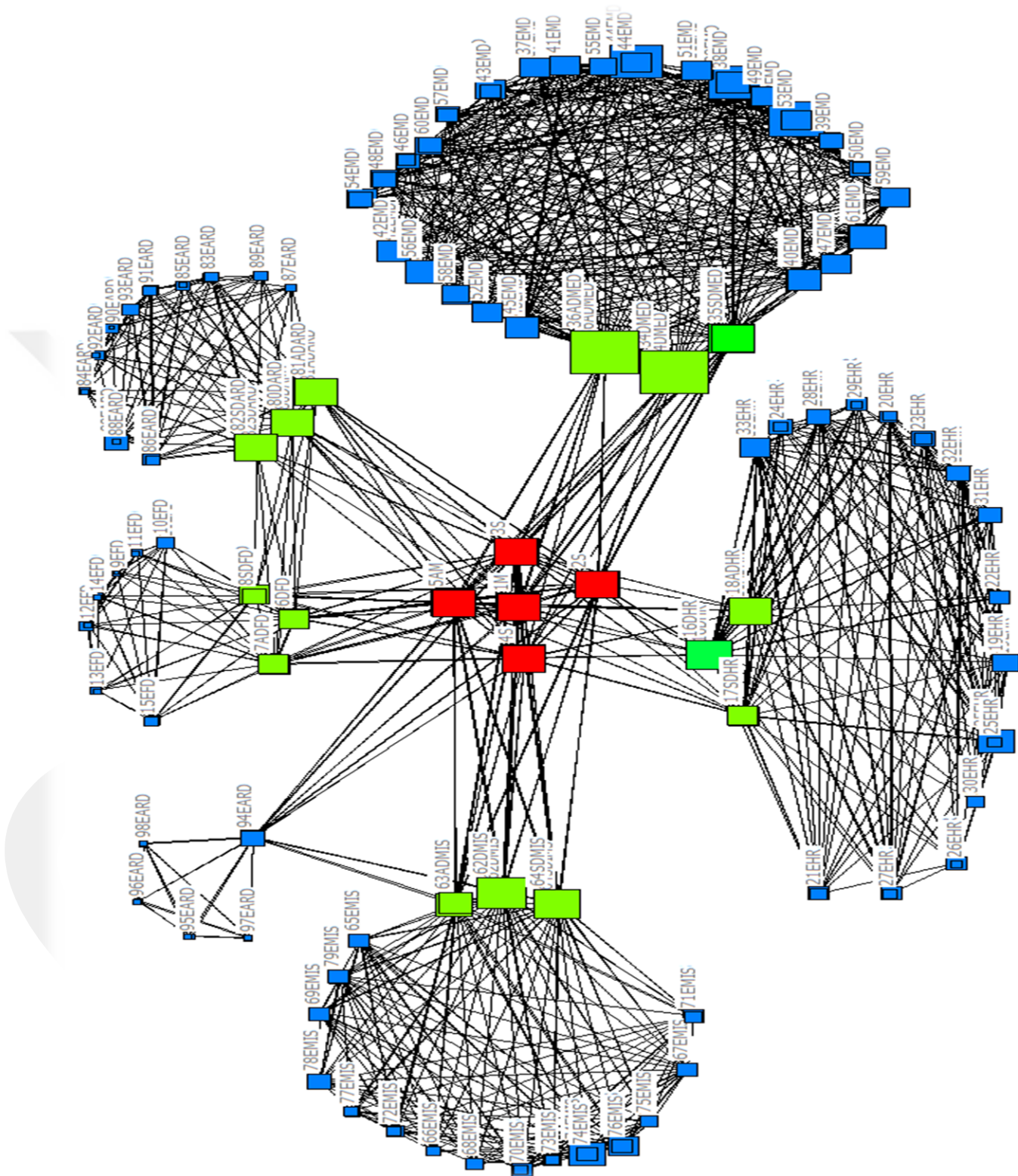


Figure 7: personal support.

Figure 7 shows the relationships in the personal support network. The network has less strength than task coordination. The reason is the personal support occurs in regard to help or other personal issues. Task coordination occurs always. There are 7 groups (clusters). In the red color, is the main cluster (M, AM, S) and they collected all cluster. FD cluster is the financial department. HRD cluster is the human resources and personal support department. MED cluster is the managerial employees department. MIS cluster is the maintenance and information systems. ARD cluster is the auditing and review department. ARD cluster is the accurate research and development department. All clusters participated to work in one network and built a united environment in order to gather themselves in one cluster. Figure 7 on the previous page, demonstrates the clusters and their participation to connect with others according to the tasks or positions. The main cluster that is in red color collected all clusters in one point and all clusters participate to link themselves with others. Even, it is clear to see the ties that link from node to another node. This process can be described as network innovation. The network above shows that there are differences and variances among each cluster because each cluster has limited members and tasks. The network demonstrates the visible relationships in regard to personal support.

3.3.2 Weak and strong ties:

The ties are the links of the relationships between members. Each member links with others according to the position. For instance, C links with H and vice versa. The tie of C is weak to H, the tie of H is strong with C. The relationships are not equal. They are different from C to H and vice versa. *Each member has scores and the scores select the degree of each one. In the end, all scores shall be collected in order to discover who has the highest scores total scores weekly.*

The strongest member in the network is 35SDMED with 110,500 scores (out-degree). The share is 0.019. The 35 as a secretary of the director in MED managerial employees department has the highest scores because the position is centered and the strength of each tie is high. That is a reason to make 35SDMED higher than other members and is close to the director. Each tie has a high score weekly and that helps the member to be the highest in the cluster and the whole network. 35SDMED in the cluster is centered and plays a big role to link relationships. The weakest member is 95ADARD. The 95 as the assistant of the director is the weakest in the network and has 12.0 scores and the share is 0.003. The 95ADARD is the lowest in regard to scores.

Each tie has a score and the scores can be collected and the result shows the strength compared with others. In this case, 95ADARD has the lowest scores because each tie is medium or weaker than other members.

The ratio of the strong tie compared to the weak ties is higher and it is 60%. *The ratio of the strong ties among members in a network is higher than weak ties although*

there are weak members in a network. The scores that select the strength of each member are important to measure the ratio of the strong links among individuals. The 60% expresses that the strong ties have the majority among members in the network and weak ties are less.

In the following network, members innovated small networks (clusters) among each other according to the position before innovating the whole network although there are differences in the degree of each tie in a cluster and network.. Network innovation can be done when all clusters participate to link themselves in one point or several in the main cluster.

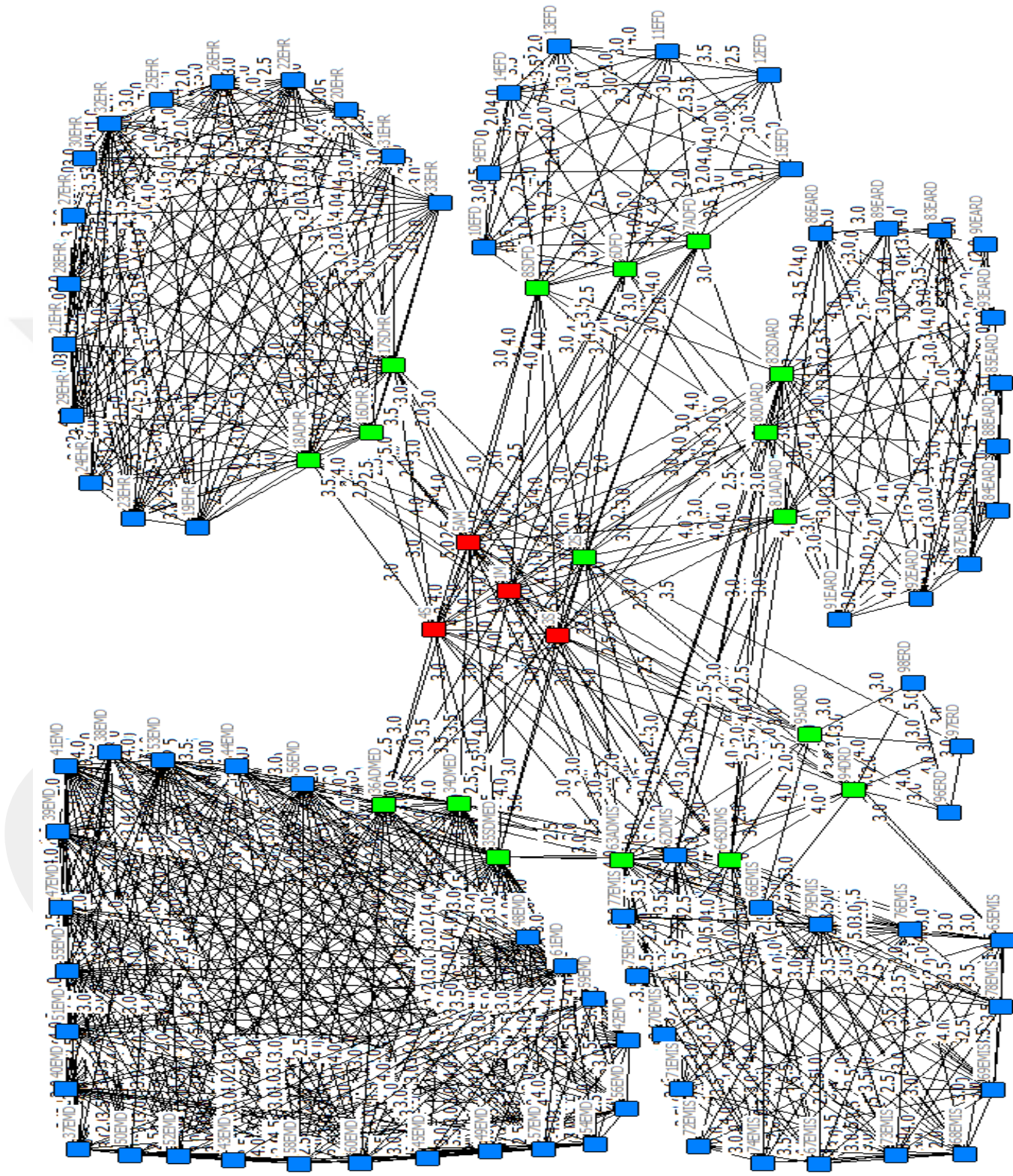


Figure 8: personal support (weak and strong ties)

Figure 8 shows that groups or teams correlate with each other. In this network, weak and strong ties represent the strength of each relationship in regard to personal support. The ties are the relationships among members. For instance, if the tie has 3 scores, it means it is a strong and active tie in a week. If the tie is 2.5 or less, it means it is a medium or weak tie. The ties select the strength of the correlations and show who is the strongest or weakest. In the network above figure 8, clusters innovated themselves and created a high density inside each cluster and among members. Then participate to innovate the network with other clusters. Each relationship can be described in the scores. For example, if M has 5 scores to S and S has 3 to M. it means that M as a node has a higher score than S in the network. it means that M is strongest. The ties have scores and the scores can be collected in order to show which member is strong and has the highest scores The network demonstrates the clusters and the differences among them. The main cluster gathers all the clusters in one point.

3.3.3 Summary of the results of the hypotheses:

Hypothesis 2A: Individuals in the personal support have a medium or low percentage of degree centrality in a social network and in their units or departments.

Findings were found for personal support in the network about degree centrality is 17.14%. The degree centrality of the Out-degree is 14.494% and the degree centrality of In Degree is 20.616%. As it was discussed before, the degree of centrality in the whole network is positive and it is an excellent ratio. The centrality of in and out-degrees is positive as well because they are lower than medium and they support the main centrality. The ratio of centrality in hypothesis 2A regarding personal support is required because in the hypothesis it was expected it is medium, but the finding was found it is less than medium. The heterogeneity and normalized percentage are low and align with degree centrality. The mentioned degree above supports hypothesis 2A regarding personal support.

Hypothesis 2B: The social network of the personal support has a high percentage of degree density in the network as a whole and in units or departments.

Findings were found for personal support in the network about degree density is low 0.1579 in the whole network. The density is lower than the expected ratio in the network. Density in subgroups (cluster) HRD is 0.8790, MD is 0.7411, MIS is 0.5163, ARD is 0.6923, FD is 0.8222, ARD is 1.0, and (M, AM, and S) is 1.0. The ratio of each cluster in the network is high and supports hypothesis 2B because personal support of shared leadership theory requires divided roles and collaboration among members. As it

was discussed before, the clusters participate to innovate themselves and they have a density inside their clusters. Then, they link with others. The low density in the whole network cannot be described as negative because the subgroups (clusters) participate to support the network and innovate it. The clusters have a high density.

Hypothesis 2C: Strong ties have a higher percentage in the personal support than weak ties between individuals.

Findings were found for personal support in the network regard to weak and strong ties for the highest member is 35SDMED and the degree is 110.5. 35SDMED as a secretary of MED cluster has 110.5 and it is the total scores were collected from each tie with others (out-degree). The lowest member is 95ADARD and the degree is 12.0. The scores were collected from ties with others as well and it is the total scores. The ratio of strong ties 60%. Strong ties are mostly higher than weak ties. The ratio supports hypothesis 2C.

Hypothesis 2A, B, and C are supported from the findings that were found through the statistical description, network pattern, and weak and strong ties, but 1B is supported from clusters because they have a high density and it is not supported by the whole network because the density is low. In this case, it cannot be invalid because the network is supported from the clusters and this case participates to innovate the network. If the network weak and cannot be gathered in one cluster (main cluster), that means it is a null or weak network.

3.4 Information Sharing:

Information sharing is one of the dimensions of shared leadership. At the same time, it is one of the characteristics of network innovation. This variable was examined by network analysis statistically and network pattern. Through the statistical description, it was found that the information sharing was positive and supports the study. Degree centrality in the information sharing was 35.93%. This degree is lower than the medium according to the hypothesis, but this degree means that it is a positive degree especially in shared leadership theory. When degree centrality is high, it means that it is negative because shared leadership theory requires medium or less degree (if it exists). In information sharing, a low degree is important because *the low ratio of centrality recognizes the strength of the information inside the network*. 35.93% expresses the meaning of *widespread of the information among members inside clusters and outside*. *If the degree is high, it means that the information is limited and narrow scope*. *The low centrality means there are a few members are central, but other members are also central less than central members and there is no big variance among members*. *That is a reason to make the centrality low and equal among members*. Information sharing among individuals increases the activity and reduces the centrality in the limited range. Even, the heterogeneity is 1.18%. It means that it is positive because low heterogeneity supports the result of the centrality. The normalized is 0.16%. The heterogeneity and normalized align with the low centrality. Whenever the Heterogeneity is low, it means that it is more combined and aligned with centrality. The normalized expresses the continuous movement in the network. If it is high, it means the movements of members

weak and stable. If it is low, it means the movements of members are strong and constant. *Therefore, heterogeneity and normalized are aligned with degree centrality.*

The strongest first three nodes are 5AM assistant of management is 57.0. The 5AM as an assistant of management has the highest degree in the network because 5AM close to the management, and the central point that the 5AM has in the middle of the network. 5AM plays a big role to transfer the information as a *bridge and brokerage* to share the information in the network. 2S is the secretary of the management and has 46.0. 2S as a secretary of the management is close to the management and has the second-highest degree. 2S plays a big role with 5AM because they are in the same cluster with management and they are as a brokerage to spread the information among other clusters. That is the reason to make them string in the network. Especially in the information sharing, the AM and 2S because they are close to the management, have a big mission to be a bridge between members and management. 35SDMED is the secretary of the MED managerial employees department and has 43.0. 35 as a secretary of the biggest cluster, plays a role in this case that make the secretary the strongest in the cluster and the most active member with the main cluster (management cluster). In order to transfer the information, 35 as a secretary of MED becomes a bridge among the MED and main cluster (management). That is the reason to make 35SDMED the highest in the cluster and in the whole network. The share of 5AM is 0.25 and NrmDegree is 58.163, 2S is 0.21 and the NrmDegree is 46.939, and 35SDMED is 0.19 and the NrmDegree is 43.878. As it was discussed above, they were the strongest brokerage among their

cluster and the main cluster. They have the highest share in the network in regard to information sharing.

The weakest last three nodes 96EARD is 8.0 and the share was 0.004 and the NrmDegree is 8.163. 97ERD is 8.0 and the share is 0.004 and the NrmDegree is 8.163. The 98EARD 7.0 and the share is 0.003 and the NrmDegree is 7.143. They were the weakest brokerage among their cluster and the main cluster. The 96, 97, and 98 in ARD accurate research and development department cluster as the members in ARD and the main reason that makes them the weakest is that the ARD cluster contains a few members and it is limited in the network in regard of the tasks and related work. That is the reason to make it weak in share in all networks. The following statistical schedule provides a precise description to understand each member in the information sharing and the strength of relationships among individuals, as well as, provides a rate of centrality in the end of the description. In the first statistics, schedule data treated as symmetric shows the role of each member from the strongest to the weakest in the organization.

Data treated as symmetric:

| | | 1 | 2 | 3 |
|----|---------|--------|-----------|-------|
| | | Degree | NrmDegree | Share |
| 5 | 5AM | 57.000 | 58.163 | 0.025 |
| 2 | 2S | 46.000 | 46.939 | 0.021 |
| 35 | 35SDMED | 43.000 | 43.878 | 0.019 |
| 4 | 4S | 42.000 | 42.857 | 0.019 |
| 3 | 3S | 42.000 | 42.857 | 0.019 |
| 34 | 34DMED | 42.000 | 42.857 | 0.019 |
| 36 | 36ADMED | 42.000 | 42.857 | 0.019 |

| | | | | |
|----|---------|--------|--------|-------|
| 62 | 62DMIS | 32.000 | 32.653 | 0.014 |
| 64 | 64SDIMS | 32.000 | 32.653 | 0.014 |
| 63 | 63ADMIS | 32.000 | 32.653 | 0.014 |
| 7 | 7ADFD | 31.000 | 31.633 | 0.014 |
| 44 | 44EMD | 30.000 | 30.612 | 0.013 |
| 47 | 47EMD | 30.000 | 30.612 | 0.013 |
| 38 | 38EMD | 30.000 | 30.612 | 0.013 |
| 45 | 45EMD | 29.000 | 29.592 | 0.013 |
| 43 | 43EMD | 29.000 | 29.592 | 0.013 |
| 40 | 40EMD | 29.000 | 29.592 | 0.013 |
| 52 | 52EMD | 29.000 | 29.592 | 0.013 |
| 41 | 41EMD | 29.000 | 29.592 | 0.013 |
| 56 | 56EMD | 29.000 | 29.592 | 0.013 |
| 6 | 6DFD | 28.000 | 28.571 | 0.013 |
| 42 | 42EMD | 28.000 | 28.571 | 0.013 |
| 58 | 58EMD | 28.000 | 28.571 | 0.013 |
| 50 | 50EMD | 28.000 | 28.571 | 0.013 |
| 48 | 48EMD | 28.000 | 28.571 | 0.013 |
| 49 | 49EMD | 28.000 | 28.571 | 0.013 |
| 39 | 39EMD | 28.000 | 28.571 | 0.013 |
| 46 | 56EMD | 28.000 | 28.571 | 0.013 |
| 60 | 60EMD | 28.000 | 28.571 | 0.013 |
| 54 | 54EMD | 28.000 | 28.571 | 0.013 |
| 55 | 55EMD | 28.000 | 28.571 | 0.013 |
| 57 | 57EMD | 28.000 | 28.571 | 0.013 |
| 61 | 61EMD | 28.000 | 28.571 | 0.013 |
| 37 | 37EMD | 28.000 | 28.571 | 0.013 |
| 53 | 53EMD | 27.000 | 27.551 | 0.012 |
| 51 | 51EMD | 27.000 | 27.551 | 0.012 |
| 59 | 59EMD | 27.000 | 27.551 | 0.012 |
| 9 | 9EFD | 27.000 | 27.551 | 0.012 |
| 81 | 81ADARD | 26.000 | 26.531 | 0.012 |
| 82 | 82SDARD | 26.000 | 26.531 | 0.012 |
| 8 | 8SDFD | 26.000 | 26.531 | 0.012 |
| 80 | 80DARD | 26.000 | 26.531 | 0.012 |
| 17 | 17SDHR | 25.000 | 25.510 | 0.011 |
| 18 | 18ADHR | 25.000 | 25.510 | 0.011 |
| 16 | 16DHR | 25.000 | 25.510 | 0.011 |

| | | | | |
|----|--------|--------|--------|-------|
| 22 | 22EHR | 22.000 | 22.449 | 0.010 |
| 24 | 24EHR | 21.000 | 21.429 | 0.009 |
| 30 | 30EHR | 21.000 | 21.429 | 0.009 |
| 28 | 28EHR | 21.000 | 21.429 | 0.009 |
| 94 | 94DARD | 21.000 | 21.429 | 0.009 |
| 26 | 26EHR | 20.000 | 20.408 | 0.009 |
| 72 | 72EMIS | 20.000 | 20.408 | 0.009 |
| 1 | 1M | 20.000 | 20.408 | 0.009 |
| 74 | 74EMIS | 20.000 | 20.408 | 0.009 |
| 67 | 67EMIS | 20.000 | 20.408 | 0.009 |
| 78 | 78EMIS | 19.000 | 19.388 | 0.008 |
| 76 | 76EMIS | 19.000 | 19.388 | 0.008 |
| 20 | 20EHR | 19.000 | 19.388 | 0.008 |
| 70 | 70EMIS | 19.000 | 19.388 | 0.008 |
| 25 | 25EHR | 19.000 | 19.388 | 0.008 |
| 69 | 69EMIS | 19.000 | 19.388 | 0.008 |
| 33 | 33EHR | 19.000 | 19.388 | 0.008 |
| 71 | 71EMIS | 18.000 | 18.367 | 0.008 |
| 23 | 23EHR | 18.000 | 18.367 | 0.008 |
| 77 | 77EMIS | 18.000 | 18.367 | 0.008 |
| 66 | 66EMIS | 18.000 | 18.367 | 0.008 |
| 68 | 68EMIS | 18.000 | 18.367 | 0.008 |
| 32 | 32EHR | 18.000 | 18.367 | 0.008 |
| 29 | 29EHR | 18.000 | 18.367 | 0.008 |
| 19 | 19EHR | 17.000 | 17.347 | 0.008 |
| 73 | 73EMIS | 17.000 | 17.347 | 0.008 |
| 65 | 65EMIS | 17.000 | 17.347 | 0.008 |
| 79 | 79EMIS | 17.000 | 17.347 | 0.008 |
| 31 | 31EHR | 17.000 | 17.347 | 0.008 |
| 75 | 75EMIS | 17.000 | 17.347 | 0.008 |
| 27 | 27EHR | 17.000 | 17.347 | 0.008 |
| 21 | 21EHR | 17.000 | 17.347 | 0.008 |
| 89 | 89EARD | 15.000 | 15.306 | 0.007 |
| 87 | 87EARD | 15.000 | 15.306 | 0.007 |
| 86 | 86EARD | 15.000 | 15.306 | 0.007 |
| 85 | 85EARD | 15.000 | 15.306 | 0.007 |
| 92 | 92EARD | 15.000 | 15.306 | 0.007 |
| 84 | 84EARD | 14.000 | 14.286 | 0.006 |

| | | | | |
|----|---------|--------|--------|-------|
| 90 | 90EARD | 14.000 | 14.286 | 0.006 |
| 91 | 91EARD | 14.000 | 14.286 | 0.006 |
| 93 | 93EARD | 14.000 | 14.286 | 0.006 |
| 88 | 88EARD | 14.000 | 14.286 | 0.006 |
| 83 | 83EARD | 13.000 | 13.265 | 0.006 |
| 13 | 13EFD | 12.000 | 12.245 | 0.005 |
| 12 | 12EFD | 12.000 | 12.245 | 0.005 |
| 11 | 11EFD | 11.000 | 11.224 | 0.005 |
| 14 | 14EFD | 11.000 | 11.224 | 0.005 |
| 95 | 95ADARD | 10.000 | 10.204 | 0.004 |
| 15 | 15EAFD | 9.000 | 9.184 | 0.004 |
| 10 | 10EAFD | 9.000 | 9.184 | 0.004 |
| 96 | 96EARD | 8.000 | 8.163 | 0.004 |
| 97 | 97EARD | 8.000 | 8.163 | 0.004 |
| 98 | 98EARD | 7.000 | 7.143 | 0.003 |

| | 1 | 2 | 3 | |
|-------|----------|-----------|-----------|--------|
| | Degree | NrmDegree | Share | |
| ----- | | | | |
| 1 | Mean | 22.857 | 23.324 | 0.010 |
| 2 | Std Dev | 8.989 | 9.172 | 0.004 |
| 3 | Sum | 2240.000 | 2285.714 | 1.000 |
| 4 | Variance | 80.796 | 84.127 | 0.000 |
| 5 | SSQ | 59118.000 | 61555.602 | 0.012 |
| 6 | MCSSQ | 7918.000 | 8244.481 | 0.002 |
| 7 | Euc Norm | 243.142 | 248.104 | 0.109 |
| 8 | Minimum | 7.000 | 7.143 | 0.003 |
| 9 | Maximum | 57.000 | 58.163 | 0.025 |
| 10 | N of Obs | 98.000 | 98.000 | 98.000 |

Network Centralization = 35.93%

Blau Heterogeneity = 1.18%. Normalized (IQV) = 0.16%

The second statistical description includes Out Degree, In Degree, NrmOutDegree, and NrmInDegree for each member in the schedule from the strongest to the weakest the Out Degree of the first three strongest are 5AM is 57.0, 2S is 46.0, and 4S is 42.0. The In Degree of 5AM, 2S, and 4S is 20.0. As it was discussed before, the 5AM as an assistant of management, 2S as a secretary of management is in the central of the network with 4S as a secretary of the management as well. They are the strongest in regard to information sharing because the majority of the information sharing starts and ends in the center of the network (main cluster). The Out Degree of the weakest are 96EARD, 97EARD, and 98EARD is 4.0. The In Degree of 96EARD, 97EARD is 8.0 and 98EARD is 7.0. As well, the 96, 97, and 98 in the ARD accurate research and development department as the members are the weakest because they are specified in their tasks and limited in their scope. That is the reason to make them weak in the sharing process. Therefore, degree centrality of Out Degree is 37.474% and centrality of In Degree is 17.066%. The degree centrality, in this case, is separated into two parts. First, percentage expresses the degree centrality of the out-degree only. Second, it means the degree centrality in regard of in degree only. They are also lower than medium and this ratio positive and excellent in regard to information sharing. *It has only been mentioned in the first and second column because they are most important for the measurement of the degree.*

Data treated as asymmetric:

| | | 1 | 2 | 3 | 4 |
|----|---------|-----------|----------|-----------|----------|
| | | OutDegree | InDegree | NrmOutDeg | NrmInDeg |
| 5 | 5AM | 57.000 | 20.000 | 58.163 | 20.408 |
| 2 | 2S | 46.000 | 20.000 | 46.939 | 20.408 |
| 4 | 4S | 42.000 | 20.000 | 42.857 | 20.408 |
| 3 | 3S | 42.000 | 20.000 | 42.857 | 20.408 |
| 35 | 35SDMED | 39.000 | 37.000 | 39.796 | 37.755 |
| 34 | 34DMED | 38.000 | 37.000 | 38.776 | 37.755 |
| 36 | 36ADMED | 37.000 | 37.000 | 37.755 | 37.755 |
| 7 | 7ADFD | 31.000 | 14.000 | 31.633 | 14.286 |
| 6 | 6DFD | 28.000 | 14.000 | 28.571 | 14.286 |
| 9 | 9EFD | 27.000 | 9.000 | 27.551 | 9.184 |
| 62 | 62DMIS | 26.000 | 32.000 | 26.531 | 32.653 |
| 8 | 8SDFD | 26.000 | 14.000 | 26.531 | 14.286 |
| 46 | 56EMD | 26.000 | 24.000 | 26.531 | 24.490 |
| 53 | 53EMD | 26.000 | 25.000 | 26.531 | 25.510 |
| 51 | 51EMD | 26.000 | 25.000 | 26.531 | 25.510 |
| 54 | 54EMD | 26.000 | 27.000 | 26.531 | 27.551 |
| 61 | 61EMD | 26.000 | 27.000 | 26.531 | 27.551 |
| 50 | 50EMD | 25.000 | 26.000 | 25.510 | 26.531 |
| 38 | 38EMD | 25.000 | 29.000 | 25.510 | 29.592 |
| 43 | 43EMD | 25.000 | 28.000 | 25.510 | 28.571 |
| 44 | 44EMD | 25.000 | 28.000 | 25.510 | 28.571 |
| 40 | 40EMD | 25.000 | 28.000 | 25.510 | 28.571 |
| 47 | 47EMD | 25.000 | 29.000 | 25.510 | 29.592 |
| 45 | 45EMD | 25.000 | 27.000 | 25.510 | 27.551 |
| 49 | 49EMD | 25.000 | 25.000 | 25.510 | 25.510 |
| 56 | 56EMD | 25.000 | 28.000 | 25.510 | 28.571 |
| 39 | 39EMD | 25.000 | 26.000 | 25.510 | 26.531 |
| 52 | 52EMD | 25.000 | 28.000 | 25.510 | 28.571 |
| 41 | 41EMD | 25.000 | 26.000 | 25.510 | 26.531 |
| 42 | 42EMD | 25.000 | 28.000 | 25.510 | 28.571 |
| 55 | 55EMD | 25.000 | 28.000 | 25.510 | 28.571 |
| 60 | 60EMD | 25.000 | 26.000 | 25.510 | 26.531 |

| | | | | | |
|----|---------|--------|--------|--------|--------|
| 57 | 57EMD | 25.000 | 26.000 | 25.510 | 26.531 |
| 59 | 59EMD | 25.000 | 26.000 | 25.510 | 26.531 |
| 48 | 48EMD | 25.000 | 26.000 | 25.510 | 26.531 |
| 58 | 58EMD | 25.000 | 26.000 | 25.510 | 26.531 |
| 37 | 37EMD | 24.000 | 24.000 | 24.490 | 24.490 |
| 63 | 63ADMIS | 23.000 | 32.000 | 23.469 | 32.653 |
| 64 | 64SDIMS | 23.000 | 32.000 | 23.469 | 32.653 |
| 17 | 17SDHR | 22.000 | 25.000 | 22.449 | 25.510 |
| 18 | 18ADHR | 22.000 | 24.000 | 22.449 | 24.490 |
| 16 | 16DHR | 22.000 | 25.000 | 22.449 | 25.510 |
| 81 | 81ADARD | 21.000 | 23.000 | 21.429 | 23.469 |
| 82 | 82SDARD | 21.000 | 23.000 | 21.429 | 23.469 |
| 80 | 80DARD | 21.000 | 23.000 | 21.429 | 23.469 |
| 1 | 1M | 20.000 | 20.000 | 20.408 | 20.408 |
| 23 | 23EHR | 17.000 | 16.000 | 17.347 | 16.327 |
| 24 | 24EHR | 17.000 | 18.000 | 17.347 | 18.367 |
| 25 | 25EHR | 17.000 | 19.000 | 17.347 | 19.388 |
| 75 | 75EMIS | 17.000 | 17.000 | 17.347 | 17.347 |
| 76 | 76EMIS | 17.000 | 19.000 | 17.347 | 19.388 |
| 77 | 77EMIS | 17.000 | 18.000 | 17.347 | 18.367 |
| 29 | 29EHR | 17.000 | 16.000 | 17.347 | 16.327 |
| 79 | 79EMIS | 17.000 | 17.000 | 17.347 | 17.347 |
| 68 | 68EMIS | 17.000 | 18.000 | 17.347 | 18.367 |
| 20 | 20EHR | 17.000 | 17.000 | 17.347 | 17.347 |
| 70 | 70EMIS | 17.000 | 19.000 | 17.347 | 19.388 |
| 22 | 22EHR | 17.000 | 21.000 | 17.347 | 21.429 |
| 71 | 71EMIS | 17.000 | 18.000 | 17.347 | 18.367 |
| 72 | 72EMIS | 17.000 | 20.000 | 17.347 | 20.408 |
| 73 | 73EMIS | 17.000 | 17.000 | 17.347 | 17.347 |
| 74 | 74EMIS | 17.000 | 20.000 | 17.347 | 20.408 |
| 69 | 69EMIS | 17.000 | 19.000 | 17.347 | 19.388 |
| 33 | 33EHR | 17.000 | 19.000 | 17.347 | 19.388 |
| 65 | 65EMIS | 17.000 | 17.000 | 17.347 | 17.347 |
| 66 | 66EMIS | 17.000 | 18.000 | 17.347 | 18.367 |
| 67 | 67EMIS | 17.000 | 20.000 | 17.347 | 20.408 |
| 32 | 32EHR | 17.000 | 18.000 | 17.347 | 18.367 |
| 78 | 78EMIS | 17.000 | 19.000 | 17.347 | 19.388 |
| 19 | 19EHR | 15.000 | 17.000 | 15.306 | 17.347 |

| | | | | | |
|----|---------|--------|--------|--------|--------|
| 27 | 27EHR | 15.000 | 15.000 | 15.306 | 15.306 |
| 28 | 28EHR | 15.000 | 21.000 | 15.306 | 21.429 |
| 30 | 30EHR | 15.000 | 21.000 | 15.306 | 21.429 |
| 31 | 31EHR | 15.000 | 17.000 | 15.306 | 17.347 |
| 26 | 26EHR | 15.000 | 19.000 | 15.306 | 19.388 |
| 21 | 21EHR | 15.000 | 17.000 | 15.306 | 17.347 |
| 94 | 94DARD | 15.000 | 18.000 | 15.306 | 18.367 |
| 83 | 83EARD | 13.000 | 13.000 | 13.265 | 13.265 |
| 84 | 84EARD | 13.000 | 14.000 | 13.265 | 14.286 |
| 86 | 86EARD | 13.000 | 15.000 | 13.265 | 15.306 |
| 87 | 87EARD | 13.000 | 15.000 | 13.265 | 15.306 |
| 85 | 85EARD | 13.000 | 15.000 | 13.265 | 15.306 |
| 89 | 89EARD | 13.000 | 15.000 | 13.265 | 15.306 |
| 90 | 90EARD | 13.000 | 14.000 | 13.265 | 14.286 |
| 91 | 91EARD | 13.000 | 14.000 | 13.265 | 14.286 |
| 92 | 92EARD | 13.000 | 15.000 | 13.265 | 15.306 |
| 93 | 93EARD | 13.000 | 14.000 | 13.265 | 14.286 |
| 88 | 88EARD | 13.000 | 14.000 | 13.265 | 14.286 |
| 10 | 10EFD | 9.000 | 9.000 | 9.184 | 9.184 |
| 11 | 11EFD | 9.000 | 11.000 | 9.184 | 11.224 |
| 12 | 12EFD | 9.000 | 12.000 | 9.184 | 12.245 |
| 13 | 13EFD | 9.000 | 12.000 | 9.184 | 12.245 |
| 14 | 14EFD | 9.000 | 11.000 | 9.184 | 11.224 |
| 15 | 15EFD | 9.000 | 9.000 | 9.184 | 9.184 |
| 95 | 95ADARD | 4.000 | 10.000 | 4.082 | 10.204 |
| 96 | 96EARD | 4.000 | 8.000 | 4.082 | 8.163 |
| 97 | 97EARD | 4.000 | 8.000 | 4.082 | 8.163 |
| 98 | 98EARD | 4.000 | 7.000 | 4.082 | 7.143 |

| | 1 | 2 | 3 | 4 |
|-------------|-----------|-----------|-----------|-----------|
| | OutDegree | InDegree | NrmOutDeg | NrmInDeg |
| 1 Mean | 20.276 | 20.276 | 20.689 | 20.689 |
| 2 Std Dev | 8.856 | 6.682 | 9.036 | 6.818 |
| 3 Sum | 1987.000 | 1987.000 | 2027.551 | 2027.551 |
| 4 Variance | 78.424 | 44.649 | 81.658 | 46.490 |
| 5 SSQ | 47973.000 | 44663.000 | 49951.063 | 46504.582 |
| 6 MCSSQ | 7685.561 | 4375.561 | 8002.458 | 4555.978 |
| 7 Euc Norm | 219.027 | 211.336 | 223.497 | 215.649 |
| 8 Minimum | 4.000 | 7.000 | 4.082 | 7.143 |
| 9 Maximum | 57.000 | 37.000 | 58.163 | 37.755 |
| 10 N of Obs | 98.000 | 98.000 | 98.000 | 98.000 |

Network Centralization (Outdegree) = 37.474%

Network Centralization (Indegree) = 17.066%

NOTE: the two different types of the statistical description means 1) first calculation is based on the assumptions that each tie between nodes is symmetric. Symmetric relations mean that a relationship exists from C to B and B to C. 2) second calculation is based on asymmetric relationships meaning uniform or one-way ties between nodes.

3.4.1 Network pattern:

The network demonstrates the links in the simplest terms the role of members. It shows the relationships among them through the ties that link them in a network. In the network, subgroups are shown. Each group represents its role in the network. The groups are different in their size and role. According to information sharing, the network consisted of actors that interact with others. The current ties in the network are 1987 and the possible ties in the whole network are 9506. Therefore, the degree density of the whole network is 0.2090. The ratio of the density is low in the whole network. The main question that can be generated in this case *why the density is low?* The main and strongest reason is that *the members innovated their clusters according to their position and created teams in order to perform their tasks. Then, they gather in the main cluster that is in red color. The clusters connect with each other in the center of the network. They gather to each other directly as well, but this process can be done according to the position and required tasks or related-work. This is the reason that makes the density low.* In regard to clusters, the density is high and excellent in information sharing inside the clusters. Each of the clusters, participate to perform the tasks and missions inside the cluster. *This case increases the density inside the clusters.*

The measurement of the density for each group (cluster) shows the size of each cluster in the network. The first cluster is HRD human resources department and the density is 0.9240. HRD has a very good density because the cluster is active and connected with other clusters in some tasks because HRD is responsible for many issues in the network. That is the reason to make it has a high density. The second cluster is the

MED managerial employees department and the density is 0.9272. The density of MED is very good as well and it is close to HRD. MED is the managerial department and the majority of the tasks can be transferred through the cluster MED.

The third cluster is the MIS Maintenance and information system and the density is 1.0. The MIS has an excellent density because the MIS as a cluster is gathered around itself and all members collaborated to innovate the most powerful cluster in regard to information system. The fourth cluster is the ARD auditing and review department and the density is 1.0. The ARD as a cluster has an excellent density because it is in the position that makes it active with another cluster, especially in information sharing. The fifth cluster is the FD financial department and the density is 1.0. The FD cluster has a high density as well because all the members are connected with each other. There is no missing member inside the FD cluster. The sixth cluster is the ARD accurate research and development and the density is 1.0. The ARD as a cluster is specified and limited, but it has a high density because its members are interactive and share information always inside and outside in regard to accurate research and development. The seventh cluster is M management, AM assistant of management, and S secretary and the density is 1.0. This cluster in the center of the network and it gathers all clusters in one point. All the information can be transferred through it. The high activity is the reason to increase the density inside the cluster.

Each group that contains members innovate the network among themselves (cluster) before innovating the network as a whole. The clusters innovate the network

and participate to collect their efforts and tasks in order to build a whole network with other clusters.

Information sharing as a dimension of shared leadership *innovates clusters according to the role of each cluster because subgroups (clusters) include individuals and they are the core of the network. Then it innovated the network in the whole with other clusters. This process can be described as network innovation.*

Figure 9 demonstrates the relationships among members. In the network, clusters are gathered in one network. Especially, in the main cluster that is in red color. The network consists of 7 clusters. The main cluster is (M, AM, S). The secondary clusters are FD, HRD, MED, MIS, ARD, and ARD innovated themselves as groups in the network. They link their relationships according to the information sharing among them. This network has a higher percentage of density than task coordination and personal support. In figure 9, the network shows that for us the clusters are different and have variety in size and strength. For example, the biggest cluster is MED and it has the highest density and effect on the network. The big squares mean high centrality and the small squares mean low centrality. The big squares are clear and they recognize the strength and the position of each member as the central node or actor and vice versa the small squares mean the low centrality and most of them are equal especially in information sharing. In network, it is clear to see the ties are more than another network because information sharing requires activity and low heterogeneity, as well as, the central cluster that gathers the network and increases the density among members.

3.4.2 Weak and strong ties

The ties are the relationships of the relationships between members. Each member links with others according to the position. For instance, B links with N and vice versa, but B is weak with N, as well as, N is strong with B. the relationships are not equal. They are different from B to N and vice versa. *Members have scores and the scores select the degree of each one. Scores can be collected in the end and it shows the strength of the member that correlates with others.*

In regard to weak and strong ties, a member in the MED managerial employees department is 35SDMED the first and has the strongest ties because the Out Degree is 130.0 and the share is 0.019. 35SDMED as a secretary of the director of MED has the highest scores. Each tie contains a score and the total score of all ties are 130.0. The reason is that the 35 as a secretary if the director has a deep connection with all members inside and the outside of the cluster. Each relationship contains a high score weekly. This is the reason to increase the 35SDMED scores. The lowest member in regard of weak and strong ties is 97EARD in ARD accurate research and development department and the out-degree is 14.0 and the share is 0.002. As it was discussed before, the ARD as the cluster is specified and limited in its tasks and the members connect inside very well, but in outside it is limited about the research, developments, and related-work. That is the reason to makes the 97 as a member in ARD weak. Therefore, the ratio of the strong tie compared to the weak ties is higher and it is 78%. *The ratio of the strong ties among members in a network is higher than weak ties although there are weak members in a network. The scores that select the degree of each member are important to measure the*

ratio of the strong links among individuals. The majority for strong ties in the network and strong relationships have a higher percentage than weak relationships (ties). This case supports the study and increases the strength of the network in regard to information sharing.

In the following network figure 10, the network clarifies the strength of ties between individuals. The ties as they are discussed, are the correlations among actors in a network. Each tie represents the out-degree of each node. For example, if the tie has 2 scores in a weekly, it means the tie is weak and vice versa if the tie has 4 scores, it means the tie is strong. The ties connect all nodes (actors) in a network inside clusters and outside with other clusters. For instance, 2S as a secretary in the main cluster has 2.5 scores weekly with 94DARD. 94DARD as a director of ARD has 4 scores with 2S. The scores are in a variance situation according to the tasks and positions. In this case, 94DARD is stronger and more active than 2S within their line (tie), but with other actors, they have different scores. Clusters innovate the whole network after they were innovating the subgroups (cluster) by themselves. Network innovation can be done when all clusters participate to link themselves in one point or several in the main cluster.

The network shows that clusters are gathered in the main cluster that is in red color. Members innovate small networks (clusters) among each other before innovating the whole network although there are differences in the degree of each tie in clusters and network.

3.4.3 Summary of the results of the hypotheses:

Hypothesis 3A: Individuals in the information sharing have a medium or low percentage of degree centrality in a social network and units or departments.

Findings were found for information sharing in the network with regard to degree centrality is 35.93%. This percentage is most important because it expresses the ratio of the information sharing inside the network. Whenever is low, it means positive percentage. The degree centrality of Out Degree is 37.474% and In Degree is 17,066% the two percentages recognize the strength of the centrality in out degree and in degree. The heterogeneity and normalized ratio are low and they are aligned with degree centrality as it was discussed before. The ratio of the centrality in the hypothesis 3A regarding information sharing is positive because in the hypothesis it was expected it is medium, but the finding was less than medium. The mentioned degree above supports the hypothesis 3A.

Hypothesis 3B: The social network of the information sharing has a high percentage of degree density in the network as a whole and in the units or departments.

Findings were found for information sharing in the network regarding degree density is 0.2090 in a whole network. Degree density is low in the whole network and it is lower than expected rate, but the degree Density of the sub groups (clusters) are high and positive. They support the study. HRD is 0.9240, MD is 0.9272, MIS is 1.0, ARD is 1.0, FD is 1.0, ARD is 1.0, and (M, AM, and S) is 1.0. the ratio of each cluster in the network is high and supports the hypothesis 3B because information sharing of shared

leadership theory determines collaboration among roles according to the position. In this case, density in the whole network is low, but density in the clusters is high.

Hypothesis 3C: Strong ties have higher percentages in the information sharing network than weak ties between individuals.

Findings were found for information sharing in the network regarding weak and strong ties for the highest and strongest member is 35SDMED in MED managerial employees department and the degree 130.0 (out degree). The weak member in regard of ties is 97EARD in ARD accurate research and development department and the degree is 14.0 (out degree). The ratio of the strong ties is 78%. Strong ties are mostly higher than weak ties. This ratio is high and supports the hypothesis 3C. This percentage is expected according to the hypothesis and it is higher than medium. It means that the strong ties among members are more than weak ties.

Hypothesis 3A, B, and c are supported from the results that were found through statistical description, network pattern, and weak and strong ties, but 1B is supported from clusters because they are connected inside their clusters and have links with others according to their position, but it is not supported from whole network in regard of density. In this case, it cannot be described as a negative or null because the clusters participate to support the network and gather in one point (main cluster) that is in red color. The density in clusters is high and this percentage helps the network to be cohesive. If the clusters are separated and cannot be connected in one point, it means that the network is weak and there are no cohesive efforts inside the network.

CONCLUSION

This study visualizes shared leadership dimensions in social network theory. Even complexity leadership theory has been discussed in detail, but it only provides a clear explanation about shared leadership theory for readers. Studying the dimensions of shared leadership through social network theory provides special results compared with traditional ways in leadership and methodologies. Social network theory is not a traditional method. So, this study does not represent wide samples or universe. It only surrounds selected participants in an institution. Social network analysis in this study covers limited boundaries to examine the variables that are the dimensions. At the same time, they are the characteristics of network innovation because the dimensions participate to innovate network when they become under the social network perspective. The dimensions of shared leadership and at the same time, are the characteristic of network innovation:

Task coordination: task coordination has been discussed in the literature and has been examined through social network analysis. Task coordination regarding degree centrality was lower than medium (13.70%) and *it is a positive degree because whenever the degree is low, it means that it is positive and supports the study.* The density of the whole network was low 0.1887. *It is a low score and needs enhancements.* The density in each cluster in the network is good and high as mentioned in the methodology chapter and *they participate to innovate the whole network through the connection with the main cluster that is in red color. Although the density is low, it does not ignore the network innovation inside the clusters and among clusters. The clusters*

participate to innovate relationships with other clusters. Network innovation can be done when all clusters participate with each other in the network.

Regarding weak and strong ties, the ratio of strong ties was higher and it is 71%. *This ratio is high and it means that the weak ties are lower than strong ties in the network. The highest member is 35SDMED as a secretary of the MED cluster. The scores are 110.5. The weakest member is 95ADRD as an assistant director in the RD cluster. The scores are 12.0.*

Personal support: personal support has been discussed in the literature and has been examined through social network analysis. Personal support regarding degree centrality was lower than medium (17.14%) and *it is a positive degree because whenever the degree is low, it means that it is positive and supports the study.* The density of the whole network was low 0.1579. *It is a low score and needs enhancements.* The density in each cluster in the network is good and high as mentioned in the methodology chapter and *they participate to innovate the whole network through the connection with the main cluster that is in red color. Although the density is low, it does not ignore the network innovation inside the clusters and among clusters. The clusters participate to innovate relationships with other clusters. Network innovation can be done when all clusters participate with each other in the network.* Regarding weak and strong ties, the ratio of strong ties was higher and it is 60%. *This ratio is high and it means that the weak ties are lower than strong ties in the network. The strongest member is 35DMED as a secretary of the MED. The scores are 110.5. The weakest member is 95ADRD and the scores are 12.0.*

Information sharing: information sharing has been discussed in the literature and has been examined through social network analysis. Information sharing regarding degree centrality was (35.93%) and *it is a positive degree because whenever the degree is low, it means that it is positive and supports the study.* The density of the whole network was low 0.2090. *It is a low score and needs enhancements.* The density in each cluster in the network is good and high as mentioned in the methodology chapter and *they participate to innovate the whole network through the connection with the main cluster that is in red color. Although the density is low, it does not ignore the network innovation inside the clusters and among clusters. The clusters participate to innovate relationships with other clusters. Network innovation can be done when all clusters participate with each other in the network.* Regarding weak and strong ties, the ratio of strong ties was higher and it is 78%. *This ratio is high and it means that the weak ties are lower than strong ties in the network. The strongest member is 35SDMED as a secretary of the MED cluster. The scores are 130.0. The weakest member is 97ERD as a member in the RD cluster. The scores are 14.0.*

Summary of the findings, degree centrality is lower than medium and it is a positive degree because whenever the degree is low, it means that it is positive. Degree density is low (it needs enhancements) in the whole network, but degree density in subgroup (cluster) is high and good. Degree density does not support because it is low, but clusters support the study because they have high degrees and good inside clusters. The clusters participate to innovate the network with other clusters and they gather into one or several main clusters although the density in the whole network was low and this

case can be described as a positive. Weak and strong ties are measured and the ratio of strong ties among members is higher than weak ties in the network. The ratio supports the study and it is positive. All the findings were positive and support the study although the degree density of the whole network is high, clusters participated to innovate the network with other clusters. This case does not ignore the network innovation. If the clusters are weak and didn't participate to innovate the network with other clusters, network innovation cannot be successfully done because there is not participation among clusters.

CONTRIBUTIONS

The contribution that could be in this study gives a great impact. It focuses on covering the gaps that were not discussed, or not in a way that gives a complete idea about them. This study discussed its contents and findings briefly in the previous section. This study contributes to filling or covering the gaps in order to give a clear idea about the topic related to shared leadership theory and social network theory. Most of the previous studies cover variables. They seek specific goals either within the scope of shared leadership theory only or in the scope of the two theories as mentioned above. Discussing previous studies contributes to give an idea about the topic and its foundations, but the gaps remain not completely filled.

In a study by Sozen (2012), Susandy and Prasetyo (2019), and Mayo, Meindl, and Pastor (2002), social networks were discussed and analyzed. They include the administrative and relational aspects of individuals. Most of the studies did not cover the two aspects that are administration and relationships at the same time. Most of the studies used the different methods to understand findings. In this study, the administration and relational sides are discussed and analyzed. The two studies mentioned above covered this aspect, but some gaps need discussion and coverage. In this study, the dimensions of shared leadership theory contribute through social network theory theoretically and methodologically in order to provide an administrative and relational section in one idea. This study demonstrates the dimensions of *task coordination, personal support, and information sharing*. The dimensions can be the characteristics of the network innovation. The relationship between shared leadership

and social network selects the network innovation as it was discussed before. This study provides hypotheses that cover the most important issues in a network between actors. Hypotheses provide the degree of centrality, density, and weak and strong ties in order to demonstrate all sections that correlate individuals in a network. This study contributes to filling gaps between administration and relationships between individuals through studying and analyzing the dimensions and giving findings in the statistical description, network pattern, and weak and strong ties between individuals.

DIRECTIONS FOR FUTURE RESEARCH

Important directions for enhancements and future researches: first, increasing the quality and density of the communications among clusters in order to develop the ratio of density. Second, develop the strength of weak ties among members in order to complete the ratio of strong ties if it is low or high and as well as the ratio of the density in the whole network because they need enhancements. Third, innovating roadmap for linking the external networks based on internal networks according to the tasks or missions and this is a reason to make them ignored from the study because there is no roadmap among the internal and external networks.

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ANNEX 1: QUESTIONNAIRE

Age:

Gender:

Experience:

Position:

Please write the names and the positions and how many times weekly in the mentioned numbers bellow in the blanks that you have a relationship with them according to the following questions. Note: if they are more than 8, you can write their names according to the questions. Note: example: if your relationships with someone during the week between 3 or 4 times, you can cycle both 3 and 4.

Question1: which of your partners do you coordinate the tasks with him/her regarding the work?

- | | | | | | | |
|----------|---|---|---|---|---|---|
| 1- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 2- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 3- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 4- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 5- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 6- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 7- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 8- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
-

Question2: which of your partners do you exchange work-related information with him/her in a workplace?

- | | | | | | | |
|----------|---|---|---|---|---|---|
| 1- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 2- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 3- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 4- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 5- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 6- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 7- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 8- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
-

Question3: which of your partners do you get a personal support or advice with him/her regarding the work?

- | | | | | | | |
|----------|---|---|---|---|---|---|
| 1- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 2- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 3- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 4- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 5- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 6- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 7- _____ | 0 | 1 | 2 | 3 | 4 | 5 |
| 8- _____ | 0 | 1 | 2 | 3 | 4 | 5 |

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