# Communication-Network-Structure-and-The-Role-of-Actors-in-The-Spreading-of-Information-Technology-in-Seko-District

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# Communication Network Structure and The Role of Actors in The Spreading of Information Technology in Seko District

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*Abstract: This study aimed to determine the structure of networks and the role of actors in the use of information technology in Seko. This explorative research tried to reveal the actor who had an essential role in the dissemination of information technology in Seko. The network structure was identified through network density (density), centrality, distance and diameter, betweenness centrality, and closeness centrality. Then, network analysis was a complete network analysis with actor level of analysis where several actors suspected of playing a role in the dissemination of information technology given particular attention. Furthermore, the collected data is processed and interpreted using Microsoft NodeXL Version 1.0.1.113. From this, it is found that the structure of communication networks in Seko is spread with the level of connectedness between low actors. Only little-centralized location. The existing communication network has a positive and strong relationship with the dissemination of information technology.*

*Keywords: Communication network analysis, Graph density, Information Technology*

## Introduction

The history of the industrial revolution notes that technical development, changes in tools and machines are used more than information technology. Now the balance of the speed of technological progress has changed. Now technology to process information is faster than the development of technology for physical activities and costs are getting cheap. The cost to store data, process data and to spread the results continues to decline rapidly. Industry 4.0 transforms the traditional production system into the model Industrial Internet of Things (IIoT) (Liao et al. 2017). Although some of these technologies are positively associated to the expected industrial benefits while others are still at a very early stage of adoption (Dalenogare et al. 2018, 391) and seems much more gradual (Clark 2014).

Information Technology covers all forms of technology used to process information. The form can vary like a computer as a multimedia tool that is supported by software that is suitable for processing that information. This information technology, makes it easy for humans to do their work. Mobile phones are among the most common material objects today. Nowdays, mobile phone not only used for texting and phone calls but for social media, gaming, shopping or entertainment (Kardos et al. 2018). Some research show how the use of mobile phones to obtain market information on the selling price of rice in rural areas in Cambodia(Shimamoto, Yamada, and Gummert 2015) andfarmers' marketing decisions(Tadesse and Bahiigwa 2015). The increasing mobile phone use gradually adapts with healthcare system in rural Indian(Haenssgen 2018). Mobile phones clearly provide many benefits especially for rural communities. However, different things when in remote areas, where it is difficult to find a mobile phone tower, so that people only rely on direct communication for information dissemination.

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Forms of communication in rural areas are more likely to interpersonal communication. Menurut Roy Berko Interpersonal communication is the interaction between two people who share a relationship. The basis for interpersonal transactions is the sending and receiving of messages in such a way that the messages are successfully encoded and decoded (Berko, Aitken, and Wolvin 2010, 17). Thus interpersonal communication is the process of exchanging information between someone with at least one other person or usually between two people whose feedback can be immediately known. As the people involved in communication become increasingly perceptions of people in communication events, the complex communication becomes increasingly complex.

Seko is a remote district located in North Luwu District, South Sulawesi. Seko sub district has an area of 2199.19 km2 with a total population of 13,073 people. This means that every km of land is occupied by only 6 people. In other words, the level of community density is still very low. Educational facilities are basically available ranging from kindergarten, elementary, junior high, to high school, but the fragility is still limited. This is one of the reasons Seko was dumped by school-age children.

The equipments of communication are still very limited. Until 2017, practically there is only one cellular tower unit located in the Capital District. This amount is not enough to reach all corners of the village plus the geographical location in the form of mountains and dense forest.

Social Network Analysis (SNA) has been widely used by researchers to look at the patterns of rural community communication. Xu Wang et al used SNA to analyze the social network structure and characteristics of the village community in Yanhe China. Kenichiro Onitsuka and Satoshi Hoshino use SNA to identify key actors in a rural community in Kyoto Japan. This study tried to apply SNA to explore how are the networking structure and actor roles in the spread of Information technology in Seko District. Objectives of this study are as follows:

1. To construct the structure of sociogram to describe communication network structure in 12 villages in Seko district.
2. To Identify and analyze the level of density, centrality, and the distance and diameter to determine the role of the actors.

## Research Methods

This communication network research using quantitative approach is descriptive and correlation to describe social phenomenon in Seko district. This study tries to describe the communication network about who are the actors in the network. Communication network in this research is based on questionnaire instrument which is disseminated by the researcher. The focus of the research is to describe the communication network variables that are emphasized to complete network analysis.

### *Location and Time of Study*

This research was carried out in 12 villages in Seko district, North Luwu Regency. The study was conducted in March 2018.

### *Method of Collecting Data*

Data was collected using a closed questionnaire. The questionnaire contained questions about the sociogram that sought to find out who were the most frequent actors in Seko district using motorbike and aircraft as a transportation. At first, the questionnaire was given to each village head from all 12 villages in Seko district. Of the names mentioned, 4 lists of top names were

taken and then given a questionnaire with the same question. Then so on until there are no new names in the top 4 names list. This sampling method is then called snowball technique.

The results of the study, there are 54 names that often travel in and out of villages in Seko district through aircraft and motorbike. The data will provide information on the structure and pattern of the network. The process of input and data analysis is done by using software NodeXL Version 1.0.1.113. Other data are secondary data that is the data about geographical condition of Seko district obtained from document and some other literature.

The analysis process is then interpreted based on the output of the application. Network analysis emphasizes the analysis of the whole network by looking at the following indicators:

1. Density

   This indicator is to find out how often actors communicate with each other. The formula used is as follows:

$$D = \frac{l}{N(N-1)}$$

   D = Density, l = linkk number, and N = network size. The grade on density is about between 0 up to 1 where the density of a network is getting higher if close to 1.

2. Diameter

   It is to find out how far the distance and the average distance of each actor so that it can connect with each other.

3. Degree of Centrality

   This is to find out which actors / communities are most in contact with other actors. The rate of centrality level is in the number 0 - 1 which is getting closer to 1 the better. 0 means no one contacted or contacted by the actor and 1 means all actors contacted or contacted.

4. Closeness Centrality

   It is to find out how close one actor relation with other actors. The smaller the centrality value of closeness is the better.

5. Betweenness Centrality

   This indicator is used to find out actors who act as intermediaries of actors with each other. The centrality value between 0 - 1 which is getting closer to 1 is better.

## Results and Discussion

Geographically, every village in Seko district is located on a plateau bordered by dense forest. This resulted in difficult access to and from the village. To overcome its basic needs, local people rely on crops and occasionally travel by motorcycle and motorcycle taxi. Travel via motorcycle taxi can take 3 - 4 days journey so done together and in groups. This situation makes them have an important role as the bearer of information other than of course its role in bringing the village community to buy basic needs from other areas around Seko District. Based on the results of data processing, there are 54 people identified most often traveling out of the village as shown in Table 1 below:

Table 1: The Summary of Graph Metrics by NodeXL.

| Metric | Value |
|---|---|
| Vertices | 54 |
| Maximum Vertices in a Connected Component | 54 |
| Maximum Edges in a Connected Component | 201 |
| Maximum Geodesic Distance (Diameter) | 4 |
| Average Geodesic Distance | 2,16 |

| | |
|---|---|
| Graph Density | 0,14 |
| NodeXL Version | 1.0.1.113 |

*Source: Results of data processing*

Overall, the density of the 54th network is 0.14 (maximum density = 1). This figure is quite low and illustrates that the relationship between all actors in the network is not going well. This means that actors do not interact with all the actors in the network. This is possible because the geographical location of each village in Seko District is difficult to access.

The relatively loose network can also be seen from the total diameter of the network (Diameter) of 4. This can be interpreted as the furthest distance one actor can communicate with other actors in the network that is 4 steps. While the average geodesic distance of each actor in the network is 2.16 steps. This means that one actor can communicate with all actors in the network an average of 2.16 steps. In other words the 54 actors cannot directly communicate with each other but through the intermediary in order to connect with other actors in the network.

Table 2: Degree, Betweenness, and Closeness from The Network

| Vertex | Degree | Betweenness Centrality | Closeness Centrality | Eigenvector Centrality |
|---|---|---|---|---|
| Resp.1 | 15 | 0,983 | 1,774 | 0,266 |
| Resp.2 | 14 | 0,911 | 1,811 | 0,229 |
| Resp.3 | 13 | 0,691 | 1,830 | 0,239 |
| Resp.4 | 9 | 0,268 | 2,000 | 0,182 |
| Resp.5 | 13 | 0,770 | 1,906 | 0,213 |
| Resp.6 | 10 | 0,471 | 1,962 | 0,172 |
| Resp.7 | 8 | 0,242 | 2,000 | 0,159 |
| Resp.8 | 7 | 0,174 | 2,264 | 0,108 |
| Resp.9 | 14 | 0,815 | 1,887 | 0,235 |
| Resp.10 | 8 | 0,273 | 2,057 | 0,151 |
| Resp.11 | 10 | 0,442 | 2,038 | 0,162 |
| Resp.12 | 8 | 0,280 | 2,038 | 0,166 |
| Resp.13 | 10 | 0,535 | 1,943 | 0,172 |
| Resp.14 | 9 | 0,391 | 2,038 | 0,142 |
| Resp.15 | 12 | 0,733 | 2,019 | 0,162 |
| Resp.16 | 10 | 0,536 | 1,962 | 0,176 |
| Resp.17 | 14 | 1,000 | 1,792 | 0,225 |
| Resp.18 | 6 | 0,207 | 2,113 | 0,117 |
| Resp.19 | 9 | 0,355 | 2,038 | 0,157 |
| Resp.20 | 5 | 0,065 | 2,377 | 0,092 |
| Resp.21 | 6 | 0,125 | 2,226 | 0,115 |
| Resp.22 | 9 | 0,418 | 2,038 | 0,152 |
| Resp.23 | 5 | 0,070 | 2,208 | 0,110 |
| Resp.24 | 4 | 0,061 | 2,585 | 0,044 |
| Resp.25 | 5 | 0,132 | 2,245 | 0,103 |
| Resp.26 | 5 | 0,191 | 2,264 | 0,075 |
| Resp.27 | 5 | 0,133 | 2,302 | 0,084 |
| Resp.28 | 4 | 0,085 | 2,509 | 0,062 |

| | | | | |
|---|---|---|---|---|
| Resp.29 | 6 | 0,196 | 2,302 | 0,078 |
| Resp.30 | 8 | 0,373 | 2,151 | 0,119 |
| Resp.31 | 8 | 0,204 | 2,151 | 0,130 |
| Resp.32 | 5 | 0,120 | 2,264 | 0,084 |
| Resp.33 | 4 | 0,041 | 2,283 | 0,073 |
| Resp.34 | 5 | 0,054 | 2,170 | 0,113 |
| Resp.35 | 5 | 0,150 | 2,340 | 0,077 |
| Resp.36 | 5 | 0,127 | 2,283 | 0,082 |
| Resp.37 | 7 | 0,284 | 2,113 | 0,108 |
| Resp.38 | 6 | 0,103 | 2,264 | 0,102 |
| Resp.39 | 7 | 0,251 | 2,094 | 0,114 |
| Resp.40 | 5 | 0,117 | 2,321 | 0,081 |
| Resp.41 | 4 | 0,067 | 2,566 | 0,048 |
| Resp.42 | 9 | 0,508 | 2,075 | 0,120 |
| Resp.43 | 5 | 0,112 | 2,264 | 0,107 |
| Resp.44 | 9 | 0,376 | 2,038 | 0,157 |
| Resp.45 | 4 | 0,060 | 2,434 | 0,060 |
| Resp.46 | 5 | 0,073 | 2,321 | 0,097 |
| Resp.47 | 9 | 0,448 | 2,113 | 0,118 |
| Resp.48 | 5 | 0,089 | 2,302 | 0,088 |
| Resp.49 | 7 | 0,155 | 2,170 | 0,116 |
| Resp.50 | 9 | 0,435 | 1,943 | 0,160 |
| Resp.51 | 4 | 0,064 | 2,415 | 0,062 |
| Resp.52 | 5 | 0,092 | 2,283 | 0,088 |
| Resp.53 | 5 | 0,129 | 2,321 | 0,066 |
| Resp.54 | 4 | 0,065 | 2,509 | 0,052 |

*Source: Results of data processing*

The relationship that occurs is decentralized that is not centered on one actor only. This is shown from the value of degree of centrality which is only 0, 148 from the maximum value of 1.

Based on Table 2, Respondent 1 is an actor with the smallest closeness centrality of 1,774. It's mean that Respondent 1 only needs 1,774 or 2 steps to contact all other actors in the network. Respondent 1 is also an actor who has the highest eigenvector centrality value of 0.266. So that Respondent 1 has a network with important actors in the network. Meanwhile, Respondent 17 is the actor with the greatest betweenness centrality, namely 1. This means that Respondent 17 is the most important actor and most able to maximize communication in the network.

The pattern of communication between each actor looks like in Figure 1. Almost all actors communicate with 2 or 3 other actors. There are no "remote" actors, namely actors who are not connected with other actors.

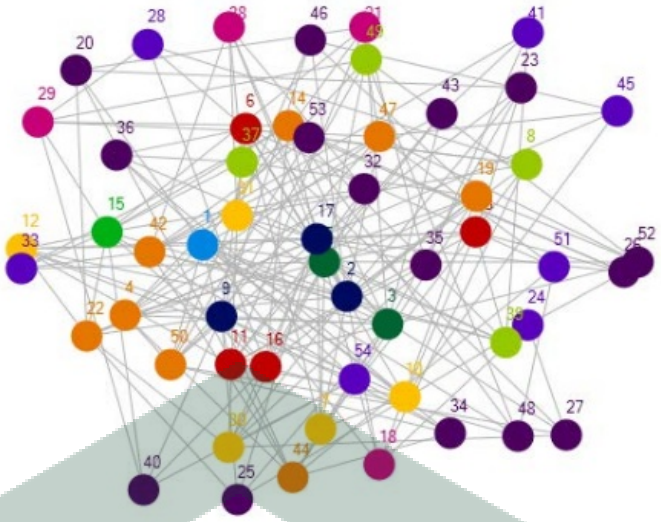

Figure 1: The Social Network in Seko
Source: Output NodeXL

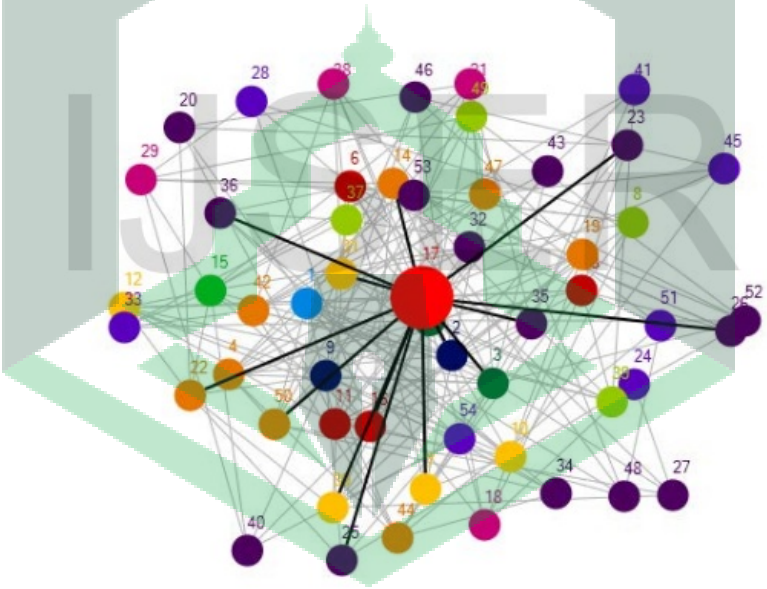

Figure 2: The Resp.17's Position in Social Network in Seko District
Source: Output NodeXL



Figure 2 shows the Respondent 17 in the structure of the communication network with the largest number of degrees, namely 14. Visually indicated by the number of lines connecting Respondent 17 with the other respondents in the network structure. Respondent 17 is also an important actor and were able to maximize communication in the network pattern because it has the greatest betweenness centrality.

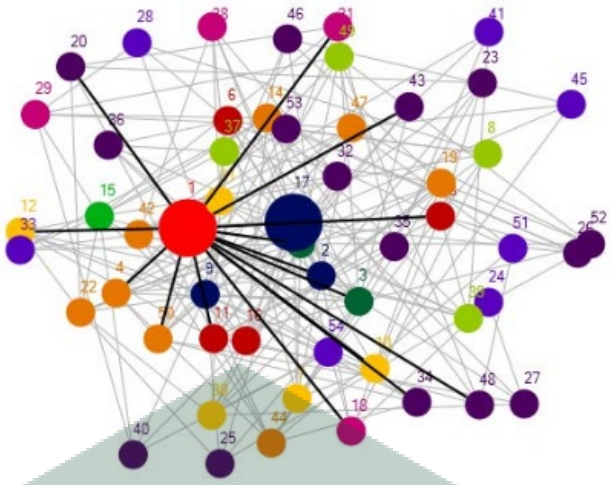

Figure 3: The Resp.1's Position in Social Network in Seko
Source: Output NodeXL

## Conclusion

The communication network structure at Seko district is decentralised (not centralised to one actor). From 54 actors, Respondent 1 is the closest with other actors and has network with important network. However, Respondent 1 is not the most important actor in the network. The Respondent 17 is the most important actor in the network because he has a role as mediator in the communication network among people in Seko district. The limitation of mobile phone towers is one of the reasons for the limited use of mobile phones in the activities of the Seko community. The wide area and extreme geographical location and other factors require the placement of mobile phone towers to be appropriate. The placement of this mobile phone tower can be the subject of further discussion as previous research on this matter (Yang et al. 2010).

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