SOCIAL NETWORK ANALYSIS AND DIFFUSION OF INNOVATION IN YOUTUBE'S TURMERIC HEALTH VIDEO

RISMA ZAHRA HANA [1] and RITA DESTIWATI [2]

[1,2] School of Communication & Social Sciences, Telkom University, Indonesia.
Email: [1]rismazahrahana@student.telkomuniversity.ac.id, [2]ritadestiwati@telkomuniversity.ac.id

Abstract

Health communication through the YouTube social media platform contributes to the dissemination of information about traditional medicine, including the utilization of herbs such as turmeric as an alternative to non-medical treatment. This study aims to determine the process of health behavior adoption through social networks in the comment section of the YouTube video "Benefits and How to Process Turmeric Properly for Health." The methodology employed was social network analysis (SNA), with a focus on four measurements: degree centrality, betweenness centrality, closeness centrality, and eigenvector centrality. The analysis was conducted using Rogers' diffusion of innovations theory. The findings indicate that the video commentary network has a decentralized structure with two central actors: @dr.Emasuperr (video owner) and @saptayusmana7022 (active user). The @dr.Emasuperr account has numerous connections and immediate access to all accounts, yet it exerts minimal influence on other accounts. In contrast, the account @saptayusmana@7022 has considerable influence on other accounts despite having fewer connections and slower access. The results of the diffusion of innovation analysis demonstrate that the video was adopted rapidly by numerous YouTube users, facilitated by the innovation, communication channel, time, and social system.

Keywords: Traditional Medicine, Health Communication, YouTube, SNA, Diffusion of Innovations.

INTRODUCTION

The slogan "Back to Nature" is one of the most popular catchphrase for a healthy lifestyle transition, which begins with the consumption of natural medicines. In order to support global public health, the World Health Organization (WHO) has recommended that its member countries utilize traditional medicine through its strategic plan, "WHO Traditional Medicine Strategy: 2014-2023." To date, more than 80% of the world's population in 170 of the 194 WHO member countries utilize various kinds of traditional medicine (WHO, 2023).

In Indonesia, the Ministry of Health of the Republic of Indonesia (Kemenkes RI) also recommends the use of traditional medicine for health maintenance and care as well as disease prevention, as outlined in Circular Letter Number: HK.02.02/IV.2243/2020. In accordance with Government Regulation Number 103 of 2014 concerning Traditional Health Services, traditional medicine encompasses materials or ingredients in the form of plants, animals, minerals, variant preparations, or a mixture of these materials. Indonesia, a tropical country, is renowned as a living laboratory due to its status as the global repository of 90% of all medicinal plants, which are classified as biopharmaceutical plants (Nisa, 2020). Turmeric is one of the most commonly used medicinal plants in Indonesia. Turmeric, believed to originate from the Southeast Asian region, has also been utilized in other countries, including India and China (Mutis & Karyawati, 2021). Turmeric contains a number of beneficial properties, including antioxidant, antibacterial, antiviral, antifungal, and anti-inflammatory effects, which can be

employed for therapeutic purposes (Shan & Iskandar, 2018). Currently, a significant proportion of the Indonesian population continues to utilise traditional medicine as a means of maintaining health and curing diseases. The results of the 2018 Basic Health Research (Riskesdas) indicate that 38.7% of the Indonesian population aged 10 years and over consumed traditional medicine. The utilisation of plants as a source of treatment has been a long-standing practice among the Indonesian people (Munaeni et al., 2022). The knowledge of the use of traditional medicine has been recognized since ancient times and has been passed down from generation to generation until it became a tradition (Nisa, 2020). The long tradition of using traditional medicine in Indonesia reflects the community's long-standing emphasis on the importance of maintaining health. This concept is in line with a broader understanding of disease as a condition that is socially recognized and requires special attention for healing.

The sociological concept of illness in the "illness" dimension concerns the manner in which society accepts those experiencing illness (both "illness" and "disease"). According to Wardhana, a person in a state of "illness" is typically granted a temporary reprieve from the responsibilities, roles, or habits typically carried out when healthy due to their unhealthiness. In the sociological context, illness is understood to entail a distinctive role that is lived in conjunction with the pain experienced, as well as novel responsibilities, namely the pursuit of healing (Wardhana, 2016). Consequently, a significant proportion of the population considers health to be of paramount importance and consistently strives for optimal health. Medical and non-medical treatments can be employed to facilitate a patient's recovery from an illness.

The rationale for selecting medical treatment is often based on the assumption that it has been subjected to rigorous scientific testing. However, it is not uncommon for patients to opt for non-medical treatments. Those who choose this route typically cite concerns about the potential side effects of medical drugs, the high costs associated with them, and the persistence of the illness despite the use of medical drugs (Andira & Pudjibudojo, 2020). Munaeni (2021) posits that the inclination to transition from pharmaceuticals to natural remedies is influenced by the social stigma surrounding chemical drugs, which are perceived as expensive and potentially harmful. The demand for traditional medicine is on the rise, with an increasing number of individuals turning to it as a non-medical alternative treatment. This is due to the numerous advantages it offers, including fewer side effects than medical drugs, ease of access, and affordable prices (Ifora et al., 2021). The growing popularity of alternative medicine underscores the significance of effective health communication as a means of disseminating information in the contemporary era.

The discipline of health communication plays a pivotal role in the digital age, where change is rapid, difficult to control, and can increase the risk of misinformation. Through health communication, misinformation can be addressed by delivering information that is easy to understand, accurate, and trustworthy, thereby enabling individuals to make informed decisions about their health. In the digital age, the roles of doctors, the government, and patients in supporting health campaigns are not mutually exclusive. Rather, they are interdependent (Solihin & Abdullah, 2023).

Table 1: List of Countries with the Most YouTube Users in the World Year 2023

No.	Country	YouTube Users
1.	India	462 million
2.	Amerika Serikat	239 million
3.	Brazil	144 million
4.	Indonesia	139 million
5.	Meksiko	83.1 million

Source: (We Are Social, 2023)

In conjunction with the advent of digitalization, social media has emerged as a prominent platform for health communication. The pervasiveness of internet access has made social media an invaluable tool for disseminating health information on a massive scale. Social media platforms are designed to facilitate the sharing and exchange of information, participation, and exchange of ideas in a visual network (Fitriyani, 2017). Among the most popular social media platforms for health education is YouTube. YouTube is the world's largest video sharing platform, presenting a wide variety of video content, including health-related content. As of October 2023, We Are Social's research results indicated that Indonesia is the fourth country with the most YouTube users in the world, reaching 139 million users. Consequently, numerous health experts utilize YouTube as a medium to share information by presenting health content.

One of the numerous channels on YouTube that addresses health-related topics is the @dr.Emasuperr account. In one of its videos, the @dr.Emasuperr account discusses the benefits and proper processing of turmeric for health. Turmeric is a medicinal plant with numerous benefits in Indonesia. The content about turmeric has gained significant traction with an audience of approximately 2.2 million YouTube users. The popularity of this content is closely related to the hereditary habits of Indonesian people, who frequently utilize herbal medicines and concoctions derived from plants as an alternative treatment. The @dr.Emasuperr channel presents content about turmeric in a manner that combines data, facts, and accessible discussions. This approach has garnered the channel over 18,000 likes and 1,489 comments from YouTube users who have viewed the video. The content features interactions between the doctor and the audience, as well as between fellow audiences.

The interactions within the YouTube video comment section can be identified through Rogers' Diffusion of Innovation (DOI) Theory. Rogers defines innovation as an idea, practice, or thing that is perceived as new by an adopting individual or group (Rogers, 2003). This perception of novelty can be relative, meaning that an innovation can be considered new to one individual but not to another. Concurrently, diffusion is the process of distributing innovations through specific communication channels within a specific period of time to members of the social system (Rogers, 2003). Diffusion of Innovation Theory describes the manner in which new ideas spread into a social system or population (Sanaji, 2015). In Al-Taie & Kadry's (2017) research, the diffusion of innovations in social processes is defined as the manner in which an innovation, such as videos, music, opinions, attitudes, trends, or products, can be disseminated through one individual to another within a social network over a specific period of time.

The Diffusion of Innovation Theory encompasses four main elements: innovation, communication channel, time, and social system. Innovation, in this context, can be defined as an idea, practice, object, or unit of adoption that is perceived as new by individuals. Innovation is characterized by several attributes, including relative advantage, suitability, complexity, trialability, and observability. The communication channel, as the second element, refers to the media utilized as a conduit for disseminating information about innovations. This channel can be either interpersonal communication or mass media. The third element is time, which encompasses the period required for individuals to learn about an innovation and subsequently decide whether to accept or reject it. This time can be relatively short or long. The social system, the final element, describes the interconnected network, comprising both individuals and groups with associated norms and values.

Diffusion of Innovations is the theory that most often applies network principles and perspectives in providing a theoretical foundation to study how a network influences and changes behavior (Al-Taie & Kadry, 2017). It was chosen to understand the process of health behavior adoption by YouTube users who watched the "Benefits and How to Process Turmeric Properly for Health" video.

This research was conducted based on several previous studies that examined the diffusion of innovations in social networks. Valente & Davis (2018) used the diffusion of innovations theory to study how social networks influence individual/group health behaviors in developing countries and the Americas. The findings indicate that individuals can be influenced by the social networks around them to eventually adopt new behaviors that affect important aspects, such as health. In accordance with previous research, Hartiningsih (2015) examined social networks in the diffusion of innovations related to Tungku Sehat Hemat Energi (TSHE) technology in Kulon Progo, Yogyakarta. This research demonstrates the pivotal role of social networks in the diffusion of TSHE innovations and the roles of the actors involved, thereby enabling the identification of the role of communication, particularly interpersonal communication, in the diffusion of TSHE innovations.

Conversely, Schuster & Koleck's (2020) research examines the global diffusion of Twitter-based social network innovations related to inclusive education. The study reveals the pivotal role Twitter plays for actors seeking to disseminate educational innovations with the aim of influencing educational policies, norms, and systems. Al-Razgan et al. (2021) also conducted research utilising Twitter social media. The study's findings indicate the percentage of acceptance and rejection using sentiment analysis within the context of the diffusion of innovation theoretical framework.

A review of previous literature reveals gaps in knowledge that this study aims to address. The study examines the relationship between social networks and the diffusion of innovations in YouTube social media comment sections, with a focus on health communication. While previous studies have discussed how social networks influence the diffusion of innovations in the context of medicine, new technology discovery, education, and women's rights, this study extends this analysis to examine the role of social networks in the diffusion of innovations in YouTube social media comment sections. In the context of innovation diffusion theory,

communication plays a pivotal role in driving social change within a community (Al-Razgan et al., 2021). The objective of this research is to examine the impact of SNA on the diffusion of innovation of the video "Benefits and How to Process Turmeric Properly for Health." The video, which offers guidance on the use of turmeric for health, has been widely shared on YouTube. This research aims to contribute to the limited body of knowledge on the use of herbal plants for health on YouTube social media. This novel approach will contribute to a more comprehensive understanding of the role of social media, not only as an entertainment medium, but also as a health promotion tool, with the objective of strengthening the positive reputation of YouTube social media.

METHOD

This research employs the Social Network Analysis (SNA) method. Tsvetovat and Kouznetsov (2011) define SNA as a study that utilizes graph theory to determine interactions and relationships between individuals. In this context, graph theory employs nodes and edges as the two main elements to represent actors who play a role in a community and the interactions between actors that are formed. This SNA method is predicated on the assumption of the significance of relationships between actors or nodes (Bakry & Kusmayadi, 2021). The research stages are illustrated in the chart below.
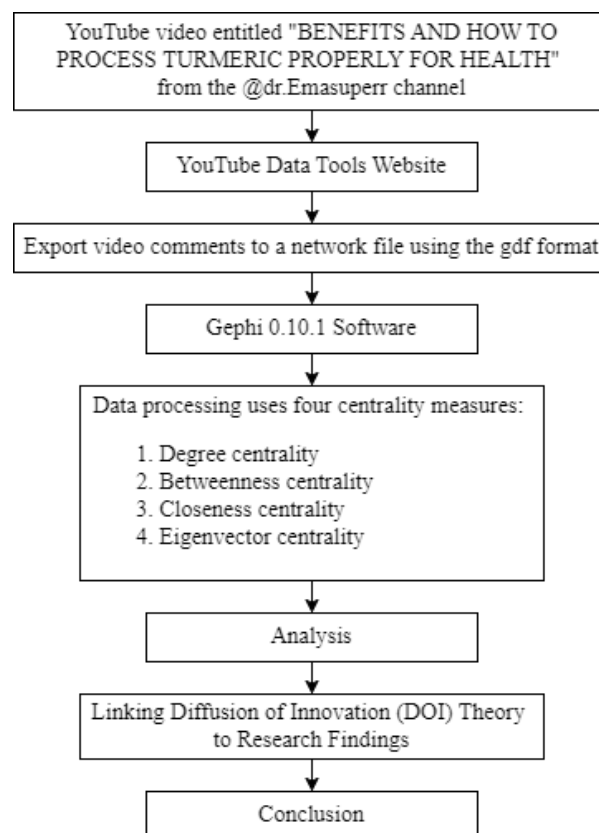

Figure 1: Chart of the Research Stages

The researcher obtained data related to user comments contained in the video "Benefits and How to Process Turmeric Properly for Health" through the YouTube Data Tools website. The data was collected on May 13, 2024. Researchers managed to identify a total of 1,085 actors (nodes) and 559 actor interactions (edges), which will be used for this research. The data was then processed using the Gephi application version 0.10.1, which enables the visualization of data to identify influential actors and actor interactions.

The Fruchterman Reingold algorithm was employed to visualize the data. This algorithm was selected due to its optimal spacing between nodes, its capacity to maintain relationships between nodes, and its high stability and convergence. Furthermore, this algorithm is suitable for various types of data, thus assisting users in comprehending the structure and relationships between nodes in the graph and producing visualizations that are informative and straightforward to comprehend (Fruchterman & Reingold, 1991).

In order to identify the most influential actors within the social network of user comments on YouTube videos, researchers employ a range of centrality measurement techniques, including degree centrality, betweenness centrality, closeness centrality, and eigenvector centrality. Degree centrality is utilized to ascertain the popularity of actors based on the highest number of relationships. Moreover, betweenness centrality can be understood as a measure of an actor's influence based on their capacity to facilitate connections between other actors within the social network. This refers to actors who act as intermediaries in the dissemination of messages. Closeness centrality is employed to assess the proximity between actors. Additionally, eigenvector centrality is utilized to determine the importance of the influence of actors who interact with actors within the social network.

The findings of the analysis of these measurements will be subsequently related to the Diffusion of Innovation Theory in order to determine the process of adopting YouTube users' health behaviors in the comments column of the "Benefits and How to Process Turmeric Properly for Health" video. SNA, as an adaptive research tool, can be integrated with various approaches and theories. The use of SNA permits the collection of pertinent data regarding social networks, thereby enabling the elucidation of the mechanisms underlying the implementation and dissemination of innovations, as well as the role of central actors in the innovation diffusion process (Houd & Amrani, 2021).

RESULT

In SNA, a node represents an actor or individual YouTube user, while the line that shows their activity in commenting is called an edge. The social network on the video "Benefits and How to Process Turmeric Properly for Health" was formed from 1,085 comments involving 559 YouTube user accounts. The data was then processed using four measurements (degree centrality, betweenness centrality, closeness centrality, and eigenvector centrality) with the Fruchterman Reingold algorithm.
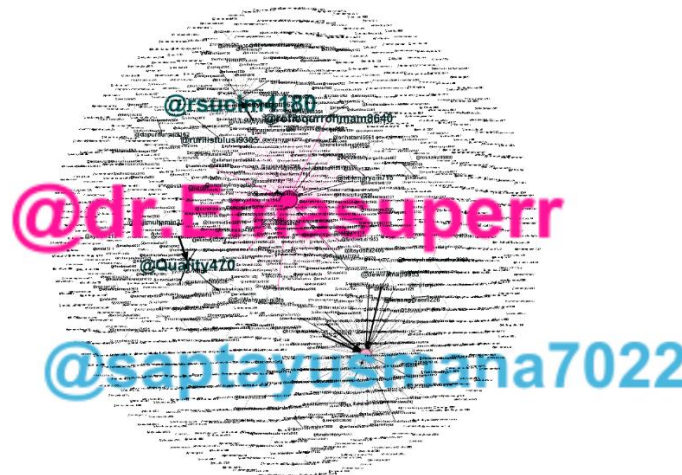
Table 2: Degree Centrality

No.	Actor	In-Degree	Out-Degree	Degree Centrality
1.	@dr.Emasuperr	6	176	182
2.	@saptayusmana7022	118	1	119
3.	@rsucim4180	30	1	31
4.	@Quality470	18	1	19
5.	@rofiequrrohmam8640	12	1	13

Source: Data Processing with Gephi Software, 2024

Table 2 illustrates that the @dr.Emasuperr account has the highest degree centrality value, which is 182. This value is indicative of the @dr.Emasuperr account's status as a central actor in the network, with the largest number of relationships with other accounts. The @saptayusmana7022 account is in second place with a value of 119, indicating its significant potential as a central actor in disseminating information on social networks. In the third, fourth, and fifth positions, we find accounts with a considerable difference in degree centrality. These are @rsucim4180 with a value of 31, @Quality470 with a value of 19, and @rofiequrrohmam8640 with a value of 13.

Upon closer examination, it becomes evident that the @dr.Emasuperr account possesses the greatest out-degree value, with a score of 176. Conversely, the @saptayusmana7022 account exhibits the highest in-degree value, with a score of 118. It can be concluded that the @dr.Emasuperr account is the only account that engages in the greatest number of social network comments within the video comments section, while the @saptayusmana7022 account is the account that receives the most reply comments from other YouTube users.

Figure 2: Degree Centrality Visualization

Source: Data Processing with Gephi Software, 2024

Figure 2 presents a degree centrality visualization, which indicates that two actors possess the greatest potential for disseminating information widely to YouTube users. These two actors are @dr.Emasuperr, representing the channel account on the YouTube video itself, and

@saptayusmana7022, representing a YouTube user account. The greater the number of relationships an actor has, the greater their potential to spread information to many YouTube users.

Table 3: Betweenness Centrality

No.	Actor	Betweenness Centrality
1.	@dr.Emasuperr	0.000899
2.	@dewiratnap9953	0.000003
3.	@trijiforji	0.000003
4.	@lisaanggraeni226	0.000002
5.	@saptayusmana7022	0.0

Source: Data Processing with Gephi Software, 2024

The results of measuring betweenness centrality using the Gephi 10.1 application are presented in Table 3. Only four accounts have a betweenness centrality value greater than zero. The @dr.Emasuperr account is the only account that has the largest value, 0.000899. The remaining three accounts, @dewiratnap9953, @trijiforji, and @lisaanggraeni226, have values of 0.000003, 0.000003, and 0.000002, respectively. In general, the value of betweenness is within the range of 0 to 1. The relatively low value of betweenness centrality indicates that these actors do not frequently act as intermediaries in the transmission of messages between other actors in the network.

Figure 3: Betweenness Centrality Visualization

Source: Data Processing with Gephi Software, 2024

Figure 3 presents a visualization of betweenness centrality. It is evident that only the @dr.Emasuperr account exhibits a clear visualization, as it possesses the largest betweenness centrality value. This indicates that @dr.Emasuperr plays a more central role in facilitating connections between other actors than other actors. Nevertheless, the value of 0.000899 can be considered relatively modest, suggesting that despite its extensive network of connections,

@dr.Emasuperr does not frequently act as a mediator in the delivery of messages between actors. In contrast, the account @saptayusmana7022, which has a value of 0, does not appear to play a role in facilitating the delivery of messages between actors in this network.

Table 4: Closeness Centrality

No.	Actor	Closeness Centrality
1.	@dr.Emasuperr	1.0
2.	@dewiratnap9953	1.0
3.	@trijiforji	1.0
4.	@lisaanggraeni226	1.0
5.	@ettyharyati9631	1.0

Source: Data Processing with Gephi Software, 2024

After taking measurements as listed in Table 4, @dr.Emasuperr is one of the accounts that has a value of 1 in closeness centrality. The value of 1 indicates that the @dr.Emasuperr account, as the owner of the YouTube video, is also an actor who has closeness to other individuals in the network. This means that @dr.Emasuperr can easily reach other actors in the network. A considerable number of actors possess a value of 1, yet the presentation of the entire data set would be impractical due to the sheer volume of information. The @saptayusmana7022 account, however, stands out as a notable exception, exhibiting a value of 0 in closeness centrality. This indicates that the @saptayusmana7022 account requires a longer period of time to reach other accounts. This indicates that the @saptayusmana7022 account has a smaller number of connections than the @dr.Emasuperr account.
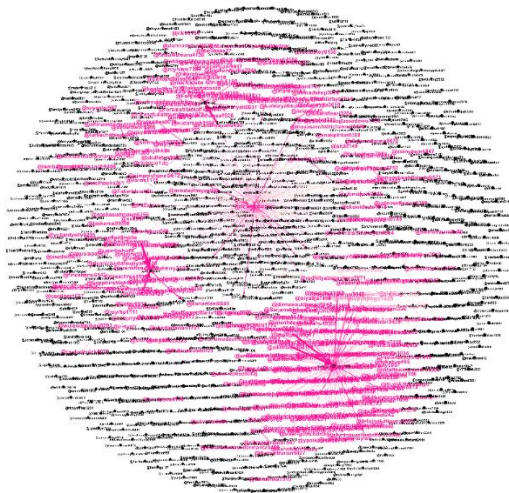
Figure 4: Closeness Centrality Visualization

Source: Data Processing with Gephi Software, 2024

As illustrated in Figure 4, no single account dominates the closeness centrality measurement; rather, a group of accounts exhibits the highest degree of closeness. This is due to the fact that as many as 287 YouTube user accounts, including the account of the YouTube video owner

@dr.Emasuperr, have the same closeness centrality value, which is 1. In other words, as many as 287 actors have proximity or fast reach access to other actors in the social network. The acquisition of this data can be validated from the figure above, which depicts the closeness centrality value of each actor. The pink color indicates actors who have a closeness centrality value greater than zero, while the actors symbolized in black have a closeness centrality value equal to zero. This demonstrates that the turmeric for health YouTube video comment network has a decentralized structure, indicating that no single account exerts complete control over the network.

Table 5: Eigenvector Centrality

No.	Actor	Eigenvector Centrality
1.	@saptayusmana7022	1.0
2.	@rsucim4180	0.29535
3.	@Quality470	0.150237
4.	@rofiequrrohmam8640	0.137399
5.	@titikmaryam715	0.078973

Source: Data Processing with Gephi Software, 2024

The final measurement taken in this study was eigenvector centrality. Table 5 shows that the @saptayusmana7022 account has the largest eigenvector centrality value, followed by four other accounts: @rsucim4180, @Quality470, @rofiequrrohmam8640, and @titikmaryam715. The @dr.Emasuperr account is positioned at the 47th rank with an eigenvector centrality value of 0.041699.
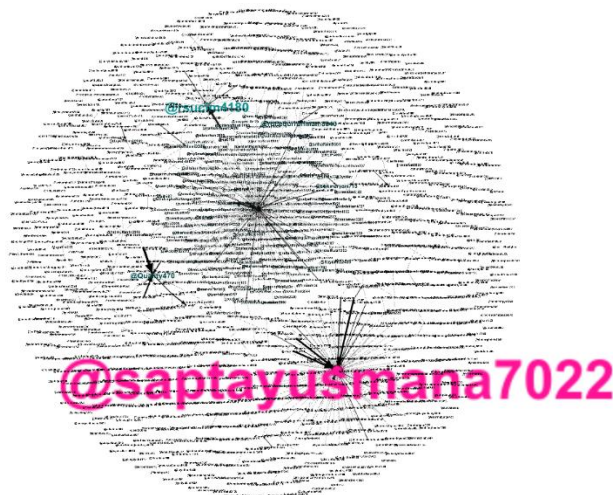
Figure 5: Eigenvector Centrality Visualization

Source: Data Processing with Gephi Software, 2024

Figure 5 presents a visual representation of eigenvector centrality. The @saptayusmana7022 account with the highest eigenvector centrality value exerts a considerable influence on the dissemination of information to other accounts within the network, despite its limited number

of connections and relatively slow access. Further analysis indicates that this phenomenon occurs because the @saptayusmana7022 account shares opinions based on its personal experience in the comments section, which are then widely approved and accepted by other YouTube users.

DISCUSSION

In the contemporary digital age, social networks can be formed through a multitude of avenues, extending beyond the limitations of face-to-face interactions. The advent of digital disruption has facilitated the development of technology that enables individuals to engage in social networking and interaction with greater ease and efficacy (Chang & Chang, 2023). Consequently, social media platforms, which represent a significant aspect of contemporary technology, can serve as a conduit for the formation of social networks. YouTube, for instance, is one of the most popular social media platforms. YouTube, a video-sharing platform, functions as a social networking site where registered users can rate, comment on, or share videos of their choosing (Ertemel & Ammoura, 2021). This discussion section presents an in-depth analysis of the processed data regarding the social network formed through the comments section of the YouTube video titled "Benefits and How to Process Turmeric Properly for Health" in relation to the Diffusion of Innovation Theory. This analysis includes the opinions of central actors who are influential in the dissemination of information related to the benefits and proper processing of turmeric and the process of health behavior adoption among YouTube users.

The analysis of centrality measurements, has identified two central actors in the social network of turmeric YouTube video comments for health. These are @dr.Emasuperr and @saptayusmana7022. The @dr.Emasuperr and @saptayusmana7022 accounts exhibit distinct strengths and weaknesses within the turmeric for health YouTube video social network. The @dr.Emasuperr account boasts a multitude of relationships and rapid access to all accounts, yet lacks significant influence over other accounts. Conversely, @saptayusmana7022 has considerable influence over other accounts, yet its network is comparatively smaller and its access is somewhat slower. The findings of SNA indicate that there is interaction between the doctor as the video educator and the users, as well as between the users in the video comments. These interactions support the dissemination of information about the benefits and proper processing of turmeric for health. This social network, formed through YouTube video comments, demonstrates how information can spread widely through interactions between users. Moreover, to gain further insight into the manner in which this information is received and adopted, it is essential to relate these findings to the Diffusion of Innovations Theory. This theory comprises four principal elements: innovation, communication channel, time, and social system. Through the SNA findings, it becomes evident that each element in the Diffusion of Innovations Theory plays a role in the process of disseminating information about turmeric on YouTube. In general, the process of Rogers' Diffusion of Innovation Model can be observed in Figure 6.
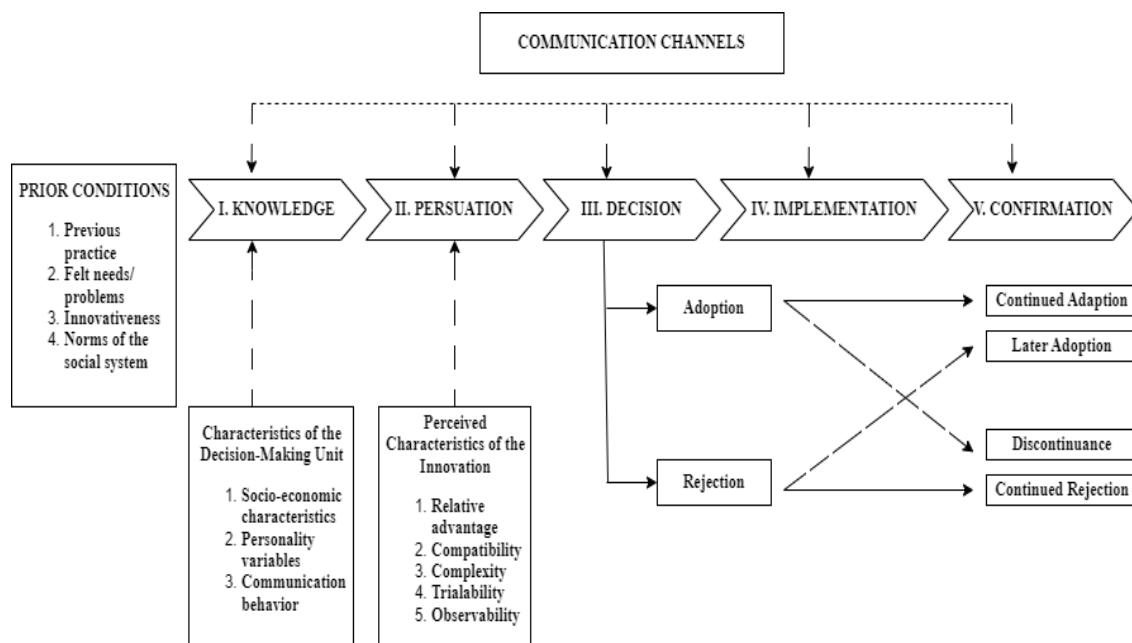
Figure 6: A Model of Stages in the Diffusion of Innovation Process

Source: Rogers, 1983

The first element of the Diffusion of Innovation Theory is the innovation itself. The innovation under consideration in this study is the use of YouTube media to share informational videos. The YouTube video can be categorized as an innovation because it presents new information based on facts and scientific research on the health benefits and processing of turmeric. The SNA analysis indicates that the YouTube video has been widely adopted by numerous users, with @dr.Emasuperr as the video's owner and @saptayusmana7022 as a prominent figure in the dissemination of supportive content. The video's characteristics facilitate its adoption.

The first characteristic is relative advantage, whereby the YouTube video offers new information about the health benefits of turmeric and how to properly process it that most audiences may not be aware of. The video provides an explanation of the health benefits of turmeric that is complemented by scientific data. For example, at 00:24, it is described as an anti-inflammatory, at 01:27, it is shown to protect heart function, at 01:56, it is demonstrated to overcome depression, and at 02:38, it is illustrated as a treatment for rheumatism.

It has been demonstrated that turmeric can reduce the symptoms of acid reflux (03:28), improve menstrual cycles (03:51), overcome symptoms of polycystic ovary syndrome (PCOS) and endometriosis (04:27), and reduce premenopausal symptoms including joint pain, inflammation, bone fractures, osteoporosis, and hot flashes (04:40). This information can assist the audience in improving their health. It is more accessible because it can be accessed at any time and from any location with an internet connection. Therefore, it does not require any physical mobility.

The second characteristic of innovation is compatibility. The video is compatible with the values, beliefs, and experiences of the audience because, as Indonesians, the consumption of turmeric has long been used in traditional medicine for generations. Furthermore, the information in the video aligns with the current "back to nature" healthy lifestyle trend. The third characteristic of innovation is complexity. The YouTube video is straightforward to comprehend and follow, as it is presented in a clear and concise manner with language that is easily understood by the general public. The content in the video is also enhanced with engaging illustrations, animations, and demonstrations that facilitate the audience's comprehension of the conveyed meaning.

Triability is the fourth characteristic of innovation. The video also presents a tutorial on the proper processing of turmeric, which can be easily applied in everyday life. In order to obtain the optimal benefits of turmeric, it is recommended to cook it as described at the second (06:07), eat it with fat (06:23), and add ingredients containing piperine substances (06:47). The necessary ingredients are also easily obtainable, inexpensive, and available in nature. The final characteristic is observability, whereby the benefits of consuming turmeric that is processed properly can be observed directly by the individual who tries it. The information presented is derived from trusted scientific sources. Furthermore, testimonials can be found in the comments section, where numerous individuals share their experiences of consuming turmeric to recover from illness and agree on the positive impact of using turmeric.

The communication channel represents the second element of the Diffusion of Innovation Theory. The channel utilized is the YouTube social media platform, where videos and comments serve as the primary means of information dissemination. The YouTube comment network subsequently became the principal communication channel for the dissemination of information about the turmeric for health YouTube video. In SNA, the accounts @dr.Emasuperr and @saptayusmana7022 played an important role as central actors in disseminating information related to the YouTube video. The reason why both accounts are central actors is because the doctor is believed to be someone who is an expert in the field of health, while the user account provides genuine testimonials based on his experience. The selection of medical professionals with extensive knowledge in the field of medicine can assist in overcoming health issues that have not been resolved by other means. This is because individuals tend to choose reliable communicators who can influence behavior change towards a healthy lifestyle (Destiwati, 2023). In line with this assertion, @dr.Emasuperr, an educator in the video, conveys information in a clear, straightforward, and easily understandable manner, and provides tutorials that can be easily practiced by the audience. Similarly, @saptayusmana7022, a YouTube user, provides his testimony until it is finally accepted, approved, and followed by other users. The wider community can easily share information, contribute, and create new spaces openly, as well as distribute discourses and viewpoints on the internet and social media platforms (Destiwati, 2023).

The communication channels on the YouTube comment network can be classified into two categories: interpersonal and mass communication channels. Interpersonal communication occurs when individuals in the network engage in direct discourse, such as through the

exchange of comments. In contrast, mass communication occurs when individuals in the network engage in discourse that is intended for the entire audience of YouTube users. Conversely, it can be classified as mass communication when commenting is intended for the entire audience of YouTube users, so that the message can be accessed by everyone and others can freely reply to the message, offering their approval, opinions, rebuttals, or questions. Mass communication channels are more effective in creating knowledge related to the innovations being disseminated, while interpersonal communication channels are more effective in shaping and changing attitudes towards new ideas so that they can influence the decision to adopt new ideas (Rogers, 2003).

The third element in Rogers' Diffusion of Innovations Theory is time. This encompasses the speed of diffusion, the stages of diffusion, and the factors that influence diffusion time. Time is a crucial factor in the innovation diffusion process. Individuals make decisions related to innovations at various stages, starting from their first knowledge of innovations to later knowledge and forming attitudes towards these innovations. They may then decide to adopt or reject these innovations, or they may implement them. At any stage, confirmation of these decisions is possible. The SNA of YouTube videos on the benefits and proper processing of turmeric for health reveals that these videos have been adopted rapidly by a significant number of YouTube users. This is evidenced by the numerous comments from individuals who have incorporated turmeric into their diets and have experienced positive health outcomes. The prevalence of comments that express agreement, acceptance, and positive opinions, as well as recommendations to others, indicates that the diffusion of innovation has been widely accepted. This suggests that the video innovation diffusion process occurred in a relatively short time. The SNA results do not explicitly demonstrate the stages of diffusion of the video innovation. Therefore, identification is necessary with regard to the content and comments in the video. However, based on the findings about the central influential actors, it can be stated that the video has entered the stage of wider adoption. Factors that may influence the timing of the diffusion of the video innovation include the characteristics of the innovation, testimonials from YouTube users, and the effectiveness of the communication channel. The process can be divided into five conceptual stages: knowledge, persuasion, decision, implementation, and decision. These stages are presented using content identification and video comments. The knowledge stage describes how individuals initially learned about the existence of turmeric for health purposes. This knowledge is obtained through various communication channels, including watching a live glimpse of the video, receiving recommendations from friends or family, conducting a YouTube search, viewing advertisements on YouTube or social media, and reading news articles or blogs. At this stage, individuals have limited information about the YouTube video and are not necessarily interested in learning more about it or adopting it as a health behavior.

Upon learning about the video, individuals begin to assess whether they are interested in learning more about it. This assessment involves considering the benefits and drawbacks of the video, whether it matches their preferences, and how it can help them. They may watch the video in its entirety, read comments from other users, or seek information from other sources. The findings indicate that the accounts @dr.Emasuperr as a video educator and

@saptayusmana7022 as an active user play an important role in this stage of persuasion. The @dr.Emasuperr account proactively provides additional information by answering questions from other users. For example, the following message replies from the @dr.Emasuperr account to users who request more information illustrate this dynamic:

> @dr.Emasuperr *"Hello Sri Hatami, this method can get the benefits of tamarind and kunir, but for curcumin from turmeric, you should mix it with a little fat. If you are afraid of milk, you can use olive oil or nuts are also rich in good fats. Hopefully this answer helps. Don't forget to be happy today Sri Hatami and always be healthy"*

> @dr.Emasuperr *"Hello Sri Sugiarti, you are absolutely right... just a little bit of pepper for flavor. Turmeric can be fresh enough for 2 thumbs every time you boil it. Can be mixed with milk, drink turmeric while eating morning, noon, afternoon when there is fat content.. hopefully the symptoms will decrease quickly and good health always Sri Sugiarti"*

The @saptayusmana7022 account plays a role in sharing its experience of successfully recovering from illness by consuming natural ingredients such as turmeric. The following is a comment message from the @saptayusmana7022 account in the YouTube video:

> @saptayusmana7022 *"Sorry just sharing this is my personal experience... If you drink turmeric by boiling, the effect is less than the maximum from my experience, I was once sick with stomach acid quite acutely until it was difficult to walk and felt pain and body heat, I had already checked with a doctor and changed doctors three times without getting better, until I finally gave up hope, I didn't drink medicine, I drank grated turmeric squeezed with honey without cooking three times a day, to eat cm porridge/mushy rice with boiled egg side dishes (don't eat and drink flavored and oily, (all food is boiled without frying) balanced by drinking enough clear water. In less than 4 days it has recovered, but it must be patient, the effect is gradual unlike taking medicine, patient and painstaking 4 hours, God willing, it will recover, it is different from taking medicine where the medicine is taken immediately the body is good, but for a while the effect of the drug runs out the body is not good anymore... The method I use has also been tried by me to a neighbor who has the same complaint. And Alhamdullilah healed. All thanks to the permission of Allah SWT. And Alhamdullilah, it has been almost 20 years since then when I feel sick, I make my own traditional medicine manually from ingredients that come from the ground such as turmeric, ginger, temulawak, cassava and the like plus moringa leaves. Without taking antibiotics"*

At the persuasion stage, YouTube users begin to consider adopting the innovation. Findings based on research data show that the video has been commented on by more than a thousand YouTube users. The majority of comments provide testimonials, ask about health cases, and thank the creators for the information provided in the video. Therefore, it can be said that the level of enthusiasm for the video is high.

After the persuasion stage, individuals will decide whether they adopt or reject the innovation. In the context of this research, innovations in the form of YouTube videos containing information on the benefits and how to properly process turmeric are adopted by audiences who are convinced and interested in the information presented in the videos. Factors that can influence individual adoption process decisions include: source credibility, information quality, interest and relevance of information to individual needs, individual personal experience with turmeric, and individual perceptions of the benefits and risks of consuming turmeric. The research findings indicate that the video has been adopted rapidly by a significant number of YouTube users, with a high rate of comments and numerous users reporting that they have tried consuming turmeric as a medicinal alternative.

> @seawoman15 "My personal experience for chronic stomach acid, namely turmeric on a grater, then brewed hot water. Wait a few minutes until warm br drink. Drink it morning and night before eating. Maknyusss. Only 2 days lgsg complete."

> @rsucim4180 "My experience routinely drinking turmeric tea every day for 3 years, making it easy is only half a thumb turmeric thinly sliced and then brewing warm water, the benefits are many, it even feels smooth skin, wrinkles are less, even though I have never been to a facial treatment clinic. My age is 41, often mistaken for 27. Alhamdulillah."

Once individuals have adopted innovations, they will begin to apply or implement the information they have learned in their daily lives. This implementation can take the form of consuming turmeric in various forms, changing their diet, adopting a healthier lifestyle, and adding turmeric to the food or drinks they consume. The research findings indicate that many YouTube users have tried consuming turmeric or adding it to dishes. At this stage, Youtubers are beginning to experience the benefits of these innovations. The following is an example of a comment reply message that initiated the implementation of the innovation.

> @chois_motivation "Thank you for the description of the experience, for sharing important information... I have applied this, I often have acid reflux, until wheezing and heavy breathing+coughing... after drinking according to your advice, now it's better... and the mood is also better... usually this relapses when I feel anxious and eat wrong... now I have been drinking it regularly... what I want to ask, can it be consumed 3x every day?? Thank you"

The final stage of the innovation diffusion process is confirmation, during which individuals re-evaluate their satisfaction with their decision to adopt the innovation. For YouTube users who perceive the benefits of the innovation to be greater, they are more confident in their adoption decision and are therefore able to recommend the video to their relations. At this stage, YouTube users become agents of the diffusion of the innovation. Conversely, YouTube users will cease consuming turmeric if they do not experience the benefits. The research findings indicate that a significant proportion of YouTube users provided positive feedback about the video and reported experiencing benefits after initiating turmeric consumption. The following examples illustrate the messages from users who benefited from the innovation.

@trisetyahaniksuratno3909 "I have a personal experience, at that time the children were out of town and I was alone at home, my stomach hurt more than three times, I was confused about the medicine for stomach pain, finally I grated 3 fingers of turmeric, I added boiled water to a glass and then I filtered it, I drank it warm, Alhamdulillah, it was really a valuable experience."

@srinovitaria7486 "Sharing from my experience, 1. My husband is a patient with intestinal cancer, rectum when bleeding medicine from the doctor, tranexamic acid at that time ran out, so I used 3 old turmeric, I grated it directly, drank it immediately the bleeding stopped. 2. When I had diarrhea 7x and vomited 3, I sliced the size of an old turmeric thumb, I gave boiling hot water to cover 10 minutes until the water turned yellow, I drank it and I drank slowly, Alhamdulillah, it decreased and 2 times I drank it. Immediately the stomach felt good and didn't even vomit and diarrhea. Hope it helps"

The social system represents the final element in the Diffusion of Innovations Theory. Social systems encompass norms and values, social network structure, and opinion leadership. Norms and values related to health and healthy lifestyles can drive behavioral adoption based on turmeric for health YouTube videos. These norms and values are linked to the hereditary traditions of Indonesian ancestors who utilized herbal plants to treat diseases and support stamina to maintain health. This tradition is of relevance to the experiences of audiences seeking information about traditional health treatments. WHO and Kemenkes RI also advocate the use of traditional medicine, making it appropriate and relevant to the social system formed. The decentralized structure of YouTube's comment network allows information about the video to spread quickly and easily. Furthermore, there is opinion leadership, which is measured by the extent to which a person can influence the attitudes and behaviors of others in a social network. The accounts @dr.Emasuperr and @saptayusmana7022 can be considered opinion leaders in the network, as they exert influence over YouTube users' decisions to adopt health behaviors from the video. The trustworthiness of information circulating can be influenced by several factors, including the credibility of the source and the credibility of information or messages shared by opinion leaders (Nur, 2023). The credibility of a source indicates the reliability of the message communicator, while the credibility of the information or message is determined by the accuracy of the content delivered. Finally, the social system describes the network of users who interact with each other and share information derived from central actors. The combination of these four elements provides a more comprehensive insight into the process of innovation diffusion in digital environments.

CONCLUSION

The SNA results of the YouTube video commentary "Benefits and How to Process Turmeric Properly for Health" indicate that the information was adopted quickly and easily by many YouTube users. The network structure of the video comment is decentralized, with two central actors: @dr.Emasuperr as the video owner and @saptayusmana7022 as an active user. The @dr.Emasuperr account has numerous connections and rapid access, yet its influence on other

accounts is relatively limited. In contrast, the @saptayusmana7022 account exerts considerable influence on other accounts despite having fewer connections and slower access. The video's diffusion process is driven by a combination of factors, including the innovation itself, the decentralized network structure, the role of central actors in the social network, the innovation's easy-to-adopt characteristics, mass and interpersonal communication channels, a relatively short adoption time, and supportive social system factors, such as value norms related to traditional medicine and opinion leadership from two central actors.

References

1) Adiyasa, M. R., & Meiyanti. (2021). Pemanfaatan obat tradisional di Indonesia: distribusi dan faktor demografis yang berpengaruh. *Jurnal Biomedika dan Kesehatan*, 130-138. doi:10.18051/JBiomedKes.2021.

2) Aisyah, P. N., Nusantara, G., & Sjafirah, N. A. (2022). Analisis Jejaring Sosial Peran Pers Dalam Penyebaran Informasi Terkait Kebijakan Ppkm. *Jurnal Komunikasi Global*, 43-65. doi: https://doi.org/10.24815/jkg.v11i1.24555

3) Alamsyah, A., & Ramadhani, D. P. (2020). *Pengenalan Social Network Analysis: Konsep dan Praktis.* Bandung: CV Sadari.

4) Al-Razgan, M., Alrowily, A., Al-Matham, R. N., Alghamdi, K. M., Shaabi, M., & Alssum, L. (2021). Using diffusion of innovation theory and sentiment analysis to analyze attitudes toward driving adoption by Saudi women. *Technology in Society*, 1-11. doi:https://doi.org/10.1016/j.techsoc.2021.101558

5) Al-Taie, M. Z., & Kadry, S. (2017). Information Diffusion in Social Networks. *Python for Graph and Network Analysis*, 165-184. doi:10.1007/978-3-319-53004-8_8

6) Andira, D. A., & Pudjibudojo, J. K. (2020). Pengobatan Alternatif Sebagai Upaya Penyembuhan Penyakit. *Jurnal Insight*, 393-401. doi:10.32528/ins.v%vi%i.2053

7) Annur, C. M. (2023, November 24). *Indonesia Peringkat Keempat Pengguna YouTube Terbanyak Dunia*. From databoks.katadata.co.id: https://databoks.katadata.co.id/datapublish/2023/11/24/indonesia-peringkat-keempat-pengguna-youtube-terbanyak-dunia

8) Bakry, G. N., & Kusmayadi, I. M. (2021). Peran Pers Sebagai Aktor Gerakan Digital Tagar #SolidaritasUntukNTT di Twitter. *Jurnal Kajian Jurnalisme*, 98-114. doi:10.24198/jkj.v5i1.33458

9) Bidang SDK. (2023, August 20). *KTT Global tentang Pengobatan Tradisional Pertama di Dunia*. From dinkes.jogjaprov.go.id: https://dinkes.jogjaprov.go.id/berita/detail/konferensi-tingat-tinggi-global-tentang-pengobatan-tradisional-pertama-di-dunia

10) Chang, C. W., & Chang, S. H. (2023). The Impact of Digital Disruption: Influences of Digital Media and Social Networks on Forming Digital Natives' Attitude. *Sage*, 1-10. doi:10.1177/21582440231191741

11) Destiwati, R., Wahyudin, U., Dida, S., & Rachmawati, T. S. (2023). The Influence of The Ulama on The Public's Interest in Selecting The Thibbun Nabawi Treatment Through Social Media. *The Seybold Report*, 2339-2350. doi:10.17605/OSF.IO/23MD9

12) Dinas Kesehatan DIY. (2022, April 19). *Penyelenggaraan Pengobatan Tradisional di Indonesia*. From dinkes.jogjaprov.go.id: https://dinkes.jogjaprov.go.id/berita/detail/penyelenggaraan-pengobatan-tradisional-di-indonesia

13) Ertemela, A. V., & Ammoura, A. (2021). Is YouTube a Search Engine or a Social Network? Analyzing Evaluative Inconsistencies. *Business and Economics Research Journal*, 871-881.

14) Fitriani, Y. (2017). Analisis Pemanfaatan Berbagai Media Sosial sebagai Sarana Penyebaran Informasi bagi Masyarakat. *Paradigma*, 148-152. doi:https://doi.org/10.31294/p.v19i2.2120

15) Gephi. (2011, June 13). *Gephi Tutorial Layouts.* From gephi.org: https://gephi.org/users/tutorial-layouts/

16) Hartiningsih. (2015). Jejaring dalam Difusi Inovasi Tungku Sehat Hemat Energi (TSHE) Kasus: Kulon Progo D.I. Yogyakarta. *Jurnal Pekommas*, 73-82. doi:https://doi.org/10.30818/jpkm.2015.1180201

17) Houd, Y. B., & Amrani, M. e. (2021). Social Network Analysis: A useful tool for studying Innovation diffusion processes. *An International Journal on Agricultural and Food Systems*, 1-59. doi:10.3280/ecag2022oa12059

18) Idris, H. (2019). *BACK TO NATURE Memanfaatkan Tanaman Obat Keluarga (TOGA).* Palembang: UNSRI Press.

19) Ifora, Sintia, B., & Srangeng, Y. (2021). Pengaruh Penghambatan Enzim Siklooksigenase-2 dan Aktivitas Antiinflamasi dari Ekstrak Daun Ketumbar (Coriandrum sativum L.). *Jurnal Kefarmasian Indonesia*, 17-24. doi:10.22435/jki.v11i1.3487

20) Kementerian Kesehatan RI. (2021, June 22). *SE Dirjen Yankes nomor: HK.02.02/IV/2243/2020.* From yankes.kemkes.go.id: https://yankes.kemkes.go.id/view_unduhan/50/se-dirjen-yankes-nomor-hk0202iv22432020

21) Mirza, Amanah, S., & Sadono, D. (2017). Tingkat Kedinamisan Kelompok Wanita Tani dalam Mendukung Keberlanjutan Usaha Tanaman Obat Keluarga di Kabupaten Bogor Jawa Barat. *Jurnal Penyuluhan*, 181-193. doi:https://doi.org/10.22500/13201716090

22) Mulyana, D., & Ganiem, L. M. (2021). *Komunikasi Kesehatan: Pendekatan Antarbudaya.* Jakarta: Kencana.

23) Mulyana, D., Hidayat, D. R., Karlinah, S., Dida, S., Silvana, T., Suryana, A., & Suminar, J. R. (2018). *Komunikasi Kesehatan: Pemikiran dan Penelitian.* Bandung: PT Remaja Rosdakarya.

24) Munaeni, W., Mainassy, M. C., Puspitasari, D., Susanti, L., Endriyatno, N. C., Yuniastuti, A., . . . Rollando. (2022). *Perkembangan Dan Manfaat Obat Herbal Sebagai Fitoterapi.* Makassar: CV Tohar Media.

25) Mutis, A., & Karyawati, A. T. (2021). Potensi Kunyit (Curcuma Longa) Sebagai Nutraceutical. *Jurnal Biotropikal Sains*, 93-101.

26) Nisaa, K. (2020). Pemanfaatan Tanaman Kunyit (Curcuma longa) Untuk Dijadikan Jamu Tradisional Sebagai Obat Penyakit Maag Didaerah Sumber, Kabupaten Cirebon. *Scientiae Educatia: Jurnal Pendidikan Sains*, 1-11. doi:http://dx.doi.org/10.24235/sc.educatia.vxix.xxxx

27) Nur, M. (2023). Eksperimen Isu Apbn Di Media Sosial: Peran Penting Pegawai Sebagai Opinion Leaders. *Indonesian Treasury Review: Jurnal Perbendaharaan, Keuangan Negara dan Kebijakan Publik*, 149-169. doi:https://doi.org/10.33105/itrev.v8i2.515

28) Rogers, E. M. (1986). *Communication Technology: The New Media in Society.* New York: The Free Pres.

29) Rogers, E. M. (2003). *Diffusion of Innovations Fifth Edition.* New York: Free Press.

30) Sanaji. (2015). Struktur Jaringan Dalam Adopsi Inovasi: Studi Konseptual. *An Nisbah*, 135-154. doi:10.21274/an.2015.1.2.135-154

31) Schuster, J., & Kolleck, N. (2020). The Global Diffusion of Social Innovations - An Analysis of Twitter Communication Networks Related to Inclusive Education. *Front. Educ*, 1-11. doi:https://doi.org/10.3389/feduc.2020.492010

32) Solihin, O., & Abdullah, A. Z. (2023). *Komunikasi Kesehatan Era Digital: Teori dan Praktik.* Jakarta: Kencana.

33) Tim Penyusun Riskesdas 2018. (2019). *Hasil Utama Riskesdas 2018.* Jakarta: Lembaga Penerbit Badan Penelitian dan Pengembangan Kesehatan.

34) Tsvetovat, M., & Kouznetsov, A. (2011). *Social Network Analysis for Startups: Finding connections on the social web.* Sebastopol: OReilly Media.

35) Valente, T., & Davis, R. (2018, May 31). *Diffusion of innovations within social networks.* From researchfeatures.com: https://researchfeatures.com/diffusion-innovations-within-social-networks/

36) Wahyuni, S., Kuncoroyakti, Y. A., & Ariq, M. (2023). Analisis Jaringan Komunikasi Pada Akun @Kemenkesri Di Media Sosial Twitter. *Jurnal Sosial Humaniora dan Pendidikan*, 70-76. doi:https://doi.org/10.56127/j

37) Wardhana, M. (2016). *Filsafat Kedokteran.* Denpasar: Vaikuntha International Publication.

38) World Health Organization. (2013). *WHO Traditional Medicine Strategy 2014-2023.* Geneva: WHO Press.

39) World Health Organization. (2023, August 9). *Traditional medicine.* From www.who.int: https://www.who.int/news-room/questions-and-answers/item/traditional-medicine

40) Shan, C. Y., & Iskandar, Y. (2018). Studi Kandungan Kimia Dan Aktivitas Farmakologi Tanaman Kunyit (Curcuma longa L.). *Jurnal Farmaka*, 547-555. doi:https://doi.org/10.24198/jf.v16i2.17610