A SOCIAL NETWORK ANALYSIS OF THE USE OF SOCIAL MEDIA TO PROMOTE AGRICULTURE TO INDONESIAN YOUTH

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by

MUH. SYUKRON

Dr. Hua Qin, Thesis Supervisor

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The undersigned, appointed by the dean of the graduate school, have examined the Thesis entitled

A SOCIAL NETWORK ANALYSIS OF THE USE OF SOCIAL MEDIA TO PROMOTE AGRICULTURE TO INDONESIAN YOUTH

presented by Muh. Syukron,

a candidate for the degree of Master of Science

and hereby certify that, in their opinion, it is worthy of acceptance.

Hua Qin, Ph.D.

Stephen Jeanetta, Ph.D.

David Adam Cletzer, Ph.D.

DEDICATION

To my parents, Mulikha and Tarmidi and my sibling, Adi Santoso

Thank you.

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ABSTRACT

Farmer regeneration remains a big challenge for Indonesia to address food insecurity and promote sustainable agricultural development. With the issue of aging farmers, youth have the potential to become agents of change for the development of agriculture and support the Industrial Revolution 4.0. Nevertheless, young people have less willingness to participate in agriculture. Instead, they prefer working in off-farm employment. It is expected that social media such as Facebook and Instagram can be great tools to promote youth to agriculture. Through social network analysis, this research aims at describing the topics discussed by communities in Instagram and Facebook, representing influential actors, and evaluating the effectiveness of social media in engaging young people in the networks. ScrapeStorm was utilized to scrape posts on Instagram and Facebook with a total of 18,866 and 6,566 posts, respectively. Analyzed through Gephi using Open Ord and Force Atlas 2 algorithms, this study found emerged themes in Instagram network and Facebook related to agricultural production and movement, agribusiness development, sustainable and scientific farming, youth encouragement, and resources needed by youth. The Ministry of Agriculture and Pastal Farm are influential actors in the network that actively advocate for young people to work in agriculture. Finally, Instagram was found to form a more cohesive network of young people. This study contributes to the literature regarding the use of social media to increase youth participation in agriculture through user-generated data and for policymakers, government, and stakeholders to design more effective ways to increase youth participation in the sector.

Keywords: Youth, social network analysis, youth participation, agriculture, farmer regeneration.

CHAPTER I

INTRODUCTION

Study Background

Agriculture faces a big challenge relating to generational succession (White, 2015). The trend of global employment in the world shows a declining number of people working in agriculture from around 44.1% in 1991 to nearly 28.14% in 2019 of total employment (The World Bank, 2019). In many countries, it is evident that aging farmers have become an issue (White, 2015) where young people turn away from the sector to non-agriculture sectors (Djatmika, 2021; Lungkang, 2018). In the United States, it was reported that the number of older farmers is increasing while the number of young farmers is declining (Katchova & Ahearn, 2015). Zagata and Sutherland (2015) reported that the shortage of young farmers was apparent in European countries like Portugal, Italy, Romania, and Greece. Young people leave the agriculture sector due to the diminishing popularity of the agriculture field concerning the industry's low profitability and future careers (Setiawan, Nugraha, & Rasiska, 2019).

As an agrarian country, Indonesia's economic development depends on the agriculture sector, as more than 50% of the population is employed in the sector (Rusliyadi, Jamil, Maseleno, & Kumalasari, 2018). Due to the aging agricultural workforce, young people's participation in agriculture is significant to foster agriculture development while achieving food security (Setiawan et al., 2019). However, following the global trend, there is also a decline in the number of young Indonesian people involved in agriculture since they have shifted to other sectors (Pradiana & Maryani, 2019). This has raised doubts for the country to achieve agricultural sustainability in the future. Therefore, Anwarudin,

Satria, & Fatchiya (2018) explained that there is an urgency for farmer regeneration to increase agricultural development and support rural development in the country.

Young generations worldwide are critical agents for social change, economic development, and technological innovation (Lyocks, Lyocks, & Kagbu, 2014). Moreover, Indonesia is expected to benefit from the demographic bonus from 2020 to 2030 since more productive workers aged 15-64 will support development (Wisnumurti, Darma, & Suasih, 2018). Due to their capacity, young farmers can become qualified human resources in agriculture and achieve sustainability in agriculture. If youth disengagement in agriculture is not resolved, Indonesia could be under threat and may need to promote food security and secure future agriculture (Setiawan et al., 2019). This states the importance of incorporating young people into the agriculture sector.

Some factors account for the cause of youth's lack of interest in agriculture. Demographic and economic factors are driving forces for the decline of young people in farm entry (Gale, 1993). Parents perceive agriculture as low social status, which makes them reluctant to support their children to work in farming (Junais et al., 2020). Young people also envision agriculture as not a promising job because of the low profitability of the sector that will lock them in poverty (Prayoga, Subejo, & Raya, 2020). Being a farmer is not a prestigious job for young people since agriculture is a low-paying job, affecting their efficacy in agriculture entrepreneurship (Nurlaela, Hariadi, & Raya, 2020). One of the significant factors involves youth migration from rural to urban areas seeking employment and better living standards (Singh, 2018). These contribute to the reasons why the number of young people is declining in the agriculture sector.

The development of information and communication technologies (ICTs) and the increasing use of social media have the potential to attract young people to farming since they can interact and connect. The connection can be established among people, including friends, to form a network in agriculture by using social media (Muktar, Mukhtar, & Ahungwa, 2015). Social media become platforms for disseminating information and creating networks among young people so they can be used to stimulate their interest in agriculture and agri-entrepreneurial activities (Muktar et al., 2015). The use of social media and its popularity offers youth opportunities to interact with other people, collaborate, exchange information, build relationships with friends, and facilitate social change (Lee & Suzanne Horsley, 2017).

There are opportunities to promote agriculture to Indonesian youths by utilizing social media due to established social networks. Social media can be used to investigate the diffusion of information about agriculture that subsequently could raise people's awareness. Social media have potential usage, mainly to track emerging agricultural issues (Zipper, 2018). However, while there is a fast-growing use of social media in research, its utility in agricultural science is limited, mostly to cover a broad representation of the farm population (Zipper, 2018). Social Network Analysis (SNA) is a quantitative-based tool that helps summarize and explain social interactions among individuals, communities, and organizations in social networks (Carrington, Scott, & Wasserman, 2005). Thus, employing the SNA in social media platforms is capable to exhibit the pattern from a broader representation of rural communities by which young people are connected and influenced by people, communities, and organizations to pursue careers in agriculture.

White (2015) noted that the research regarding the disengagement of young people in agriculture generational renewal should focus not only on the causes that prevent youth from pursuing their career in agriculture-related work. Instead, future research needs to elaborate on why youth are attracted to the agriculture sector. Besides, rural youth's aspirations to develop their agriculture careers are badly understudied in the current research (Giuliani et al., 2017; Sumberg et al., 2012). The study of people's influences on young people has crucial implications for comprehending young people's aspirations that can translate into their involvement and contribution to agricultural development (Leavy & Smith, 2010). Hence, focusing on young people who want to become farmers and their social networks would be helpful as it could be aspirations for young people to work in the agriculture sector.

Moreover, the study on cross-media and social media research related to campaign activities using social media is limited on Facebook, although it is overwhelming on Twitter (Stier et al., 2018). Kerry (2015) noted that although there is a plethora of studies focusing on the use of social media for industry marketing, the study about social media to analyze user-generated content in agriculture is not much explored. By doing so, researchers would be able to shed some light on what social media platform is the most effective to be used by influencers in the agriculture industry (Kerry, 2015). Concomitant with this, Namkoong, Nah, Record, & Van Stee (2017) note that little attention has been given to the study of Social Networking Services (SNSs) such as Instagram, Facebook, and Twitter for an interactive social media campaign to change people's perceptions, attitudes, and behaviors, primarily to target young adult populations. Finally, social networking sites has the capability to promote agriculture to youth through exchanging agricultural

knowledge and skills and success stories in agriculture (Bao, Zhu, Cen, Peng, & Xue, 2018), and the formed networks are more likely to influence the current and future career plans (Mukembo et al., 2015). Therefore, this study of the social network analysis in social media, namely Facebook and Instagram among youth in agriculture, is significant to understand the role of social networks to make agriculture more attractive to young people.

Research Purpose

The purpose of this research is to study the use of social media platforms (Facebook and Instagram) based on extensive data to analyze the influence of those two social media platforms to attract young people to the agriculture sector. This study explored the topics of discussion in the social networks that become youth's concerns in agriculture, influential actors that connect young people with peers, and organizations in agriculture. In addition, this research analyzed the effectiveness of social media (Facebook and Instagram) platforms to influence young people to work in agriculture through a campaign based on social network principles.

Research Objectives

1) To describe the topics discussed in the Facebook and Instagram networks to influence young people to work in agriculture through a campaign of *#petanimuda*
2) To describe actors in the networks formed that can attract young people to get involved in agriculture
3) To explain which type of social media is significantly effective to promote agriculture to young Indonesian people

CHAPTER II

LITERATURE REVIEW

Definition of Youth

There is no official, universal definition of youths. Regarding the definition of young people, the United Nations (UN) explains that "youths" as those aged 15-24 years for statistical purposes (UNFPA, n.d.). The International Labour Organization (ILO) (2005) recommends that 15-24 be the appropriate age to define youth, and the World Health Organization (2011) agrees that "youth" is between 10 and 24 years old. In line with WHO, Smolík (2014) conceptualizes young people as a group of people in the age bracket fifteen to twenty-five or between the period of children to adults. The Swedish National Board for Youth Affairs (2010) explains that youth are a heterogeneous group ranging from 13 years-old secondary school students to 29 years-old young adults with jobs, families, and homes. Since the age cohort of youth includes 15 to 18 years old, sometimes it is referred to as 'adolescents' (UNDP, 2006). However, UN agencies such as the World Health Organization (WHO), United Nations Children's Fund (UNICEF), and the United Nations Population Fund (UNFPA) have a disagreement on this term, since 'adolescent' is referred to as people between ages of 10-19 (UNDP, 2006).

To obtain a broader youth cohort, USAID (2012) puts youth, which is used interchangeably with young people, in the 10-29 years age range, although the 15 to 24 age range is widely used for statistical purposes. Slightly older than the age bracket defined by USAID, the Law of The Republic Indonesia Number 40 the Year 2009 concerning youth on article 1 paragraph 1, explains that "youth are Indonesian citizens who enter an important period of growth and development aged 16 to 30 years". Among other Asian

countries, young people are described as those up to age 25 in Thailand, The Philippines to age 30, India, Vietnam, and Papua New Guinea to age 35, and up to age 40 in Malaysia (Naafs & White, 2012).

The conception of youth can also be explained as a period of transition instead of using a determined age group. Youth can be defined as a period of transition between childhood and adulthood where these people explore their roles and identities as part of the social integration process in society (Henze, 2015). Spence (2005) asserts that youth is associated with the meaning of young, a phase between childhood and adulthood where they involve in learning, apprenticeship, and training to be adults. UNDP (2006) also marked that youths are in the transition phase toward adulthood, and they have the capacity to change the economic status of their family.

The social construct of youth provides a different perspective regarding the challenges faced by contemporary society. Perovic (n.d.) alluded that defining the concept of youth by age is challenging, so the social status by which young people play their role should not be neglected. Young people are those who need attention due to their vulnerability during their transition to adulthood (Perovic, n.d.). By this, youth also have a different way of thinking and behavior, including systems of models, values, and norms due to psychosocial development (Smolík, 2014). Young people are symbolized as those who have optimism and the ability to propose a better future (Tomanović & Stanojević, 2015). Being youths means that young people shift from being dependent to independent, which is associated with the family, education, work, and leisure (Spence, 2005). Spence (2005) argues that young people have opportunities to change their social-economic status through education and employment that provide meaning for them. This aligns with

Indonesia's founding father, Soekarno, who said that "a thousand of old men are just capable of dreaming, but a young man can change the world!". Therefore, it is expected that young people, with acquired knowledge, experience and potentials, can bring hope for achieving a better future through their actions (Tomanović & Stanojević, 2015).

With a broad range of definitions of youth from Indonesian to the global context, it is not simple to provide a precise meaning of youth. It is plausible, primarily when referring to the social construction of what being youth implies. For the research and practicality purposes and by referring to the locus of study, young people in this context are defined as people aged 16 to 30 years as stipulated in the Law of The Republic Indonesia Number 40 the Year 2009.

Potentials of and the Need to Involve Youths in Agriculture

Young people can be development engines if they are given opportunities in the development process (UN DESA, 2018). A country that depends on its economy on agriculture will need young people, especially rural youth, to serve as laborers both for the present and in the future (Muhammad-Lawal et al., 2009). Young people are assets to fight against extreme poverty and hunger as well as economic, political, social, and environmental unsustainability through development programs (DFID-CSO, 2010). Naamwintome & Bagson (2013) also argue that this class of people, with their dynamism and flexibility, has the potentials to serve as agents of change in agricultural development by becoming future farmers and leaders in agriculture that can generate innovation and involve in public policy and action. The characteristics of youth that always bring energy, vitality, and innovation will support the need to address food insecurity and fulfill the demands for foods (Som et al., 2018). The involvement of youths in agriculture will not

only address the issue of the aging farm population but also contribute to solving youth unemployment (Naamwintome & Bagson, 2013). Provided that, there is an urgency to invest youth in agriculture to contribute to wealth creation while addressing financial insecurity and youth unemployment (Som et al., 2018).

Today's world requires such productive and efficient farmers in the agriculture sector, and young people generally have these demanded characteristics (Leonard, Kinsella, O'Donoghue, Farrell, & Mahon, 2017). Young generations all around the world are key agents for social change, economic development, and technological innovation (Lyocks, Lyocks, & Kagbu, 2014). Young farmers who are more educated are more likely to adopt advanced technologies due to their knowledge and capacity (Howley, O. Donoghue, & Heanue, 2012). These young farmers can relate and adapt to ongoing change processes within the agricultural sector (Grubbström, Stenbacka, & Joosse, 2014). According to Grubbström et al. (2014), young people like agriculture college alumni have a vision of developing agriculture. They are also perceived to expand agriculture through renovating, modernizing, and diversifying the sector (Joosse & Grubbström, 2017).

Challenges in Preparing Youth for Future Agriculture

While enticing youth to agriculture is vital for farmer regeneration, some issues need to be considered, especially child labor. Child labor is defined as employing children under 18 years old to work (Landrigan, Pollack, & Godbold, 1995) due to economic-related factors such as poverty, illness, or job loss of primary wage earners (Unicef, 2021). The youth age cohort involves people aged 16 and 17 (ILO, 2015; UNDP, 2006; UNFPA, n.d.; USAID, 2012; UU No. 40, 2009), but making underage children work is unacceptable. This issue remains unresolved in Indonesia and other countries, especially when the

economic crisis hit households (Manning, 2000). A study suggests that children who work are more likely to be associated with mortality, malnutrition, and disability when contrasted to children that are not working (Vassar & Holzmann, 2013). Their physics and psychology are more likely to be affected due to workload and hazards from working in the field. Since children and early youths are more susceptible compared to adults when exposed to health-related risks (National Research Council, 1993; Volkow, Koob, Croyle, Bianchi, Gordon, & Koroshetz, 2018), involving them in agriculture as labor forces can endanger their health and moral development (UNICEF, 2021). In this case, they will lose their opportunity for schooling and are prone to slavery and economic exploitation, halting their access to healthcare and rights to have a bright future (UNICEF, 2021).

Early youth labor in agriculture have been found since the Dutch colonization of Indonesia. In the past, studies conducted in West Java, North Sumatra, and North Sulawesi provinces confirmed that rural children and youth began working in agriculture from age 11 to 13 with an average of 25 working hours (Manning, 2000). Most rural children and youths work as family workers in the informal sector and the agriculture sector. In Eastern parts of Indonesia, children and youth were less likely to be involved in agriculture employment than other provinces, with manufacturing, trade, and services becoming the largest employers, followed by the agricultural sector that is more common in Java (Manning, 2000). However, children or early youths need to be motivated to work on farms or other people's farm businesses (UNICEF, 2021) to help address the farmer regeneration issue.

Increasing youth aspiration to work in a safe place is also demanded despite increasing their participation in agriculture. Nevertheless, some studies depict how unsafe

are some agricultural practices that involve youth and children as a labor (Cai, 2012, Fassa et al., Harrison & Ross, 2016; Koh et al., 2017; Ramos, 2018; Serrano-Medina et al., 2019; Van Minh, 2009). Tobacco plantations and farms are not suitable for children and early youth to work since they will bring issues about child labor and youth and occupational health hazards primarily found in low- and middle-income countries (Ramos, 2018). This work will not only expose children to toxic chemicals such as absorption of nicotine that will cause them sick and affect their respiratory and psychology (Fassa et al., 2014; McKnight & Spiller, 2005) but also result in their addiction to cigarettes (Van Minh et al., 2009). In China, Cai et al. (2012) research discovered that tobacco farmers were more likely to smoke and experience nicotine addiction.

In addition, a study conducted by Van Minh et al. (2009) in Vietnam revealed that working in tobacco farming contributed to more health problems, injury, and illness among farmers. In Argentina, youths working in tobacco farming were found to have an increased risk of cigarette smoking and health risks (Alderete et al., 2020). It will lead to a big problem when they participate in farms or agricultural industries that do not implement sustainable farming practices. Youth are more likely to be exposed to hazards, precisely when involved with toxic materials such as inorganic pesticides that can cause skin irritation, nerve damage, and respiratory problems (Fassa et al., 2014; McKnight & Spiller, 2005). It is suggested that there might be a correlation between exposure to pesticides and mental health among tobacco farmers (Fassa et al., 2014; Koh et al., 2017; Campos et al., 2016; Harrison & Ross, 2016; Serrano-Medina et al., 2019).

Youth Disengagement in Agriculture

Due to the increasing population, agriculture production and productivity must be improved, and agricultural workers are needed to address the issue. However, the trend of global employment in the world shows a declining number of people working in agriculture from around 44.1% in 1991 to nearly 28.14% in 2019 of total employment (The World Bank, 2019). The number of young farmers (aged under 35 years), based on agriculture census in 2013 Conducted by the Indonesian Office of Central Statistics (2013), was much lower at 32.76% compared to middle-aged farmers (ages 35-55 years old) and aging farmers (aged over 65 years) at 54.37%, and 12.87% respectively. Moreover, the figure for agricultural business households owned by older farmers (over 35 years old) was much higher (32.76%) than those owned by young farmers (less than 35 years old) at 12.87%. Similarly, in Europe, the percentage of young people (less than 25 years) engaging in agriculture as farm managers were around 1% which is much lower than the age group in the total population (Eurostat, 2016). India also faces the same issues where young people's involvement in agriculture decreases (Paroda, 2018; Som et al., 2018). Muhammad-Lawal et al. (2009) also found that young people in Nigeria have strong apathy toward agriculture, although agriculture is an important sector for economic development and poverty reduction.

The decline of the agricultural workforce and employment in agriculture, the increase in elderly farmers, migration, and the need for addressing food security and hunger problem state the importance of incorporating youth as part of farmer regeneration. Referring to her study in Indonesia, Susilowati (2014) states that young people are reluctant to work in agriculture as they are more engaged in non-agricultural sector work. The

number of young people working in non-agriculture jobs showed an increasing trend. Since the number of young farmers is much lower than the aging farmers in Indonesia, this situation cannot guarantee the country to achieve sustainable agriculture due to the issue of farmer regeneration (Anwarudin, Sumardjo, Satria, & Fatchiya, 2018). With the fewer number of young people involved in agriculture, there is a doubt about the future of agriculture (Russel, 1993). To reduce the adverse effect, increasing the number of young professional farmers is important to solve the problems (Guo, Wen, & Zhu, 2015).

The low motivation of youth to develop their career in agriculture-related work relates to their perception toward agriculture and aspiration to work in the sector. Youth have a negative perception toward the face of agriculture considering their future. The low participation of young people in agriculture in developing countries is due to the miserable image of agriculture associated with high risks, costs, and inefficiency, so working in agriculture would not give them a decent working and living (Irungu et al., 2015). Besides, there is a lack of aspiration among youth for an agriculture-related occupation that causes agriculture not to be the top priority for their choice to develop their careers, especially young women (Elias et al., 2018). In their study, Elias et al. (2018) found that farming can be the last choice for young people when they do not obtain a professional diploma. Young people will have no options despite following what their parents do, farming on their ancestral land.

Other factors also account for youth disengagement in the agriculture sector. These include the patriarchal structure in rural societies and the lack of land ownership among the rural youth to start farming (White, 2015). The misconceptions about the future of an agricultural industry that youth retain as well as outmigration from rural areas make the

active involvement of youth in agriculture cannot be reached (Giuliani et al., 2017). The lack of awareness and information regarding agriculture opportunities is also significant to make youth reluctant to work in agriculture (Magagula & Tsvakirai, 2020). Owing to this, Mwaura (2017) argued that the existence and relationships among people in social networks could promote youth to farming and agriculture. Social networks, including peers and role models, have the capabilities to change their aspirations regarding the future of agriculture and encourage young people to work in agriculture (Mukembo, Edwards, Ramsey, & Henneberry, 2015). There are also potential benefits in using ICTs such as social media to address youth less participation in farming (Irungu et al., 2015).

Linking ICTs, Agriculture, and Youth

The role of ICTs has been perceived as a useful agricultural extension by accelerating agricultural dissemination and expanding agricultural information to audiences (Muktar et al., 2015). Social media also play a significant role in disseminating positive messages related to the agricultural sector to audiences. Kumar et al. (2019) argue that social media incorporates young people's daily life. These platforms also encourage the exchange of information among young people and network for young professionals (Paisley, 2014). Kumar et al. (2019) claimed that social media such as Twitter, Facebook, or Pinterest help build relationships, provide information, and connect users. The agriculture sector could be promoted to them by changing their perceptions. The increasing role of social media and its popularity offers youth opportunities to interact with other people, collaborate, exchange information, build relationships with friends, and facilitate social change (Lee & Horsley, 2017). Therefore, employing ICTs, mainly social media

networks such as Facebook, Instagram, and Twitter, can be a method to promote youth engagement in agriculture.

Known as Web 2.0, social media are conceptualized as a set of new internet applications that stress participation, connectivity, and user-generation, providing users space to share information and to interact with institutions and other people (Henderson & Howley, 2010). These social media, together with ICTs, have the potential to change youth's negative perceptions towards miserable careers in the agriculture sector (Brand & Galdava, 2019). Paroda (2018) found that social media are essential to increase young farmers' concern for the agriculture sector. Social media play roles in addressing agricultural issues such as Facebook and other social media that could make young people aware and change their perception due to information posted on such platforms (Brand & Galdava, 2019). Social media are essential to increase young farmers' concerns to the agriculture sector by changing their perception due to information and campaign on such platforms (Brand & Galdava, 2019). Muktar et al. (2015) reported that youth's involvement in the agri-entrepreneurial sector in Nigeria is stimulated by social media, so they have an interest in agricultural production and agri-entrepreneurial programs due to increased interaction and shared information through the platforms. In Kenya, ICT and social media have become sources of information. People could tell their success stories in the agriculture sector and draw young people to embark on agribusiness (Yami et al., 2019).

Social networking tools have capabilities to diffuse information about agriculture that could rebrand the miserable image of agriculture. Social media have potential usage, mainly to track emerging agricultural issues (Zipper, 2018). Besides, social media and short message service (SMS) used to depict the success stories in agriculture could also open

youth opportunities to be actively engaged in agriculture since youths spend a considerable amount of time on the internet, including Facebook (Irungu, Mbugua, & Muia, 2015). In Irungu et al. (2015) study, they found that the use of ICT such as Facebook facilitated interactions among youth since they can share photographs, videos and discuss particular issues regarding agriculture. This platform helps them diffuse information that encourages youth to agriculture. This will open opportunities for other growing use of ICTs such YouTube, Twitter, and WhatsApp to attract young people to agriculture.

ICTs have potential advantages to increase youth's awareness concerning agriculture since young people can communicate with one another in their network. Lohento & Ajilore (2015) argue that the use of a networking platform such as Twitter could tie people together in a network where young people are able to share knowledge and ideas and discuss issues by using campaigns targeted at young people. Furthermore, Kerry (2015) states that Twitter can be a medium to clarify misconceptions, realities, and myths within and outside of the agriculture industry by facilitating interactions between people. Bezu & Holden (2014) concluded that the networks that young people build with their relatives and friends have the power to influence their decision on their future careers. The networking among rural youth can positively affect young people to engage in agricultural activities as young people interact with their experienced farmers, scientists, and peers in their networked groups (Akpan, Patrick, James, & Agom, 2015). Through the aid of ICTs, youth can be exposed to the latest technologies in agriculture that can amaze them and increase the probability for youth to engage in farming (Akpan et al., 2015). Freeman & Qin (2020) reported that the use of ICTs such as mobile phones and radio in Uganda facilitates people to obtain information through interactions with peers as well as through

information hubs like websites. This can overcome network barriers that are faced by physically restricted communities by reinforcing social networks among farmers (Freeman & Qin, 2020).

Social Media Functionality for Social Network Formation and Campaign

Social media have been used widely in many disciplines for campaigns through linkages in social networks. In the fashion industry, for example, Wolny & Mueller (2013) argue that the social networking sites such as Facebook and Twitter have the power to influence consumers to engage in electronic word-of-mouth (eWOM) by talking and interacting with each other in brand-related topics on those social media. The effects of the social networks in those social media could raise people's awareness and perception of brand image, especially when the trend is adopted by a considerable amount of people (Wolny & Mueller, 2013). In a political context, social media are employed in a political campaign to introduce and promote issues to make users aware of the topics (Stier et al., 2018). Social media and social networking sites such as Facebook, Twitter, YouTube, Instagram, and LinkedIn, enable people to form and enlarge social network ties that have a positive relationship with public participation in civic and political activities (Boulianne, 2015). Özdemir (2012) reported that social media were used for advocacy campaigns about genetically engineered organisms (GEO) by Greenpeace in the agriculture sector.

Attracting more people to social networks is one of the usefulness of using social media that facilitates information exchanges. This can be done by using a specific hashtag (#) to promote a campaign and increase social media users' participation to discuss a particular issue. A hashtag (#) can be defined as a word or phrase preceded by a hash or pound sign (#) employed to locate information on a particular topic or keyword on

conversations in social media (Walfred, 2018). In Twitter, a microblogging platform that facilitates farmer-to-farmer learning, the use of some hashtags is reported capable of inspiring new farmers to adopt new farming techniques as they are linked with other growers in those hashtags. This is because active farmers with distinctive profiles become influencers to increase the number of new and younger farmers in the networks through publicly available discussions connected by those hashtags (Mills, Reed, Skaalsveen, & Ingram, 2019).

Moreover, hashtags can also be helpful to increase social media users' engagement in agriculture-related discussions. The use of some hashtags such as #covercrops and #notill helped the EU study project's Twitter account, SoilCare emerge influential farmers that are followed by several people where it facilitates young and innovative farmers to engage in the problem-solving discussion associated with agricultural production (Mills, Reed, Skaalsveen, & Ingram, 2019). Similarly, some hashtags such as #plant14, #ags, #harvest14, #fromthefield, #corn, #soybeans, #BacktoAg, in Twitter were used by the majority of Canadian agriculture influencers to inform their followers about "the truths of farming," make them aware of what farming is about and make people engage in an open discussion with themes associated with agriculture industry (Kerry, 2015). Correspondingly, a "Yemezler! hashtag on Facebook and Twitter and "mentions" feature on Twitter could help users notice a hashtag pool, and the corresponding organization could obtain people's support and assembly people interested in that project (Özdemir, 2012). With the proper use of a hashtag, social networking sites become a space to gain more public participation in agriculture.

Analysis of hashtags provides an opportunity to help explore how people can relate to one another in social media networks. Through their social media research study using Twitter, Burgess et al. (2015) concluded that a hashtag #agchatoz could support engagement between Australian farmers and stakeholders in the Australian agriculture industry and coordinate discussions between them and even beyond their close followers about agriculture topics such as sustainable agricultural practices and animal welfare. Furthermore, the hashtag is useful to increase engagement between people in urban and rural areas associating with agriculture and food themes as well as to identify communities in the network structures related to the hashtag, including additional hashtags that emerge from the networks such as youth in agriculture and agricultural industries (Burgess et al. (2015).

A *#petanimuda*, a hashtag that means 'young farmers' in Indonesian, is the most used jargon found in social media posts for a campaign targeting young Indonesian people to participate in agriculture. This hashtag seems to be the most popular jargon in both Facebook and Instagram posts compared to other Indonesian-written hashtags with similar meanings. Retrieved from Facebook on November 25, 2021, the *#petanimuda* (young farmers) contained more than 17,000 posts, *#petanimilenial* (millennial farmers) with 11,000 posts, *#petanimudaindonesia* (young Indonesian farmers) with 2,100 posts, *#petanimillenial* (millennial farmers) with 1,600 posts, and a few posts for *#pemudatani* (young farmers), *#petanimudamilenial* (millennial Indonesian farmers), and *#petanimudakeren* (cool young farmers). Similarly, the number of posts containing *#petanimilenial* on Instagram as of November 25, 2021, was more than 250,000, followed by *#petanimilenial* with 94,103 posts, *#petanimudaindonesia* 25,862 posts,

#petanimillenial with 12,263 posts while *#pemudatani*, *#petanimudakeren*, and *#petanimudamilenial* were under 5,000 posts. Thus, the use of the *#petanimuda* in this study is perceived to be appropriate since it could reach a large number of posts and users both on Facebook and Instagram. Since more users use that hashtag, there will be more connections that individuals could build with other people and it will be more meaningful to analyze the network formed by the hashtag (De Brún & McAuliffe, 2018). Consequently, it is not implausible to study how the hashtag could promote Indonesian youth to agriculture.

Social Networking Services (SNSs) are proven successful to channel communications that facilitate network formations among people (Namkoong et al., 2017). Facebook, Twitter, and Instagram enable the utilization of hashtags for specific campaigns, and their use will be more effective if the social posts are public (Walfred, 2018). Reflecting the previous studies in using hashtags to increase people's participation in the discussion as well as to change their behavior, this research seeks to understand how the hashtag *#petanimuda* (Indonesian for young farmers or millennial farmers) could increase youth's participation in the issues related to agriculture and youth's involvement in agriculture. The campaign using *#petanimuda* has shown an increasing trend in social media, including Facebook and Instagram, aimed at attracting young people to farming-related work. Lanham (2010) noted that social media are capable of persuading people through information exchange in social networks.

Each social media platform has different effectivity to engage people in agriculture. It is expected that Facebook will be the most effective social media platform to leverage young people in the agriculture sector. The development of ICTs, including social media,

becomes an effective means to disseminate information while altering behavioral change (Muktar et al., 2015). In Nigeria, it was reported that Facebook enticed new members to be part of agricultural communities, not only for young people but also for older people, through massive social media campaigns on that platform about benefits in agripreneurship (Muktar et al., 2015). Muller (2020) suggested that due to its highest penetration after YouTube and WhatsApp, Facebook is extensively used by the Indonesians aged 16-64 years (Muller, 2020), and it has the largest users compared to other social media such as Twitter and Instagram (Pew Research Center, 2014). Kim and Kim (2018) also confirmed that with the ease of Facebook's algorithm, people interact more on Facebook than on Instagram. Therefore, it is predicted that Facebook would serve as the most effective social media platform to leverage more young people to agriculture.

Social Network Analysis in Social Media

There is a growing interest in the use of Social Network Analysis (SNA) from computer science to cultural fields (Frith, 2014) since it allows people to analyze the relationship that people build in relation to the utilization of social media. Borgatti & Lopez-kidwell (2015) state that social network theory can present an approach to evaluate large-scale user-generated data from social media by describing the body of social networks and the way information is disseminated within and between the networks. SNA provides a tool to explain the advanced structural system of social connectedness while defining assessment to locate and interpret networks (Wasserman & Faust, 1994). Besides, SNA can elaborate on how people affect one another to form another's behavior (Marin & Wellman, 2011).

In the application of the SNA, human connection, networks of relations, and information distributed within those relationships can be studied, and the generated data can be visualized and mapped (Frith, 2014). The SNA is manifested as a process of mapping and measuring relationships between entities in the networks, including people, groups of people, institutions, and other entities (Jamali & Abolhassani, 2006). Facebook and Instagram store a significant amount of user-generated data since users are facilitated to exchange their information and opinions on active discussions, and this space could help identify people's concerns, needs, and interests (Min et al., 2018). In Min et al. (2018) study about data mining using social media on luxury cosmetics brands and animal testing, it is found that SNA could be performed using data mining technique to learn relationships in social entities formed by individuals, communities, and organizations. As a result, a network visualization can be generated to indicate how people are connected to each other and how they are concerned about animal welfare and sustainability (Min et al., 2018).

Most studies that use social network analysis are mainly conducted on a small scale within a specific context, such as for a particular community to understand the linkages in the networks. SNA is crucial for policymakers (Ramirez, 2013) as an approach to raise youth's involvement in agriculture through their connection with one another in the user-generated content on social media for a larger scale. Besides, mining and analyzing social media through large-scale user-generated data could enrich the literature on how young people are connected and influenced to get involved in agriculture. Moreover, identifying actors that are influential in affecting young people and key topics discussed in the network is helpful for policymakers to formulate appropriate methods to target youth to raise their awareness and increase their participation in agriculture. Therefore, addressing farmer

regeneration needs to be resolved as the number of young farmers is much lower than the aging (Anwarudin, Sumardjo, Satria, & Fatchiya, 2018).

In SNA, actors play significant roles in connecting individuals with one another. Actors have tractions that link a young individual to another person so that they can be connected and influenced to participate in agriculture. Agricultural extension institutions could significantly encourage youth involvement in agricultural income-generating activities due to the potential profits from the sector (Som et al., 2018). As a big actor, NGO and government institutions could increase youth's awareness by diffusing information regarding youth development programs, agripreneurship development programs, and promotion of farming and agribusiness. As an actor is SNA is not only people and organization, but it also includes social media pages. Past literature shows that a famous Facebook page could draw young people's attention to agriculture through links, footage, discussions related to agriculture on that platform (Irungu et al., 2015). Young farmers and entrepreneurs can leverage young people to agriculture as they share success stories when conducting farming and or farm business (Som et al., 2018).

Theoretical Framework

Small-World Theory

The small world theory proposed by psychologist Stanley Milgram provides an excellent explanation for understanding people's relationships (Milgram, 1967; Travers & Milgram, 1969). In the small world theory (SMT), social networks are abundant in short paths known as the small-world phenomenon of "six degrees of separation." However, there is no guarantee that people can effectively locate these short paths without knowing a global map of a network (Easley & Kleinberg, 2010). Pioneered by Milgram's idea about

SWT, John Guare in 1990 popularized the theory of six degrees of separation that two people are separated by an average of six-step of intermediate friends' chain or six degrees of separation (Kleinfield, 2002; Zhang & Tu, 2009). In 1998, Duncan Watts and Steve Strogatz elaborated social network theory through small world theory in that social networks features homophily, a fundamental premise that people will be connected to others if there are similarities between them, and weak ties or links that hub people outside of the ties with the existing cliques (Easley & Kleinberg, 2010). This is due to the chains of acquaintances that people have are capable of expanding people's contacts by breaking the geographical and social barriers in a small world (Milgram, 1967; Travers & Milgram, 1969). Since the network has many triangles (two adjacent nodes connecting to a node), this network will expand and will overlap to produce other triangles with a high likelihood of having short paths (Easley & Kleinberg, 2010).

According to Humphries & Gurney (2008), there are three main types of networks, namely regular, random, and small-world networks. These social networks connect individuals as agents or nodes from one another through strong ties or edges. It also implies that although people take a trip away from people surrounding them and find new people who become friends, it is defined as "a small world." In other words, societies are found to be close to each other due to the existence of social networks in those societies (Milgram, 1967). The path as measured by the minimal number of ties to connect between actors is then found to be short (Watts and Strogatz, 1998). Actors as nodes can be linked with each other in any form, such as web pages, articles, emails, or words in which connections happening among them can be analyzed (Scott & Carrington, 2014). In this network,

individuals can relate to one another so that the young people who do not have an interest in agriculture can be influenced to involve in agriculture.

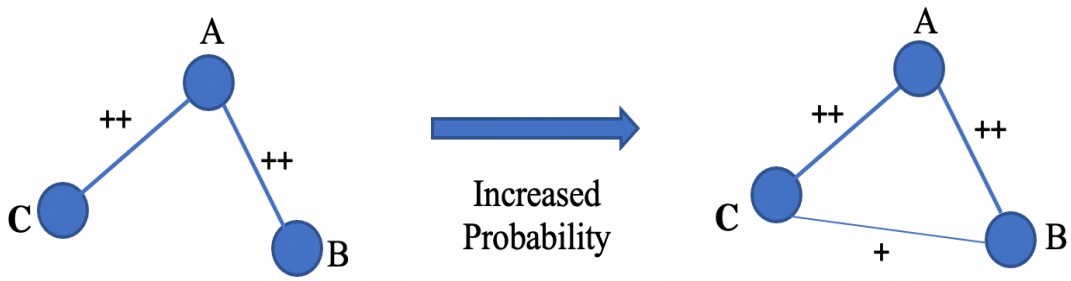
Bassett & Bullmore (2017) explained that in small-world theory, it is viewed that in many complex systems, small-world-ness comes from social networks. Small world theory focuses on the complex network structures where although it is giant enough, people as actors see it small because of the high clustering and weak, bridging ties that construct the structures (Prell, 2009). In social networks, ICTs allow farmers to obtain information on agricultural input from strong ties such as friends, family members, and other proximity and weak ties such as extension agents, other farmers, and stakeholders (Freeman & Qin, 2020). The relationship that people build with strong-tie members will provide a limited amount of new information. In contrast, developing networks with weak-tie entities provides farmers with diverse information that can influence their adoption decision (Freeman & Qin, 2020).

Strength of Weak Ties Theory

In the strength of weak ties theory (SWT), nodes have opportunities to relate with other nodes directly and indirectly. Drawing on Granovetter's strength of weak ties (SWT) theory, Borgatti & Lopez-Kidwell (2011) explain that when people have stronger ties with others, they are more likely to have overlapping social worlds due to the transitivity feature in the network. When person A shares similarities with B and A have similarities with C, then B and C are likely to hold resemblances with one another (Borgatti & Lopez-Kidwell, 2011). This transitive relationship is illustrated in Figure 1. Another premise is related to balance or cognitive dissonance theory. If node X supports Y, and Y supports Z., Thus, X is likely to support Z to hinder cognitive dissonance (Borgatti & Lopez-Kidwell, 2011).

Figure 1

Granovetter's Clause in Strength of Weak Ties (SWT) Theory

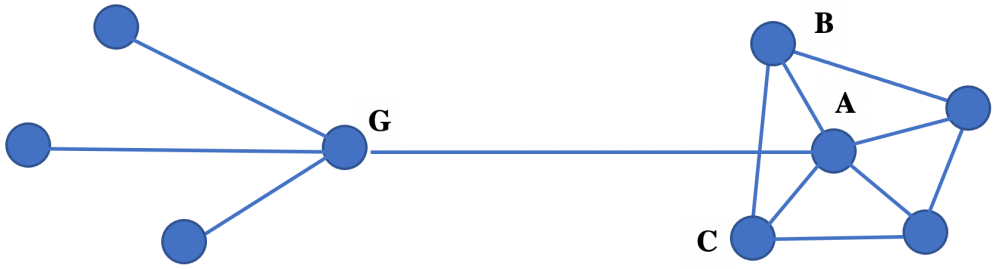


Source: Adapted from Borgatti & Lopez-Kidwell (2011)

Another clause that Granovetter made is related to the capacity of weak ties to bridge nodes. Even though these ties are not robust, they are probable to connect other nodes that are not directly connected to core nodes (Borgatti & Lopez-Kidwell, 2011). The bridge ties provide a shortcut for far-flung cliques and shorten the length of a tie between nodes in a network (Giuffre, 2013). The weak ties are proven to bridge actors outside with the core network, which and shortens the path between nodes outside the network and the existing network (Giuffre, 2013). As depicted in Figure 2, A and G have weak ties that make them possible to be connected, and this is true since G does not have at least a strong tie with A's directly connected nodes (Borgatti & Lopez-Kidwell, 2011). Borgatti & Lopez-Kidwell (2011) also explain that in Burt's structural holes theory, when a network has more structural holes that allow more bridges to connect different nodes to the central nodes, nonredundant information is likely to be obtained as the source of novel ideas are brought by new nodes. Granovetter argues that weak ties are not always being bridge ties, but the bridge ties seem to be weak (Giuffre, 2013). When two nodes share a strong tie, they will draw their closed nodes together to make a clique, and weak ties become a solution for disconnected cliques to be reconnected in a network (Giuffre, 2013).

Figure 2

Bridging Tie from A to G. Removing the Tie Detaching the Network



Source: Borgatti & Lopez-Kidwell (2011)

Compared to solid ties, the "strength of weak ties" promises that weak ties can connect socially distant groups with other groups (Giuffre, 2013). People with few ties are perceived as living in an encapsulated world that only has few ties (Giuffre, 2013). One shortcoming of this group is that members are unable to acquire a new source of information beyond their cliques (Giuffre, 2013). The presence of weak ties is argued to bridge actors detached from the existing groups so that they are capable of bringing novel information that cannot be provided by the existing cliques (Giuffre, 2013). Unlike strong ties that limit new ideas to be generated in the networks, the bridge ties construct a new connection that has the ability to induce new information (Borgatti & Lopez-Kidwell, 2011). These weak ties are thus significant to reduce the chain length in the network so actors can obtain information immediately from the connected outside nodes (Giuffre, 2013).

One limitation of sociological theory is that it is not able to link micro-scale connectedness to the macro-scale pattern (Granovetter, 2019). The existence of social networks bridges this constraint by explaining the interaction beyond the small-scale relationships. The theory of strength of weak ties could elaborate on the relations among

social networks and the distribution of information. As people interact, there will be a tie that links them so that other people with the same thought will form the corresponding ties. Although weak ties are found when people from different societies connect with each other, they have a greater strength to deliver new information (Borgatti & Lopez-kidwell (2015). Finally, this theory is fundamental to describing social structures and how information travels from one individual to another and from one community to another.

Social Network

A collection of socially appropriate nodes linked by one or more relations is named a social network (Marin & Wellman, 2011). This social network is constructed by a collection of actors and relations among them (Giuffre, 2013). These actors that are often called "nodes" and the relations that they build are named ties in sociogram (Giuffre, 2013) can be any forms, such as people, organization, web pages, articles, countries, neighborhoods, divisions in institutions, positions, or any units that are connected (Marin & Wellman, 2011). When two nodes are tied together, they form a dyad which becomes the fundamental building block of a social network (Giuffre, 2013). Nodes are tied to each other by a variety of reasons, such as by kinship, belonging to an organization, attending events, disliking others, shared diplomatic relations, and other things (Giuffre, 2013), and their relationships can be symmetric and asymmetric (Fu, Luo, & Boos, 2017). In the case of the online social network, replying to emails, connecting to web pages, posting writing in a blog, commenting on YouTube videos, and other platforms creates records that make nodes are connected in a social network based on topics of interests, affiliation, a community of practices and collective action (Gruzd & Haythornthwaite, 2011). Similarities in this network are identifiable through shared traits between two nodes, such

as, but not limited to, demographic properties, attitudes, locations, and group memberships (Marin & Wellman, 2011).

Connections that every member of a network establishes form a tie, although not every node in this network is tied to every other node by a specific type of tie (Giuffre, 2013). This tie that actors create in a social network has distinct properties. Strength and direction are properties of ties. A tie can be directionless when the joined nodes have a mutual relationship that provides a feedback loop with each other (Giuffre, 2013). In the case of ties that have direction, one node can only have one-way relation with the other such as when a boss directs his subordinates (Giuffre, 2013). The degree of strength is dependent on the relationship between actors that form a tie in a network that can be weak, moderate, and strong (Giuffre, 2013).

In defining network boundaries, it is important to note that nodes cannot be perceived as having mutually exclusive connections to a particular group. Rather, nodes are tied to multiple groups and cross-cutting ties between groups (Marin & Wellman, 2011). Thus, determining boundaries in this social network can be based on three approaches (Laumann et al., 1983). First, those holding positions or becoming a member of such a society can be deemed as network members while all others can be removed from the network. Second, in the event-based approach, people who have participated in relevant events proposed the population can be included in the networks. Lastly, the relation-based method starts with a small group of nodes and defines who can become part of the network depending on whether new units share relations and connect to the core network. However, Marin & Wellman (2011) remind that those methods are not mutually exclusive, meaning

that in practice, a combination of these approaches is robust to define boundaries in a network.

Borgatti et al. (2009) studied network arguments that are classified into four types, namely transmission, adaptation, binding, and exclusion. The transmission of a network assumes that a network is a pipeline where many things can flow in the system, and different network structures develop different patterns of flow (Marin & Wellman, 2011). In this flow, nodes disconnected to others could still receive information and ideas, while nodes connected to one another can transfer shared expectations and obvious norms (Marin & Wellman, 2011). Adaptation in the network means people embedded in related networks could have the same decision, especially when exposed to favorable and unfavorable conditions (Marin & Wellman, 2011). Featuring binding in the network, Marin & Wellman (2011) elucidate that a node linked with one another in the network has the potentials to act as a collective action due to the existence of internal structure in the network. When the network is internally detached, full information cannot be distributed across the network members, creating less effective communication in the network (Marin & Wellman, 2011). In the event of exclusion, the existence of ties deters the opportunities of other ties to be included in the network that will subsequently impede these ties' relation in the network (Marin & Wellman, 2011).

Summary

Social media gives opportunities to analyze people's opinions, aspirations and concerns, and evaluation of their attitudes regarding the agriculture sector (Barau & Afrad, 2017). Platforms such as Facebook, Twitter, and WhatsApp are tools to facilitate interaction and exchange of information among people. Such networking platforms are also

examples of small-world networks (Myers et al., 2014) that can link and group people from one another along with the delivered information. Subsequently, young people's opinions framed as a hashtag (#) posted on social media platforms such as Facebook and Instagram can be captured by other people. The networks, nodes, and edged could be analyzed to explain how young people's concerns in agriculture are increased due to their connectedness in social media. Hence, their awareness and perceptions regarding agriculture may alter so that they could get involved in the sector. Ramirez (2013) suggested that SNA is proven beneficial for policymakers, especially on raising youth's involvement in agriculture through their linkages with one another in social media.

CHAPTER III

RESEARCH METHODOLOGY

This study used data-mining-based social network analysis (SNA) as secondary data from Facebook and Instagram as social media research with a quantitative approach. Referring to Wasserman & Faust (1994), SNA can be employed to analyze social networks according to the relationships between actors in such a network. Social relations between entities or elements can be visualized as a graph that reflects a structure of relations with entities as nodes or vertices and pairs of entities as ties or edges (Butts, 2008). What makes SNA significant compared to other approaches, such as Activity Theory (AT) and Actor-Network Theory (ANT), is that SNA is heavily grounded to social networks and is applicable to study at individual and institution levels (Frith, 2014). Besides, SNA can elaborate on how people affect one another to form another's behavior (Marin & Wellman, 2011). In the application of the SNA, human connection, networks of relations, and

information distributed in the networks can be studied, and the generated data can be visualized and mapped (Frith, 2014). Graphical and mathematical evaluation of social interactions and the distribution of information pictured as visual maps can also be explained by a model in SNA so linkages between actors in the networks can be elucidated (Kadzamira & Kazembe, 2015). Although such an approach fails to detect whether the information flowing between those people is streamlined and explains rationales of actors to develop linkages (Tzatha and Schepers, 2009), SNA supplies users with qualitative and quantitative measurements of a network (Kadzamira & Kazembe, 2015).

Five most popular social media platforms with highest penetration rates among Indonesians aged 16-64 are YouTube (88%), WhatsApp (84%), Facebook (82%), Instagram (79%), and Twitter (56%) (Muller, 20200). WhatsApp does not provide open access data, and YouTube does not feature networks between people. So, they are excluded from the study. Facebook is one of the most used for social media activisms and social movements (Lim, 2013). Although Indonesia is considered the most active Twitter user globally (Ritonga & Sayahputra, 2019), the users are dominated by people living in Indonesia's capital city Jakarta and other big cities (Carley et al., 2015). This means that it is not representative enough to include rural Indonesian Twitter users in this study. Moreover, even though Twitter is regarded as the most famous social media platform used by youth, campaign on environmental destruction, for example (Alam, 2020), this tool is not widely used by young people for the campaign in agriculture. Counting the number of *#petanimuda*-containing posts (tweets) on Twitter, there were 97 tweets retrieved from Python as of March 28, 2021. This modern programming language can perform many functions, such as API's data extraction process (Bassi, 2007). API is an application

programming interface that enables software to communicate through reference documentation (Meng, Steinhardt, & Schubert, 2018), such as from Facebook, Twitter, and Instagram developers. The number of posts (tweets) containing *#petanimuda* on Twitter is considerably smaller than Facebook (more than 12,000 posts) and Instagram (more than 213,000 posts). In this case, Twitter was excluded from the analysis since the unconnected nodes, and the small network would make the social network analysis impossible to be performed. Also, due to the small number of nodes as well as the edges, it is not representative enough to present the overall structure of social networks of young practitioners in agriculture at the national level, Indonesia. De Brún & McAuliffe (2018) explain that a higher network density will require many connections within the network itself. Thus, Twitter does not capture a good representation of young people's involvement in using social media to connect communities concerning agriculture. The study also does not use other research approaches such as a survey due to difficulties reaching potential participants within closed groups, a short time frame, and ethical issues (Chae, 2015).

A public campaign using the hashtag *#petanimuda* or young farmers is used in social media to promote young people to work in agriculture as young farmers in any related agriculture sectors as a broad science such as agriculture, fishery, animal husbandry, and plantation. A hashtag or a string preceded by a "#," according to Thelwall et al. (2011), can be used as a tool to look for specific posts in a particular theme. This campaign could attract young people to get involved in the agriculture sector due to linkages among influential actors. Therefore, that hashtag appearing on Facebook and Instagram posts will be extracted as a source of data. Instagram features a #hashtag and an "@" to mention or tag other accounts (Instagram, 2020). In contrast, Facebook makes hashtag features to turn

topics and phrases into clickable links so that other users can find specific issues they are interested in (Facebook, 2020).

Population and Samples

This study mined data from Facebook and Instagram in the form of posts containing *#petanimuda* (i.e., "young farmers" in Indonesian. Webb and Wang (2014) define the population as every instance of the studied phenomenon where researchers would like to generalize. The network is formed from relationships between nodes that connect to other nodes (Tabassum, Pereira, Fernandes, & Gama, 2018; Wasserman & Faust, 1994). These can be used to explore patterns and typologies of relationships between vertices (De Brún & McAuliffe, 2018b). Thus, it implies a need to have more nodes connected to visualize a good network. Using the keyword *#petanimuda* on Instagram and Facebook, there were over 213,000 posts on Instagram and 12,000 posts on Facebook containing such hashtags as of March 28, 2021. Indonesian youths widely use both social networking platforms to connect with the communities concerning agriculture matters.

Data Source, Collection, Instrumentation, and Data Analysis Procedures

The data mining process is usually done using application programming interfaces (APIs) that allow third-party platforms to access data from social media (Instagram, 2020; Facebook, 2020). However, it has a limitation in which only 1% of the data will be provided if data extraction is done through the APIs from corresponding social media platforms (Morstatter, Pfeffer, Liu, & Carley, 2013). Due to Application Programming Interface (API) limitations on both Instagram and Facebook, a web scraping method is often selected since it can access the data beyond the APIs restrictions (Himawan et al., 2020). Web scraping is a method to process data extraction from any sites available online (Pereira &

Vanitha, 2015). ScrapeStorm is one of the web scraping tools besides Octoparse, PhantomBuster, and ScrapyGram that enables researchers to retrieve data from Facebook and Instagram more than APIs limits (Himawan et al., 2020). This web scraper tool, also known as a crawler, was found to be more efficient in extracting big data from any social media such as Twitter and Facebook, as it could scrape more than three million users' posts retrieved (Oleji et al., 2020). Therefore, the samples from those two social media platforms would be randomly selected according to the work of the platform without any specific time frame.

ScrapeStorm software was employed to scrap the data from Facebook and Instagram using hashtag *#petanimuda* from all posts without a time limit. Then, such positions were extracted to create nodes and edges from each social media platform. Nodes are actors that can be individuals, community, or organizations depending on who post the hashtag that connects each individual and can be studied to see a pattern in the social networks (Marin & Wellman, 2014). Edges, on the other hand, can explain if different topics are discussed between different nodes in the network. The network datasets from these three platforms will be separately loaded to Gephi software to be analyzed and visualized so that there will be three social networks resulting from each digital tool. Gephi is a software that could display social networks by converting the network into a map (Jacomy et al., 2014). There are other available software, but they have limitations, such as TouchGraph that has serious performance problems, and the layouts could not be adapted to scale-free networks. At the same time, Pajek is not designed for dynamic exploration (Jacomy et al., 2014).

Posts containing #*petanimuda* on Facebook and Instagram were crawled from May 29 to July 20, 2021. Initially, 1% of the total posts would be crawled for pilot testing. This study separated network datasets from Facebook and Instagram for analysis and visualization of Facebook and Instagram by extracting the posts on both social media platforms to obtain nodes or nodes and the edges or relationships among the vertices. Using the keyword #*petanimuda* on Instagram and Facebook, there were over 213,000 posts on Instagram and 12,000 posts containing such hashtags, respectively as of March 28, 2021. There were 18,866 posts scraped on Instagram, and 6,566 posts crawled on Facebook. These datasets are then loaded into Gephi software for analysis and data visualization.

Three-level analyses were performed, which are topological analysis, centrality analysis, and community analysis using Gephi algorithms. The topological analysis visualizes the nodes and edges of the social network that represent the relationships among them. Chae (2015) explained that the visualization from this social network in the form of a graph tells the pattern of interactions among the nodes. The visualization of the typological analysis employed the "Open Ord" algorithm to create a graph that represents the social network for Instagram due to its large size. At the same time, "Force Atlas 2" was used to display the networks on Facebook because of the small to medium size. Such an algorithm is appropriate, and Force Atlas 2 is the default visualization embedded in the Gephi software (Jacomy et al., 2014). Actors that are called "nodes" in sociogram (Giuffre, 2013) can be any form such as people, organization, webpages, articles, countries, neighborhoods, divisions in institutions, positions, terms, or any units that connect each unit in a tie (Marin & Wellman, 2011).

To visualize and run the social network analysis, k-core is used as a filter to select specific nodes featured in Instagram and Facebook networks using Gephi software. *K*-core informs how many adjacent nodes (neighbors) a node has, and it measures the overall engagement in the networks (Zhang et al., 2017). *K*-core in an undirected graph is defined as a connected maximal subgraph such that every node has at least a degree at least *k* (Bhawalkar et al., 2015; Kong et al., 2019; Zhang et al., 2017). Bhawalkar et al. (2015) explained that a *k*-core is the result when omitting unnecessary nodes that do not have degrees (number of connections or neighbors) at least equal to *k* in any order. However, determining the *k*-core is challenging since deleting many vertices contributes to coreness loss (reducing the coreness from every edge) (Zhang et al., 2021), while not removing unimportant nodes (having fewer degrees) would lead to increased network complexity (Bhawalkar et al., 2015).

Researchers tried to play around with the networks to find the best k-core in the models they proposed that generate stabilized networks (Bhawalkar et al., 2015; Kong et al., 2019; Zhang et al., 2017; Zhang et al., 2020); Zhang et al., 2021). The determination of the *k* in this study was based on the size of nodes in both networks. Since Instagram has more extracted posts than Facebook, the *k* used in the analysis (typological, centrality, and community analyses) for the Instagram network was slightly larger than that in Facebook. This research applied a *k*-core of 27 for Instagram and 25 for Facebook separately, meaning that any nodes with less than 27 neighbors in the Instagram network or 25 in the Facebook network were removed to form maximal connected subgraphs. Consequently, only important nodes would remain in the networks and form more engaged networks (Zhang

et al., 2020). Using these thresholds, the networks remained stable without losing major nodes in the proposed networks.

The resulting graphical representation from the loaded data is called a network graph or sociogram consisting of dots (nodes or vertices) connected by lines (edges) (Nooraie et al., 2020). Nooraie et al. (2020) suggested that there is no single equivocal approach to explain the graphical visualization of network graphs. Rather, researchers are given the flexibility to process and try different layouts (e.g., sizes, colors, other attributes of nodes, and length of ties, and social clusters) to decide the most satisfactory presentation through a subjective and repetitive process (Nooraie et al., 2020). The next step was to draw meaning from the generated network graphs. Bennett et al. (2007) explained that interpreting the network graph is a voluntary and involuntary process based on the researcher's perception. Therefore, a detailed graph description is needed to help readers gain informed interpretation (Nooraie et al., 2020). Some nodes will be found in the same cluster if they have close connections or similar properties (Azizifard, 2014). The generated layouts (networks) from Gephi were used to differentiate the nodes (topics) with different colors that reflect the groups of key themes discussed in the network. The results of the analysis were then used to answer the first objective, identifying the issues discussed in the Instagram and Facebook networks.

To investigate the influential actors as one of the research objectives, centrality analysis was carried out by measuring degree, closeness, and betweenness centrality. Degree centrality is the number of points or nodes to which a given point is adjacent, measured by counting the nodes that connect to other nodes (Freeman, 1997). Closeness is described as the number of nodes that should pass through to reach an adjacent node. It is

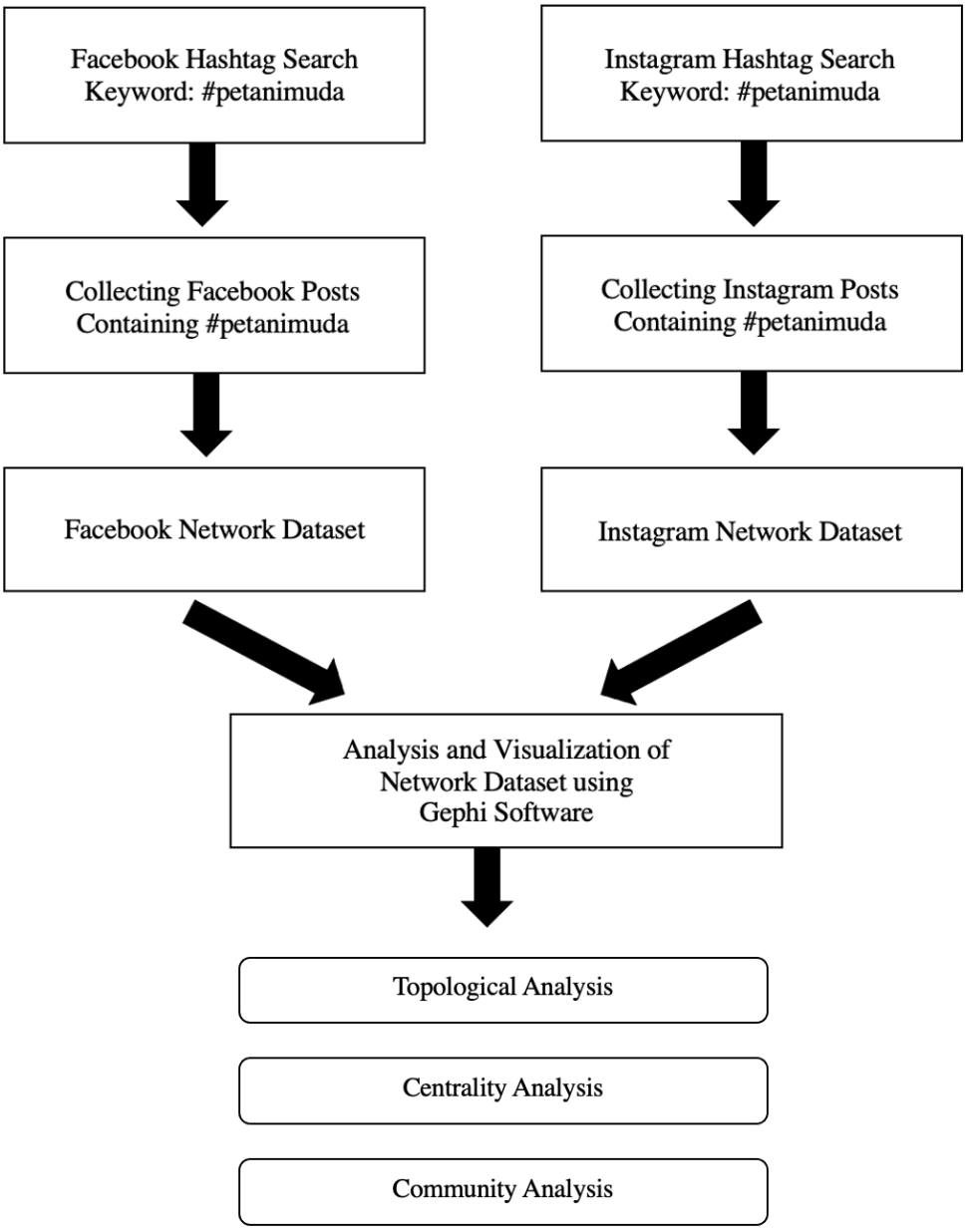
measured by evaluating the average distance between points. Lastly, betweenness shows the average difference between the centrality of the majority of key points and that of other nodes. A higher value of degree centrality, a lower value of closeness centrality, and a higher betweenness centrality depict more influential actors in the network. These three independent variables will identify who are the influential actors (nodes) in the network to attract young people to agriculture that are analyzed using the Gephi software.

The community analysis was performed to describe the characteristics of each network, such as network density, path length, and cluster coefficient. Network density indicates the connectedness between nodes and measures network cohesion (Wasserman & Faust, 1994). It is measured by the proportion of total possible ties in the network from random nodes. The path length is the length in which messages between nodes reach, and it is calculated as the average path length between nodes in the network to represent society as close-knit structures in small world theory (Travers & Milgram, 1969). The clustering coefficient assesses the existence of clustering by measuring the degree to which nodes are more likely to clump together (Watts & Strogatz, 1998). These three components serve as variables that could determine the cohesiveness of the overall network. This cohesiveness reflects the stickiness of members to the network in that members feel motivated to work together in the network (Salas et al., 2015). The more significant is the degree of cohesiveness, the better connected are nodes in the network in terms of both direct and indirect relationships (Tulin, Pollet, & Lehmann-Willenbrock, 2018). When the degree of cohesiveness is high, more nodes are bound together, making individuals less motivated to leave the network (White & Harary, 2001). This higher density would also increase the diffusion of information among nodes, which could nourish a homogenous attitude in the

group (Tulin et al., 2018). Thus, the social media platform with higher cohesiveness reflects the most effective platform that channels youth with helpful resources (e.g., professional farmers, suppliers, successful millennial farmers, experts, and etc.). Figure 3 shows the research procedures to collect and analyze posts from Facebook and Instagram.

Figure 3

Research Procedures for Data Collection and Analysis



CHAPTER IV

RESULTS

A three-level analysis was performed to analyze the structures of and clusters in the networks, assess the significance of nodes, and evaluate the cohesiveness of the overall Facebook and Instagram social networks. The first research objective is to describe the key themes emerged in the Instagram and Facebook networks of *#petanimuda*. Thus, the topological analysis was employed to identify the topics discussed by Instagram and Facebook users in corresponding networks. Typological analysis refers to the visualization of connected nodes with edges in the network. It shows how nodes interact with one another, and therefore a pattern of interactions can be uncovered (Chae, 2015). This result will also provide information about youth's concerns on agriculture-related matters.

Topological Analysis

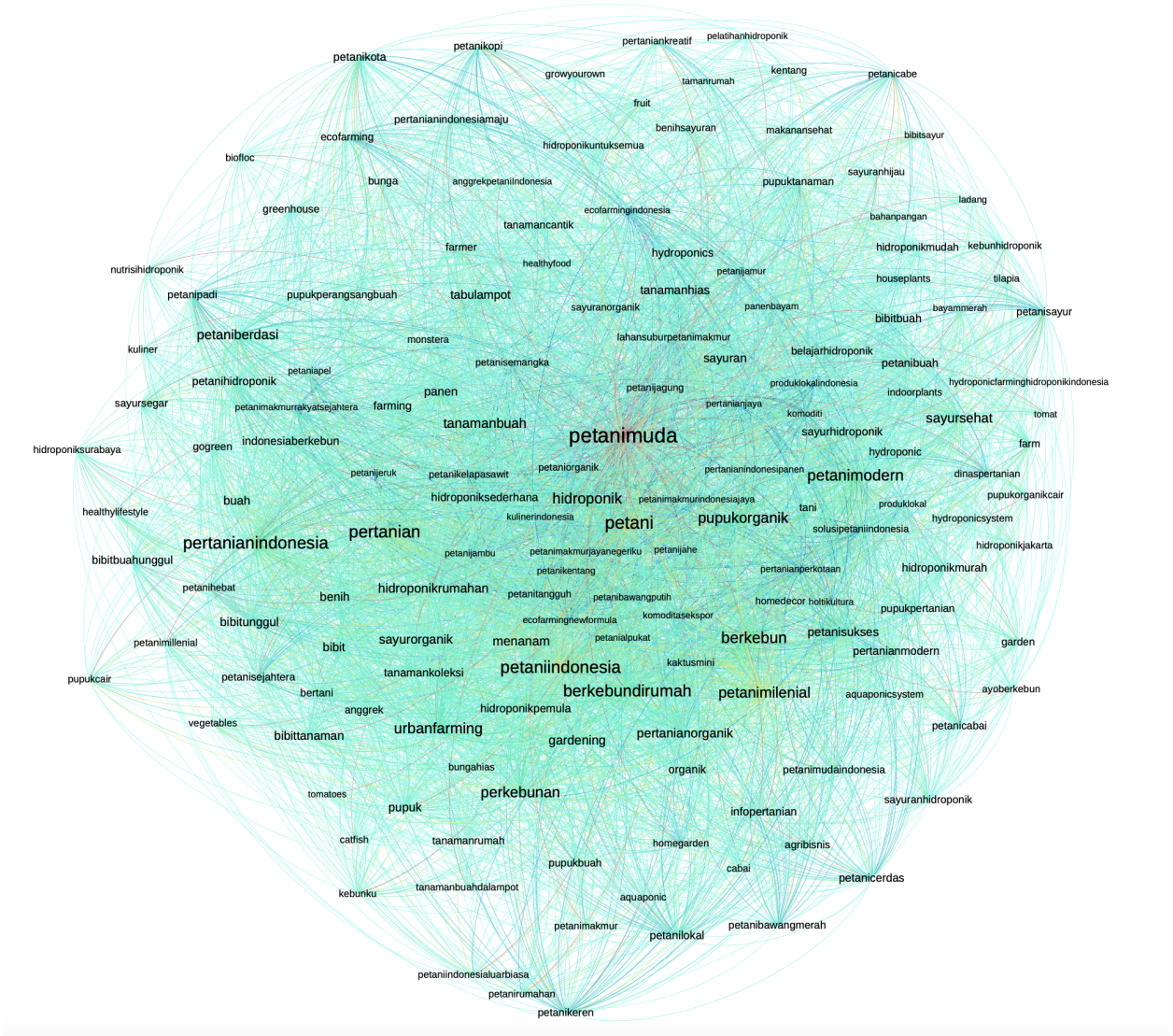
Instagram Network

The first analysis used to analyze the structure of the network is typological analysis. Nodes that are commonly linked to one another will be closer in the network. It used a filter (*K-core*) of 27 which means that only terms that have at least 27 connections with other keywords would be selected and included in the network. Figure 4 shows the key topics discussed in the web of *#petanimuda* in the Instagram network. The description of the nodes in the network is available in appendix 1. Based on the typological analysis, it can be qualitatively interpreted that the Instagram network seems to present no clear, distinct clusters of topics discussed in the network. Instead, it shows a giant network centered by the hashtag *#petanimuda* (young farmers) as a central node that connects all

the other nodes in the network. Although there are no clear clusters, there are some central themes discussed by Instagram users in the network that will be elaborated as follows:

Figure 4

Instagram Network of Key Topics



Agricultural Production. The Instagram network generates one extensive network without clear clusters yet connected themes. One of the most notable discussions is about farming techniques such as hydroponics and the use of smart farming. Hydroponics, a high-

technology and capital-intensive system, is a method for growing crops in nutrition with or without the support of artificial plant growth medium for equipping plants with mechanical support (Jensen, 1997). Hydroponics can also be a great choice for younger farmers to start farming and agribusiness due to its high potentials (Putra et al., 2018). Moreover, hydroponics done through vertical farms are less risky for younger generations as the system could not involve heavy machines and equipment as used in conventional farming (Dayananda, 2021). Smart farming can be defined as an implementation of information and communication technology to manage farming through an automated environment monitoring system (Sisyanto, Suhardi, & Kurniawan, 2017). This relatively new farming method was found to engage more young farmers to the agriculture field (Dayananda, 2021). One young farmer in Indonesia, Gumelar Bayu Fadilah, has run hydroponic agribusiness, and his competency could open other young people's eyes to get involved in the business (Saudi, Baker, Surayya, Saudi, & Firdause, 2021). People in the Instagram network also discuss the difficulty of implementing hydroponic techniques, the cost of building the infrastructure and maintaining the system, and how to operate the hydroponic system.

Agriculture includes a broad range of activities, both on-farm and off-farm. Youth connected to the network of *#petanimuda* (young farmers or millennial farmers) have spent their time engaging in discussing agricultural inputs. Agricultural inputs are any resources that are used in farm productions, including chemicals, equipment, feed, seed, and energy. In the networks, people have conversations over the need for quality seeds. Not only vegetable seeds, but they also discuss the importance of fruit seeds especially superior fruit

seed. Some of them focus on organic fertilizer, fruit stimulants, and liquid fertilizers for their farms.

In a global south country like Indonesia, in-country availability and economic accessibility of agricultural inputs remain a big challenge for agricultural production farms (Anglade et al., 2021). Thus, ICTs perform a significant role in disseminating information regarding agricultural inputs so that farmers can be helped to gain access to those resources and understand how to use them (Freeman & Qin, 2020; Kante, Oboko, & Chepken, 2016). Through its Instagram account, @bibittabulampotmodern posted, "Growing and caring for grapes at home is not difficult; you just need to find the right type to cultivate in your area. For example, this type of imported wine. In Indonesia, it is popularly known as Giovanni wine…". This reflects the importance of ICTs and social media to disseminate information regarding farming activities.

Another focus of the discussion in the Instagram network based on topography analysis is aquaculture-related issues. Aquaculture can be defined as a process of production and captive rearing of fish and other aquatic living creatures through the managed environment (Bosire, Breidahl, Sikora, & Mikkelsen, 2017). Young people engage in conversation about rearing tilapia fish and catfish. They also mentioned one of the methods in fish farming which uses biofloc. The biofloc is an advanced technology in fish farming that uses activities of bacteria, algae, fungi, protozoa, metazoan, rotifers, nematodes, gastrotricha, and other organisms' activities to form flocks under specific environmental conditions (Gustiano et al., 2021). These activities will not only boost the production of fish but also reduce the cost and alter toxic chemicals into harmless substances, improve water quality, increase feed efficiency, and shorten rearing periods

(Avnimelech, 2007). The topics about catfish, tilapia, and biofloc seem to be associated in the Instagram network since these fish, including carp, are the most common and suitable fish cultivated in the biofloc technology in Indonesia (Gustiano et al., 2021). Thus, it is not surprising when these keywords appear in the Instagram network of *#petanimuda*.

Agriculture Movement. The Instagram network also shows a discussion about agriculture movement, such as the tendency to favor eco-farming and organic farming practices. One topic that appears on the network is the shift from conventional agriculture to eco-farming practices. FAO (1999) defines eco-farming practices as "a holistic production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity" (FAO, 1999). One of Instagram users, @teguhgumilang, shared information about the organic food certification body available in West Sumatra Province in his timeline:

> These are some of the institutions that have the right to issue organic certification on agriculture in Indonesia. The addition of one more institution, namely the Department of Food Crops, Horticulture and Plantation, West Sumatra Province. Please see more details on my feed…

The discussion about local products also surfaces in the Instagram network among young people. Hashtags related to local products, fresh vegetables, healthy vegetables, and healthy food relate to one another in the web of *#petanimuda*. In this case, people in the network advocate the benefit of consuming local products. Not only are they a source of fresh, healthy food, but the movement will also support local farmers.

Another major discussion in the Instagram network is the promotion of home gardening using any available backyards (*pekarangan*). Some hashtags associated with the

promotion of home gardening are “let’s garden,” “garden,” “gardening,” “home gardening,” “go green,” and “grow your own food.” Instagram users in the network of *#petanimuda* discussed how to make use of *pekarangan* (backyard) as a space for them to grow their own food. They can plant from any horticultural crops such as tomatoes, lettuce, spinach, chili, and long beans to tropical perennial crops such as mango, rambutan, longan, pawpaw, jackfruit, star fruit, and other fruits if space and other considerations permit. Young people are also found to talk about to use the backyard to grow houseplants such as orchids and cacti. An Instagram user @wangsatani shows how a young Indonesian female celebrity, Prilly Latuconsina practices home gardening:

> The Covid-19 pandemic has made people start to take on various new hobbies such as home gardening (using *pekarangan*). In fact, many celebrities use their home gardens like Prilly Latuconsina does. On her Instagram, Prilly Latuconsina shows the excitement of harvesting vegetables in her garden next to her house… Gardening with them! Just take organic vegetables, just take them out…Prilly wrote a caption for the video that was uploaded to her account @prillylatuconsina96…Wow, that’s fun #SobatTani. Don’t you want to join in the Prilly’s gardening hobby?

Based on this finding, the existence of social media is used by young people to discuss topics about growing plants in their backyards (*pekarangan*).

Call for Agribusiness. One major node in the Instagram network among young people is the encouragement for young people to enter agribusiness. This becomes one of the interesting topics as many youths perceive agriculture as unprofitable work, and agribusiness has great potential to be a lucrative enterprise for young people in this era

(Putra et al., 2008). One Instagram user @agreeculture.id made a post on its Instagram account as follows:

> …@hendrosarjito is the CEO of @bakoelsehatcom (an agricultural enterprise)! Alumni of Agribusiness from Diponegoro University… following his father, Hendro shared that he often witnessed the grief of a farmer from the experience of his father, who was once tricked into selling his crops which resulted in high production costs and low yields. In addition, farmers often do not obtain price certainty and lack knowledge of processing agricultural products, so they only end up as conventional farmers. According to Mas Hendro, farming is dirty, but it is good even though the process takes time… but when he sees the results, it feels very pleasant, that's what made him interested in going into the agricultural industry… he has started farming since the age of 17…

However, youth need to change their mindset when perceiving this business, and supports from the government (e.g., entrepreneurial education), parents, and financial institutions are also needed to motivate young people to run agribusiness.

Resources Needed by Young Farmers. Providing youth with great resources to motivate them to work in agriculture is also an important task. In the Instagram network, young people mentioned some hashtags related to agricultural information and training for specific techniques in farming. An Instagram user, @bpp_kec.maja (the Bureau of Agricultural Extension in Maja Sub-District, Banten Province), documented an agricultural training targeting women farmer groups:

> …at BPP Hall Maja District, the Food Security Office, Lebak Regency, held a Thematic Training for Sustainable Food Gardens targeting Dahlia Women

> Farmers Group (KWT) in the village of Curugbadak…the officer hopes the audiences of the training can be participative. He hopes that this P2L (Thematic Training for Sustainable Food Gardens) can become a major role in promoting food security in the households of Dahlia women farmer group during this COVID-19 pandemic…

In Indonesia, the Ministry of Agriculture has created plans to promote young agripreneurship through young agricultural entrepreneurs by providing agricultural education and extension for youth targeting vocational college agricultural students (Yunandar, Hariadi, & Raya, 2019). This program, however, does not reach young people who do not attend colleges, making them difficult to be motivated to involve in agriculture. Anwarudin, Satria, & Fatchiya (2018) elaborated that although there are agricultural training programs proposed by the Indonesian Ministry of Youth and Sports aimed at rural youth, the implementation of such educational programs is not successful, especially in rural areas.

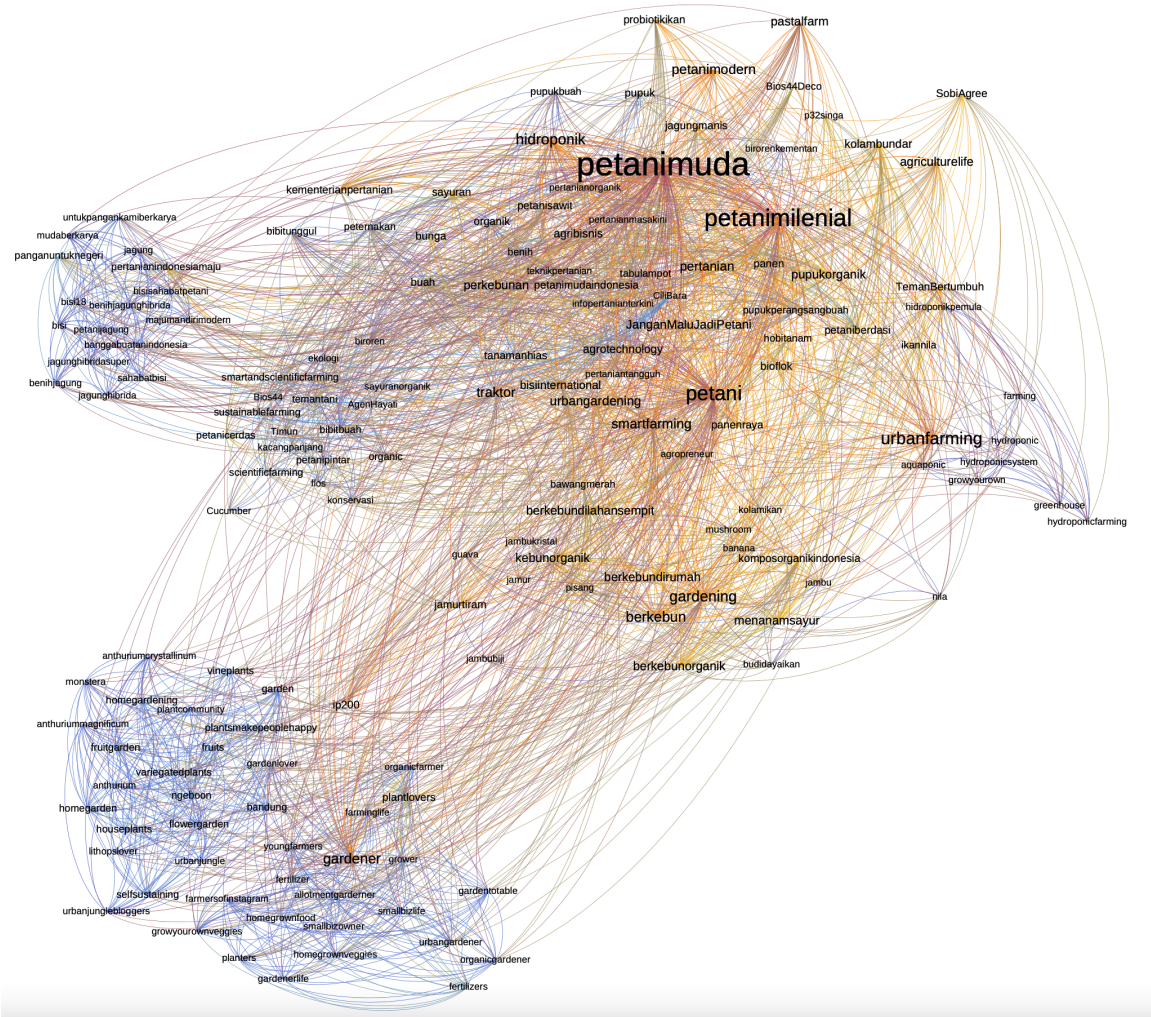
Facebook Network

The typological analysis for the Facebook network results in seven distinct clusters that fall into three different topics discussed by people in the network of *#petanimuda*. It was based on a threshold (*K*-core) of 25, leaving out terms that have less than 25 connections to others. Figure 5 depicts the network of people sharing *#petanimuda* in the Facebook network. The description of the nodes in the network is available in appendix 1. These themes are: (a) agricultural production; (b) sustainable farming and precision agriculture; and (c) motivating youth to participate in agriculture. The topics discussed by people in the Facebook network seem to relate to one another and be connected by the

#petanimuda. However, the different clusters in the network form some connections within the network so that the topics are narrowed into smaller themes. The key topics discussed by young people in the network will be elaborated on as follows.

Figure 5

Facebook Network of Key Topics



Agricultural Production. One emerging issue that young people are interested in engaging in conversation is home gardening and urban farming. In the network of *#petanimuda*, young people made some posting related to home gardening activities.

Christianty et al. (1986) noted that home gardening and urban farming support food provision and address food insecurity, if not broad enough, at the household level. Facebook users in the network also said that plants make people happy. When they grow plants in their backyard, there will be many benefits, not only economic aspects but also an environmental sphere. Facbook user @Irul Putu Abdurahman wrote, "Just being a rural farmer who tries to grow vanilla to decorate my yard as a shade, and who knows it will be profitable."

Another issue that relates to agricultural production is the techniques used in farming. People in the Facebook network of *#petanimuda* discuss how they should propose hydroponics and aquaponics, including a greenhouse for their farming businesses. In the network, a young farmer, @Ferdy Nurfauzi, also mentioned how he learned to adopt a hydroponics system: "…hello my hydroponics buddy. My second-day routine is setting up 90 water pipe tubes for my hydroponics. Practices is better than just my imagination, and I hope we can be successful together".

As part of agricultural production-related issues, agricultural inputs also surface in the Facebook network. Some hashtags narrated about fertilizers for fruit plants, fertilizers, rice seeds, fish seeds, and fish feed. Another theme that emerged related to agricultural production is regarding the management of farms. A farmer, through his account @ Fandi Dmt, shared his experience about how to best manage their farm "…in farming, we need to adjust the feed for the cattle we are raising. If not, we will gain less profit…". This states the importance of management, especially for new farmers. Another issue regarding these topics is the sustainability and accessibility for farmers to obtain these agriculture and aquaculture inputs.

Sustainable Agriculture and Scientific Farming. One big cluster in the Instagram network of *#petanimuda* is the debate on sustainable agriculture and advanced and precision agriculture. Facebook user joining the network advocates the practice of sustainable farming. Sustainable farming, as part of the sustainable development agenda, is a farming system that puts efforts into maintaining resources and conserving the environment so that the implementation of the system can be socially, economically, and environmentally accepted (Anasiru, Rayes, Setiawan, & Soemarno, 2013). @Ecovillage_Suntenjaya shared in its post, "Barupari Tulip Village nursery managed by women farmers group. There is no harvest season or planting season because we implement a sustainable cropping system *#banggajadipetani* (proud to be farmer, *#petanimuda* (young farmers), #petanimilenial (millennial farmers), #kitajagaalam_alamjagakita (we take care of nature, nature takes care of us).

Networks of people on Facebook also touch on the considerations of ecology and conservation in agriculture. Terms related to organic farming and organic food are also found in the network, reflecting that nowadays, younger generations also consider how to shift from conventional farming that does not implement good agricultural practices to regenerative agriculture that follow guidelines to ensure practices are environmentally friendly, socially, and economically acceptable. A farmer from Nganjuk, East Java, @Rahman Utomo, said on Facebook:

> Let me tell my story. We do not want to be dependent on using industrial inorganic pesticides. We refrain from our intention to use rodenticide to kill mice in our field, although our field was overrun by rats. Please give us recommendations for

biological agents to eradicate mouse outbreaks. Thank you, best, a farmer from Balonggebang, Nganjuk.

Motivating Youth to Participate in Agriculture. Some interesting topics appearing in the network are associated with youth encouragement to work in the agriculture sector. Some of the hashtags relate to the topics in the Facebook network of *#petanimuda* are "#mudaberkarya" (young people work), "#untukpangankamiberkarya" (for food, we should work), "janganmalujadipetani" (do not be shy to be farmers), "petaniberdasi" (professional farmers), "petanimudaindonesia" (young Indonesian farmers), and "agribusiness." These jargons could motivate and mobilize the younger population to involve in agriculture. The agribusiness topic shows the importance of pursuing agribusiness as an alternative to young people's careers, considering its potential profits. In the network, people are calling for the next farmers to substitute aging farmers.

A call for young people to work in agriculture, as shown in the Facebook network, is helpful to motivate them. Motivation means to increase the enthusiasm of people to achieve their desired goals (Ibrahim, Djibran, Indriant, & Gobel, 2020). People with strong motivation are more likely to realize their goals (Ibrahim et al., 2020). Referring to this, external motivation is needed for young people so that they can open their minds considering agricultural works as their choice of career development. This is because young people, even in rural areas, are less motivated to work in the agriculture sector. This needs attention from the government to provide support such as training and education for young people to have higher motivation and be ready to start farming. The account @Alzi Jayafarm mentioned in his post, "new farmers, please guide me….". Another Facebook user, @Karim Sulaiman, encouraged young farmers to contribute to agricultural

development in Indonesia. He posted, "… let's encourage young Indonesians to take part and contribute directly to the sustainability of agriculture in our beloved country…". @Aldy Susilo from Temple Krian village, Surabaya, East Java wrote in his post "spirit of youth. Even though life is hard, we will be successful. There will be no successful people if there are no farmers…" Facebook user @Rizki Anggita M tried to increase youth awareness about the issue in agriculture and encourage young people to be involved in farming-related activities. From Wonokerto, Semarang District, Central Java, @Muh Cahyono said, "It is the rainy season, time to plant. Teach them [young people] to do gardening. Let them know that the fruits on our table exist because farmers planted trees producing fruits…". Interestingly, there is also a post encouraging young women to engage in poultry farming. User @Fitri Melini Hasibuan wrote on her Facebook timeline, "This is my small business; I hope I can succeed and develop my farm. Being a woman does not mean I cannot raise livestock…". Another user @Rizki Anggita M stressed the issue of aging farmer,

> Based on data from Agricultural Extension and Development of Agricultural Resources, the Ministry of Agriculture found that around 30.4 million people or 91 percent of farmers in Indonesia are older generation farmers with an age of around 50-60 years, and only 9 percent of farmers from the younger generation aged between 19-39 years which are also decreasing in number. The depletion of the number of farmers belonging to the young category causes Indonesia to be threatened with a farmer crisis problem in the next ten years, where this problem becomes very important for the Indonesian economy because the agricultural sector itself is the highest contributor to Indonesia's economic growth. Therefore, the

> regeneration of young farmers is very necessary because the younger generation as a generation that is closer to technology will be able to develop and improve the agricultural sector in Indonesia…

Farmers also need great resources such as financial supports. @Andrie Permana informed agripreneurs to obtain "KUR" or people's business credit targeting local people who want to start doing business. "…good morning farmer's buddies. Today P3B (porang farmers association in Bali) members conducted phase 3 of the credit agreement to obtain KUR for farmers from a partner bank. This business capital can be used for pouring (a perennial tuberous plant) cultivation with the yarnen model or pay after harvest system, hopefully this capital can be used as best as possible by pouring farmers, especially by P3B farmers…keep working and working…greetings from porang farmers and be successful as always."

Centrality Analysis

The second objective of this study is to describe influential actors in both Instagram and Facebook networks. These dominant nodes are expected to have capabilities in attracting Indonesian young generations to participate more in agricultural-related activities especially in pursuing careers in agriculture. Provided that, centrality analysis was undertaken for both Instagram and Facebook networks of *#petanimuda* using Gephi software. The results of this analysis are elaborated below.

Degree Centrality

The second part of the analysis deals with the centrality analysis, which measures the important nodes or actors in the Instagram network of *#petanimuda* (young farmers). This analysis used a threshold of *K*-core of 27 since the Instagram network of *#petanimuda*

is massive, containing more than 200,000 posts involving that hashtag. *K*-core means the number of neighbors that a node has, which reflects the overall engagement in the network. Thus, any node, which has less than 27 neighbors, was dropped out from the network. Nodes can be individuals, communities, organizations, social entities, and things such as pages and topics. Edges reveal the relations between two nodes. The shorter is the distance between two nodes, the closer is the relationship between those two. Nodes are also weighted based on the number of degrees (connections) they have with other nodes. The bigger is the size of the nodes, the more connection they should have. People who constantly post their stories mentioning *#petanimuda* will appear in the network and perhaps can be part of the most influential nodes since they have more links that connect with other people in the network. Table 1 represents 30 nodes with the highest degree of centrality in the Instagram network.

Table 1

Top 30 Nodes with Highest Degree Centrality in the Instagram Network

No.	Nodes	Degree	No.	Nodes	Degree
1	*petanimuda* (young farmers)	163	16	*petaniberdasi* (professional farmers)	85
2	*pertanianindonesia* (Indonesian agriculture)	131	17	*petanihidroponik* (hydroponics farmers)	83
3	*petaniindonesia* (Indonesian farmers)	129	18	*hidroponikrumahan* (home hydroponics)	80
4	*petani* (farmers)	127	19	*perkebunan* (plantations)	80
5	*petanimilenial* (millennial farmers)	120	20	*petanilokal* (local farmers)	80
6	*petanimodern* (modern farmers)	120	21	*pupuk* (fertilizers)	79
7	*berkebundirumah* (home gardening)	111	22	*sayursehat* (healthy vegetables)	79
8	*pertanian* (agriculture)	109	23	*sayurhidroponik* (hydroponic vegetables)	77
9	urbanfarming	104	24	*benih* (seeds)	76
10	*hidroponik* (hidroponics)	102	25	*bibittanaman* (crop seeds)	76
11	*pupukorganik* (organic fertilizers)	101	26	*petanibuah* (fruit farmers)	76
12	*pertanianorganik* (organic agriculture)	94	27	*sayurorganik* (organic vegetables)	76
13	*berkebun* (gardening)	92	28	*bibitunggul* (quality seeds)	75
14	*petanisukses* (successful farmers)	88	29	*hidroponikpemula* (beginner hydroponics)	75
15	gardening	85	30	*petanikota* (urban farmers)	75

Note. Nodes with higher degree centrality are considered central or important in the network.

Table 1 displays 30 important nodes in the Instagram network of #*petanimuda* grounded on the measurement of centrality analysis. These 30 nodes appear to have the highest degree centrality because they link with the most nodes (have more total incoming and outgoing connections) in the network. In this network some influential nodes with the

highest degree of centrality are *#petanimuda* (young farmers) (163), *#pertanianindonesia* (Indonesian agriculture) (131), *#petaniindonesia* (Indonesian farmers) (129), *#petani* (farmers) (127), *#petanimilenial* (millennial farmers) (120), *#petanimodern* (modern farmers) (120), *#berkebundirumah* (home gardening) (111), *#pertanian* (agriculture) (109), *#urbanfarming* (urban farming) (104), and *#hidroponik* (hydroponics) (102). These nodes are influential since they have more connections in the network than other nodes.

The Facebook network of *#petanimuda* uses a *K*-core of 25 to filter only the most influential nodes in the web of *#petanimuda* (young farmers), which contained more than 10,000 Facebook posts. The cutoff of 25 (*K*-core) means that have less than 25 neighbors were removed from the network. The following section shows the result and discussion of centrality analysis within the Facebook network of *#petanimuda*. Table 2 shows the top 30 nodes that have the highest degree of centrality.

Table 2

Top 30 Nodes with Highest Degree Centrality in in the Facebook Network

No.	Nodes	Degree	No.	Nodes	Degree
1	*petanimuda* (young farmers)	192.00	16	*menanamsayur* (growing vegetables)	57
2	*petani* (farmers)	142.00	17	*pertanian* (agriculture)	56
3	*petanimilenial* (millennial farmers)	134.00	18	*berkebundilahansempit* (gardening in small plot)	55
4	gardening	93.00	19	*kebunorganik* (organic garden)	55
5	urbanfarming	85.00	20	*pupukorganik* (organic fertilizers)	55
6	*petaniindonesia* (Indonesian farmers)	81.00	21	*kolambundar* (round fish farming pond)	51
7	*berkebun* (gardening)	79.00	22	*kebunsayur* (vegetable garden)	50
8	gardener	78.00	23	*petanimodern* (modern farmers)	50
9	*hidroponik* (hydroponics)	77.00	24	pastalfarm (Pastal Farm, a farm located in West Java)	48
10	*menanam* (growing)	76.00	25	*perkebunan* (plantations)	45
11	*traktor* (tractors)	66.00	26	*JanganMaluJadiPetani* (do not be shy to be a farmer)	43
12	smartfarming	65.00	27	*bisiinternational* (PT Bisi International Tbk (an agriculture company established in Indonesia)	41
13	urbangardening	60.00	28	*sayuran* (vegetables)	39
14	*berkebundirumah* (home gardening)	57.00	29	agriculturelife	38
15	*berkebunorganik* (organic gardening)	57.00	30	*kementerianpertanian* (Indonesia Ministry of Agriculture)	37

Note. Nodes with higher degree centrality are considered central or important in the network.

Based on the analysis using Gephi on the Table 2 the top ten influential nodes with highest degrees are *#petanimuda* (young farmers) (192), *#petani* (farmers) (142), *#petanimilenial* (millennial farmers) (134), *#gardening* (93), *#urbanfarming* (urban farming) (85), *#petaniindonesia* (Indonesian farmers) (81), *#berkebun* (gardening) (79), *#gardener* (78), *#hidroponik* (hydroponics) (77), *#menanam* (growing) (76). These are the most significant nodes in the network that can help to increase youth participation in agriculture. People in the network advocates young people to be young farmers or millennial farmers with involvement in agriculture such as urban farming, gardening, hydroponics, and growing plants. Some social entities also appear to be some of the most dominant nodes in the Facebook network. They are #pastalfarm (Pastal Farm) with 48 degrees and *#kementerianpertanian* (The Indonesia Ministry of Agriculture) with 37 degrees in the network.

According to the results of degree centrality analysis, Instagram and Facebook networks of *#petanimuda* have both similarities and differences in terms of the nodes with the highest degree of centrality. Some nodes such as *#petanimuda* (young farmers), *#petani* (farmers), *#petanimilenial* (millennial farmers), #urbanfarming, *#petaniindonesia* (Indonesian farmers), *#berkebun* (gardening), *#berkebundirumah* (home gardening), *#pertanian* (agriculture), *#pupukorganik* (organic fertilizers), *#petanimodern* (modern farmers), *#perkebunan* (plantations), and *#hidroponik* (hydroponics) appeared in both networks. Instagram networks, however, depicted concerns on professional farmers (e.g., *#petanisukses* or successful farmers and *#petaniberdasi* or professional farmers), urban farming (e.g., *#petanikota* or urban farmers), and the importance of locality (e.g., *#petanilokal* (local farmers). However, people in the Facebook network seem to focus on

the importance of gardening as there are some hashtags related to that matter, such as #gardening, #gardener, #urbangardening, *#menanamsayur* (growing vegetables), and #*kebunsayur* (vegetable garden).

Betweenness Centrality

The betweenness centrality analysis help uncover the roles of nodes in sharing information. Nodes with the highest betweenness centrality are more likely to pass information to other nodes in the network. Betweenness centrality measures the ratio of shortest paths that must go through specific nodes (Golbeck, 2015). The nodes with the highest betweenness centrality in the Instagram network are depicted in Table 3. According to the Table 3 some nodes with the highest betweenness centrality are #*petanimuda* (young farmers) (1392.36), #*pertanianindonesia* (Indonesian agriculture) (538.61), #*petaniindonesia* (Indonesian farmers) (419.63), #*petanimodern* (modern farmers) (394.62), #*petani* (farmers) (127) (391.61), #*petanimilenial* (millennial farmers) (377.46), #*petanihidroponik* (hydroponics farmers) (283.96), #*berkebundirumah* (home gardening) (269.67), #*pupukorganik* (organic fertilizers) (240.30), and #*urbanfarming* (urban farming) (235.09). Most of the top nodes involve the promotion of being "farmers," which shows young people's interest in engaging topics about the profession as farmers.

Table 3

Top 30 Nodes with Highest Betweenness Centrality in the Instagram Network

No.	Nodes	Betweenness Centrality	No.	Nodes	Betweenness Centrality
1	*petanimuda* (young farmers)	1392.36	16	*petanikota* (urban farmers)	136.04
2	*pertanianindonesia* (Indonesian agriculture)	538.61	17	gardening	134.09
3	*petaniindonesia* (Indonesian farmers)	419.63	18	*petanibuah* (fruit farmers)	126.22
4	*petanimodern* (modern farmers)	394.62	19	*berkebun* (gardening)	125.71
5	*petani* (farmers)	391.61	20	*petaniberdasi* (professional farmers)	116.78
6	*petanimilenial* (millennial farmers)	377.46	21	*sayursehat* (healthy vegetables)	89.92
7	*petanihidroponik* (hydroponics farmers)	283.96	22	*sayurhidroponik* (hydroponic vegetables)	84.07
8	*berkebundirumah* (home gardening)	269.67	23	*pupuk* (fertilizers)	81.70
9	*pupukorganik* (organic fertilizers)	240.30	24	*perkebunan* (plantations)	80.83
10	urbanfarming	235.09	25	*petanisayur* (vegetable farmers)	79.28
11	*pertanian* (agriculture)	229.16	26	*hidroponikrumahan* (home hydroponics)	77.60
12	*pertanianorganik* (organic agriculture)	201.42	27	*benih* (seeds)	77.21
13	*petanisukses* (successful farmers)	191.36	28	*pertanianmodern* (modern agriculture)	71.06
14	*hidroponik* (hidroponics)	183.95	29	*bibittanaman* (crop seeds)	70.79
15	*petanilokal* (local farmers)	171.43	30	*petanicerdas* (smart farmers)	70.29

Note. Nodes with highest betweenness centrality are more influential in the network.

Table 4 illustrates the 30 most significant nodes based on betweenness centrality analysis in the Facebook Network. The analysis using Gephi, the top 10 nodes that are central in the network, according to betweenness centrality measures, are #*petanimuda* (young farmers) (5662.45), #*petani* (farmers) (2499.19), #*petanimilenial* (millennial farmers) (1699.53), #gardening (674.87), #gardener (457.31), #*petaniindonesia* (Indonesian farmers) (456.40), #urbanfarming (376.58), #*menanam* (growing) (287.86), #*hidroponik* (hydroponics) (281.57), and #*traktor* (tractor) (267.60). In this analysis, Pastal farm #pastalfarm and Indonesia Ministry of Agriculture #*kementerianpertanian* are influential actors in the Facebook network with betweenness centralities values of 130.49 and 81.97, respectively.

Table 4

Top 30 Nodes with Highest Betweenness Centrality in the Facebook Network

No.	Nodes	Betwenness Centrality	No.	Nodes	Betwenness Centrality
1	*petanimuda* (young farmers)	5662.45	16	*sayuran* (vegetables)	96.77
2	*petani* (farmers)	2499.19	17	*pertanian* (agriculture)	85.23
3	*petanimilenial* (millennial farmers)	1699.53	18	urbangardening	84.39
4	gardening	674.87	19	*kementerianpertanian* (Indonesia Ministry of Agriculture)	81.97
5	gardener	457.31	20	*petanimodern* (modern farmers)	77.25
6	*petaniindonesia* (Indonesian farmers)	456.40	21	*bawangmerah* (shallots)	77.20
7	urbanfarming	376.58	22	*TemanBertumbuh* (Buddies for growing)	75.75
8	*menanam* (growing)	287.86	23	*berkebundirumah* (home gardening)	70.02
9	*hidroponik* (hydroponics)	281.57	24	*berkebunorganik* (organic gardening)	70.02
10	*traktor* (tractors)	267.60	25	*menanamsayur* (growing vegetables)	70.02
11	smartfarming	259.94	26	*bisiinternational* (PT Bisi International Tbk (an agriculture company established in Indonesia)	66.04
12	*berkebun* (gardening)	239.25	27	*bioflok* (biofloc system for fish farming)	64.12
13	*pupukorganik* (organic fertilizers)	160.41	28	*petanisawit* (palm oil farmers)	63.11
14	pastalfarm (Pastal Farm, a farm located in West Java)	130.49	29	*kebunorganik* (organic gardening)	62.63
15	*kolambundar* (round fish farming pond)	127.39	30	*berkebundilahansempit* (gardening in small plot)	62.48

Note. Nodes with highest betweenness centrality are more influential in the network.

When comparing Instagram (Table 3) and Facebook (Table 4) networks in terms of betweenness centrality, they have some overlapping and different nodes. These results (Table 3 and Table 4) show that Instagram and Facebook users have similar and different concerns regarding agricultural-related issues. Nodes that surfaced in both networks are #*petanimuda* (young farmers), #*petani* (farmers), #*petanimilenial* (millennial farmers), #*petaniindonesia* (Indonesian farmers), #urbanfarming, #*berkebun* (gardening), #*pupukorganik* (organic fertilizers), #*pertanian* (agriculture), and #*petanimodern* (modern farmers). Some significant nodes in the Instagram network are related to being farmers by posting hashtags such as #*petanihidroponik* (hydroponics farmers), #*petanisukses* (successful farmers), #*petanilokal* (local farmers), #*petanikota* (urban farmers), #*petaniberdasi* (professional farmers), #*petanisayur* (vegetable farmers), and #*petanicerdas* (smart farmers). On the other hand, some influential nodes are related to growing crops, such as #gardening, #*menanam* (growing), #urbangardening, #*berkebundirumah* (home gardening), #*menanamsayur* (growing vegetables), and #*berkebundilahansempit* (gardening in the small plot).

Page Rank

Page rank analysis considers the importance of neighboring nodes when evaluating the significance of nodes (Golbeck, 2013). This implies that nodes that have relations with important nodes are considered to have higher page rank, becoming more important nodes. Page rank provides rank for nodes according to the nodes' in-degree and out-degree, so it considers the interconnection of nodes with their neighbors (Priyanta & Nyoman Prayana Trisna, 2019). The result of page rank analysis is shown in Table 5 depicting 30 nodes with the highest values in the Instagram network. The influential nodes with highest page rank

are *#petanimuda* (young farmers) (0.018), *#pertanianindonesia* (Indonesian agriculture) (0.014), *#petaniindonesia* (Indonesian farmers) (0.014), *#petani* (farmers) (0.014), *#petanimilenial* (millennial farmers) (0.013), *#petanimodern* (modern farmers) (0.013), *#berkebundirumah* (home gardening) (0.012), *#pertanian* (agriculture) (0.012), *#urbanfarming* (urban farming) (0.011), and *#hidroponik* (hydroponics) (0.011). Most of the influential nodes are dominated by the term "farmers," which means that young people in the network emphasize the profession as producers or farmers.

Table 5

Top 30 Nodes with Highest Page Rank in the Instagram Network

No.	Nodes	Page Rank	No.	Nodes	Page Rank
1	*petanimuda* (young farmers)	0.018	16	*petanihidroponik* (hydroponics farmers)	0.009
2	*pertanianindonesia* (Indonesian agriculture)	0.014	17	*petaniberdasi* (professional farmers)	0.009
3	*petaniindonesia* (Indonesian farmers)	0.014	18	*petanilokal* (local farmers)	0.009
4	*petani* (farmers)	0.014	19	*perkebunan* (plantations)	0.009
5	*petanimilenial* (millennial farmers)	0.013	20	*hidroponikrumahan* (home hydroponics)	0.009
6	*petanimodern* (modern farmers)	0.013	21	*sayursehat* (healthy vegetables)	0.009
7	*berkebundirumah* (home gardening)	0.012	22	*pupuk* (fertilizers)	0.009
8	*pertanian* (agriculture)	0.012	23	*petanibuah* (fruit farmers)	0.009
9	urbanfarming	0.011	24	*sayurhidroponik* (hydroponic vegetables)	0.009
10	*hidroponik* (hidroponics)	0.011	25	*sayurorganik* (organic vegetables)	0.008
11	*pupukorganik* (organic fertilizers)	0.011	26	*bibittanaman* (crop seeds)	0.008
12	*pertanianorganik* (organic agriculture)	0.010	27	*benih* (seeds)	0.008
13	*berkebun* (gardening)	0.010	28	*petanikota* (urban farmers)	0.008
14	*petanisukses* (successful farmers)	0.010	29	*bibitunggul* (quality seeds)	0.008
15	gardening	0.009	30	*hidroponikpemula* (beginner hydroponics)	0.008

Note. Nodes with a higher page rank score (0-1) have increased likelihood to connect with others in the network, indicating the importance of the nodes in the network.

Nodes with highest page rank in the Facebook network are illustrated in the Table 6. According to the Table 6 the nodes with highest page rank are in the Facebook network are #*petanimuda* (young farmers) (0.030), #*petani* (farmers) (0.022), #*petanimilenial* (millennial farmers) (0.020), #gardening (0.014), #urbanfarming (0.013), #*petaniindonesia* (Indonesian farmers) (0.013), #*berkebun* (gardening) (0.012), #gardener (growing) (0.012), #*menanam* (growing) (0.012), and #*hidroponik* (hydroponics) (0.012). Pastal farm #pastalfarm (0.008) and Indonesia Ministry of Agriculture #*kementerianpertanian* (0.007) also become two important actors in the network.

Table 6

Top 30 Nodes with Highest Page Rank in the Facebook Network

No.	Nodes	Page Rank	No.	Nodes	Page Rank
1	*petanimuda* (young farmers)	0.030	16	*berkebunorganik* (organic gardening)	0.009
2	*petani* (farmers)	0.022	17	*pupukorganik* (organic fertilizers)	0.009
3	*petanimilenial* (millennial farmers)	0.020	18	organic gardening	0.009
4	gardening	0.014	19	*berkebundilahansempit* (gardening in small plot)	0.009
5	urbanfarming	0.013	20	*pertanian* (agriculture)	0.009
6	*petaniindonesia* (Indonesian farmers)	0.013	21	*kolambundar* (round fish farming pond)	0.008
7	*berkebun* (gardening)	0.012	22	kebunsayur (vegetable garden)	0.008
8	gardener	0.012	23	*petanimodern* (modern farmers)	0.008
9	*menanam* (growing)	0.012	24	pastalfarm (Pastal Farm, a farm located in West Java)	0.008
10	*hidroponik* (hydroponics)	0.012	25	*perkebunan* (plantations)	0.007
11	*traktor* (tractors)	0.010	26	*JanganMaluJadiPetani* (do not be shy to be a farmer)	0.007
12	smartfarming	0.010	27	*sayuran* (vegetables)	0.007
13	urbangardening	0.009	28	*bisiinternational* (PT Bisi International Tbk (an agriculture company established in Indonesia)	0.007
14	*menanamsayur* (growing vegetables)	0.009	29	*kementerianpertanian* (Indonesia Ministry of Agriculture)	0.007
15	*berkebundirumah* (home gardening)	0.009	30	*bioflok* (biofloc system for fish farming)	0.006

Note. Nodes with a higher page rank score (0-1) have increased likelihood to connect with others in the network, indicating the importance of the nodes in the network.

Based on Table 4.5. and Table 4.6. regarding the page rank measurement in Instagram and Facebook, a set of influential nodes was revealed in both networks. Those nodes are *#petanimuda* (young farmers), *#petani* (farmers), *#petanimilenial* (millennial farmers), #gardening, #urbanfarming, *#petaniindonesia* (Indonesian farmers), *#berkebun* (gardening), *#pupukorganik* (organic fertilizers), *#pertanian* (agriculture), *#petanimodern* (modern farmers), and *#perkebunan* (plantations). Some significant nodes in Instagram network emphasize on "farmer profession" such as *#petanisukses* (successful farmers), *#petanilokal* (local farmers), *#petaniberdasi* (professional farmers), *#petanihidroponik* (hydroponics farmers), *#petanibuah* (fruit farmers), and *#petanikota* (urban farmers). Facebook network, however, depicts some important nodes related to "gardening." Those nodes are *#menanam* (growing), #urbangardening, *#berkebundirumah* (home gardening), #organicgardening, and #berkebunorganik (organic gardening). Facebook networks also caught some influential actors such as #bisiinternational (PT Bisi International Tbk (an agriculture company established in Indonesia), #kementerianpertanian (Indonesia Ministry of Agriculture), and #pastalfarm (Pastal Farm, a farm located in West Java).

Community Analysis

Explaining which social media platform (Instagram or Facebook) is more effective to engage more young people in agriculture is the third objective of this study. To answer this question, a community analysis was performed to conclude this series of social media network analysis. This was done to investigate the network-level structures such as network density and cluster coefficient in both Instagram and Facebook networks. Network density calculates the number of actual relationships a node has with other nodes relative to the possible number of connections (Stockman, 2001; Wasserman & Faust, 1994). Density is

measured across the total number of dyads, a pair of actors, or the smallest structure of a social network (Frey, 2018), that are mutual (Faust, 2006). Tight-knit networks feature a highly dense network that features many inter-relations between nodes, while a loose-knit network represents fewer inter-connections among the actors in the network (Barness, 1969).

On the other hand, the clustering coefficient is broadly defined as a measure of the degree to which nodes tend to cluster together in the network. In most real-life, nodes are more likely to form close-knit groups reflected by relatively dense ties. The clustering coefficient, rather than measuring centrality, evaluates density metrics for the whole network (Hansen, Shneiderman, Smith & Himelboim, 2020). It measures the density of a 1.5-degree egocentric network for each node, and a high clustering coefficient implies that nodes have strong connections with others (Hansen, Shneiderman, Smith & Himelboim, 2020). A 1.5-degree egocentric network is a network that involves all ties between friends, not only connections between the central node to the other nodes in the network (Bernie, 2011). Finally, the average path length means the average distance between any pairs of nodes in a network (Perez & Germon, 2016). The shorter the average path length, the more effective the communication process is since nodes do not require to have more connections to disseminate information to other nodes. Thus, based on these three measures, it can be determined which network (Facebook or Instagram) has a more close-knit structure representing small-world theory.

Table 7

Result of Community Analysis of Facebook and Instagram Networks

No.	Social Media Platforms	Average Path Length	Network Density	Clustering Coefficient
1	Facebook	1.836	0.158	0.807
2	Instagram	1.681	0.319	0.745

The result of the community analysis using network density and clustering coefficient parameters is displayed in Table 7 Facebook network of *#petanimuda* has a slightly higher average path length (1.836) than in the Instagram network (0.681). Similarly, the clustering coefficient in the Facebook network is also higher compared to that in Instagram, with values of 0.807 and 0.745, respectively. Conversely, the Instagram network is denser (0.319) than the Facebook network (0.158). Based on these results, Instagram seems to have a more cohesive network than Facebook. This is not surprising since the topological analysis uncovered that there is only one giant cluster in the Instagram network, meaning that nodes relate to one another without any groups within the overall network. This result informs that Instagram is found to be more efficient in delivering information to users in the campaign of *#petanimuda*.

CHAPTER V

DISCUSSION AND IMPLICATIONS

Discussion

Aging farmers remains a big challenge for the development and sustainability of agriculture in Indonesia. Ironically, youth participation in agriculture has shown a declining trend (Pradiana & Maryani, 2019). The sector is not seen as profitable enough, so many rural younger generations migrate to big cities in the hope of pursuing a decent job that can

pay them well. Younger generations prefer working in other sectors such as industry, manufacturing, and services, leaving the agriculture sector for non-farm work opportunities. It is indubitable that young people need to be motivated to pursue agriculture for their future jobs. As an agriculture-dependent country, Indonesia needs more youth as labor forces to address the issue of farmer regenerations and help realize national goals to reach food self-sufficiency and address food insecurity.

As an agent of change for social, economic, and environmental development, Indonesian young people are expected to support agricultural development. Attracting youth to agriculture is the right decision since the country will benefit from a demographic bonus from 2020 to 2030 by having more productive labor forces aged 15-64 that can be directed to developing the sector (Wisnumurti, Darma, & Suasih, 2018). However, several studies have discovered that young people are reluctant to work in agriculture (e.g., Anwarudin, Satria, & Fatchiya, 2018; Katchova & Ahearn, 2015; Lungkang, 2018; Setiawan, Nugraha, & Rasiska, 2019; White, 2015; Zagata & Sutherland; 2015). Some economic, social, and psychological factors have accounted for this problem. Young people do not perceive agriculture as a lucrative business in which they can have a bright future. Working in farming is also seen as a non-prestigious job for some societies so that youth find less interested in pursuing a career in the sector. Moreover, high family expectations and lack of community and parental support also become barriers for youths to involve in agriculture.

The proliferation of ICTs such as social media is a great resource to increase youth participation in farming-related activities. The connection that people have established in the social media platforms such as Facebook and Instagram can be helpful to disseminate

information and create networks among young people. This network is robust to stimulate youth interest in agripreneurial-related work (Muktar et al., 2015). Through its ability to spread information, social media has the potential to rebrand agriculture to be more attractive for young people and connect young people with professionals, social entities, and other actors that can influence youth minds regarding agriculture.

One of the major campaigns to promote agriculture to Indonesian youth is *#petanimuda* (young farmers) on Facebook and Instagram. Young people have opportunities to engage in discussion by asking questions young professionals and experts can reply to inquiries. Through this network, young professionals have space to increase youths' awareness about agriculture-related issues and work in agriculture. SNA offers a valuable lens to explain social interactions among individuals, communities, and organizations in social networks (Carrington, Scott, & Wasserman, 2005). By employing SNA, this study tries to describe the topics discussed in the Facebook and Instagram networks of *#petanimuda*, investigate the influential actors in the network, and identify the more effective social media platform to facilitate networks targeting young people.

Agricultural Production, Agricultural Innovation, and Scientific Farming

Employing Gephi to analyze the network of *#petanimuda* (young farmers) in both Instagram and Facebook, this study found several interesting findings. Based on the typological analysis, one interesting topic in the Instagram network is related to agricultural production and the use of agricultural technologies such as hydroponics, smart farming, and implementation of hydroponics farming and information on how to adopt the system. Hydroponics system, a farming method using planting medium other than soil (Wulandari & Marzuki, 2017), is increasingly adopted in various countries across the world, such as

the United States, Canada, Western Europe, and Japan (Jensen, 1999). Modern agricultural practices using hydroponics are popular among professional farmers from Java, Indonesia (Jahroh, 2013). Due to the lack of farmlands, people have higher motivation to adopt hydroponics since the system does not require much land as compared to traditional farming, yet profitable and suitable with the rural conditions in Indonesia (Putra, Jamaludin, & Djatmiko, 2018). Not only are hydroponics favored by rural agriculture practitioners but also by urban communities due to its flexibility in using available spaces. Hydroponics done by urban dwellers can also improve living spaces, generate additional income for economically disadvantaged groups, cut the food supply chain, and support the creation of an eco-friendly environment (Schnitzler, 2013). Putra et al. (2018) explain that hydroponics could improve rural communities' welfare as the systems can increase more production compared to conventional agricultural works. People are expected to adopt this technology since the hydroponics system is a lucrative business, and farmers do not need huge acres of land to start running hydroponics (Putra et al., 2018).

Although one method of hydroponics, such as Nutrient Film Technique (NFT), requires much investment for installation, hydroponic farming has the potentials to generate more income while supporting the environment (Pratama et al., 2019). Lack of access to financial and technical supports from the governments make it difficult for young farmers to start investing in more advanced farming technique. Consequently, guidance and supports for both materials and nonmaterial from the government and fellow farmers are needed for those who want to pursue a hydroponics system for their business. Access to markets and information will create opportunities for farmers to adopt farming technologies (Schipman & Quaim, 2010). People in the Instagram network also mentioned

affordable hydroponics and greenhouses that can use any spaces and tools for growing plants, even in their home, garage, or backyard so that they will not require a great number of capitals to build hydroponics systems.

Another theme appeared in the social media networks of *#petanimuda* is about aquaponics. Aquaponics adopts a hydroponic system that utilizes fishponds as a nutrient source circulated to the plant growing media (Maucieri, 2017). In this technique, the aquaponics method improves water use since the water used by plants is reused for growing fish (Amin Alamsjah, Sulmartiwi, Tri Pursetyo, & Sulmartiwi, 2016). These great techniques should be promoted to young generations due to their potential economic, social, and environmental benefits. Nevertheless, economic, and societal barriers need also to be considered since young farmers will need material supports and agricultural training and education.

Schipman & Quaim (2010) also explained that young farmers have more willingness to adopt new technology. Moyo & Salawu (2017) studied the adoption of sweet pepper cultivation in Indonesia, Thailand, Zimbabwe, and India, and the result showed that better educated young farmers tend to implement hydroponics systems as agricultural innovation in their farming. Young farmers are in favor of this technology since it is capable of increasing production, reducing the use of water and land, and supporting the environment (Jensen, 1997).

The involvement of digital technology in the era of Agricultural Revolution 4.0 is essential to advance the agriculture sector. Djatmika (2021) suggested that moving to Industrial Revolution 4.0 also needs the support of information and communication technology (ICTs). This is because the application of technology through the concept of

smart farming and precision agriculture could ensure an increasing yield of agricultural production (Djatmika, 2021). Since young people have more experience in using the internet and ICTs facilities such as social media, it would be promising to attract youth into the development of smart farming and precision agriculture. The network of *#petanimuda* talking about the issue will certainly increase their awareness of the impacts of smart farming on their society in terms of economic, social, and ecological aspects. With the increased production, it is expected that young people will be attracted to consider smart farming due to high profitability. However, not only the development of scientific farming needs to be promoted, but also farmers' access to land, water, and capital (Djatmika, 2021).

The networks of *#petanimuda* also engaged in the discussions of agricultural inputs. Farmers undoubtedly need access to agricultural inputs since it becomes a barrier to increasing agricultural production and productivity in developing countries (Crawford, Kelly, Jayne, & Howard, 2003). The availability of types of fertilizers and pesticides, including updated technologies for farmers, could become a constraint for them when running their farms (Anglade, Swisher, & Koenig, 2021). In the networks, young farmers could be more aware of fertilizers used by other farmers who they know or even they do not know. Since the network is open to public, suppliers and agricultural input producers could promote their products. On the one hand, it can be advantageous for farmers to understand the great resources for their farms. On the other hand, it can be disadvantageous since they may follow what other people use, but the products do not always provide many benefits that are advertised in the network they follow. However, the existence of suppliers and access for farmers to buy any agricultural inputs are important for rural communities to run their farms. Consequently, new young farmers should receive advice from other

expert farmers, extension workers, and other professional people. Farmers' interactions with their peers facilitated by social media like Facebook make them connect with great resources to overcome the barriers to obtaining the right supplies for their farms.

Young people also engaged in discussing agricultural inputs like fertilizers, pesticides, and seeds and topics relating to aquaculture and fish rearing. The agricultural movement has also become a major topic in the Instagram network that stresses the importance of organic farming, eco-farming, urban farming, and home gardening using *pekarangan* (backyards). Instagram users following the network also emphasized the importance of increasing entrepreneurial motivation among young people to start agribusiness. The last major topic found in the Instagram network is the discussion about resources needed by youths to participate in agriculture. Not only is information found to be useful, but financial and social supports are believed to be beneficial for new farmers.

As the accessibility to and availability of agricultural inputs in a developing country like Indonesia remain a big challenge, connecting farmers with one another and external resources (e.g., suppliers) in the networks through social media is important. It will provide insight for farmers to grow grapes, while on the other hand, it also motivates farmers. Based on Kante, Oboko, & Chepken's (2016) research, using an SMS-based platform to connect farmers with local suppliers, farmers work more effectively and efficiently since the platform makes them easier to obtain necessary agricultural information related to their business. They also found that connecting with suppliers of fertilizers helps farmers to better use fertilizing methods. Provided that, the discussion about agricultural inputs on social media is helpful for young farmers to manage the supply of products they need for

their farming. Rural farmers with limited resources will eventually find a way to supply their farms with any products to increase production.

Agricultural Movements

Due to the proliferation of information and communication technologies (ICTs) and social media such as Facebook and Twitter, urban farming has gained much attention (Schnitzler, 2013). Not only does urban agriculture address food insecurity issues in urban areas, but it also supports urban farmers with lucrative income (Mougeot, 2006). Nowadays, urban farming shifts toward urban horticulture that heavily emphasizes the production of vegetables and ornamental plants (Schnitzler, 2013). This agriculture branch is still advantageous to improve the urban environment, lessen the effect of climate change due to CO_2 reduction, open spaces for relaxation, and more jobs and income, reduce urban poverty, and improve community livelihoods (Schnitzler, 2013). The development of urban agriculture aligns with the principles of urban planning agenda that propose social, economic, and environmental sustainability in the cities (FAO, 2015). The development of urban agriculture and urban horticulture in the city would also allow lower-income groups to have access to healthy, nutritious food from their areas (Keatinge et al., 2011). Schnitzler's (2013) study found that urban agriculture positively impacted poor people in urban and peri-urban areas through increased nutritional status due to food accessibility. Supporters of urban farming also believe that the development of urban agriculture can create agriculture-based employment for young people, generate income for citizens, and address the issue of urban and peri-urban food insecurity (Kaufman & Bailkey, 2000).

The agriculture industry has created environmental hazards and problems due to emissions and wastes production, and this condition threatens agricultural biodiversity and

people's livelihoods (Muralikrishnan & Philip, 2018; Ramakrishnan, 2002). Eco-farming becomes a solution for addressing the demand for high quantity production while providing fresh, nutritious food, conserving water, land, and environment, and reducing waste production (Sarkar & Majumder, 2015). The eco-farming system offers invaluable social, economic, and environmental benefits for farmers, society, and the environment (Muralikrishnan & Philip, 2018). The practice of sustainable farming will lead to decreasing water, soil, and air pollution while enhancing the quality of livelihoods. In this case, young people are expected to be aware of such a movement.

According to Jahroh (2013), organic farming in Indonesia was pioneered in 1984 by the Bina Sarana Bakti (BSB) Foundation by Rev. Agatho Elsener that built a center for organic agriculture. It was followed with the establishment of the first Indonesian Organic Agriculture Network (JAKERPO), organic rice market proposed by SAHANI cooperative in Yogyakarta in 1999, Indonesia Organic Community (MAPORINA) that involved the Minister of Agriculture staff and academia in 2000, Indonesian Organic Alliance (IOA) in 2002, Indonesian Organic Producer Association (APOI) in 2003, and regulatory bodies for regulating organic farming practices (Jahroh, 2013). These organizations and certification bodies are essential to make farmers and even the public aware of the benefits of organic farming not only for increasing farmers' incomes due to the high selling price of organic food but also for preserving natural resources and the environment.

Discussions about consumptions of local products also emerged in the networks. Consumers of local products help local farmers to sell their products so they can receive monetary benefits from producing local food. Local food and local food movement directly contribute to the ownership and practice of local food where people, through participatory

democracy, empower the local community (DeLind, 2011). It contributes to the development of the food system, especially the food supply chain, so that it will benefit the environment and community.

Another concern that young people has in the network of *#petanimuda* is home gardening by using *pekarangan* (backyards). As one of the traditional farming systems in Indonesia, home gardening, growing any plants in *pekarangan* (lands around the house) is mushrooming among rural people. Not only could it generate subsistence products, but also commercial food that can generate additional household income (Christianty et al., 1986). Sometimes, people are interested in growing horticultural crops, perennial crops, medicinal plants, or even raising animals and conducting fish farming that is important for supporting households' needs for food and the environment (Jahroh, 2013). Young people can generate income from the food they planted as well as obtain food and medicinal plant products for household consumption and ecological services (Kusumaningtyas, Kobayashi, & Takeda, 2006). As agents of change toward sustainable agriculture, youth should realize this issue since conventional and industrial farming that do not follow best agricultural practices can ecologically pollute the environment and harm natural resources. Encouraging people to start growing on their yards will not only bring social-professional changes to villagers but also could balance the ecological environment across cities and villages.

Youth Encouragement for Growing Agripreneurial Skills

Negative stigmatization that young people perceive toward agriculture can be reduced by promotion of agribusiness. However, in some parts of Indonesia, youths still undervalue agribusiness (Setiawan, Sumardjo, Satria, & Tjitropranoto, 2019) since they

still think working in agriculture will only obtain a small fraction of wage (Novanda, Khaliqi, Jamil, & Bakhtiar, 2020). A case study in West Java, Indonesia conducted by Setiawan, Sumardjo, Satria, & Tjitropranoto (2019) about youth readiness in agribusiness discovered that this type of business is favored by high skilled and educated young generations. This is because low-educated young people stigmatize agribusiness as risky and full of uncertainty (Naess, 1993; Maani & Cavana, 2000; Marten, 2001). In West Java, 1.6 million out of 4.6 million farmers are young people (34.2%) age 15-39 with 10%-12% of them being educated and skilled (Setiawan, Sumardjo, et al., 2019). As agribusiness brings hope for economic and social development through the generation of profits and absorption of labor workers, encouraging youth to enter agribusiness and agripreneurship is crucial. As that process can be challenging, it is suggested that young people's entrepreneurial intention in the agricultural sector can be increased with the role of family, peers, business consultants, and professionals who could provide them with consultations about the importance of agripreneurship for the nation (Ridha, Burhanuddin, & Wahyu, 2017).

Finally, motivating youths to the agriculture sector is done by members in the Facebook network by using hashtags "#*mudaberkarya*" (young people should work), "#*untukpangankamiberkarya*" (for food, we should work), "#*janganmalujadipetani*" (do not be shy to be farmers), "#*petaniberdasi*" (professional farmers), "#*petanimudaindonesia*" (young Indonesian farmers), and "#agribusiness". These jargons could help to increase young people's intention to engage in farming. Young people, even in rural areas, are generally not motivated to work in the agriculture sector. This needs

attention from the government to provide support such as training and education so that they will have higher motivation and be ready to start farming.

What Youths' Need

Young people still hold the belief that agriculture is not worthy of their future career due to low wages, and they cannot make a livelihood (Irungu, Mbugua, & Muia, 2015). Working in agriculture is time-consuming, risky, and unprofitable. The development of information and communication technologies (ICTs) and the use of social media such as Facebook not only contribute to the diffusion of agricultural information such as market information, price, and financial support but could also attract youth to agriculture (Irungu et al., 2015). In their study, young farmers can chat on the platform with other fellow farmers, while professional farmers could respond to inquiries from new farmers regarding specific topics. The existence of ICTs will also overcome barriers of extension workers shortage, especially in rural areas due to the availability of the staff and geographic-related issues. With access to information and technology, young people are facilitated to shift from traditional agriculture to digital farming and other sophisticated agricultural production methods. The acceptance of ICTs among young people could retain their motivation to pursue careers in the sector (Irungu et al., 2015).

Agricultural training and education, as mentioned in the network, is also important to encourage young people to enter work related to agriculture. Through their study in Indonesia, Pratiwi & Suzuki (2019) found that agricultural training increases agroforestry promotion and participants' knowledge. Providing technical training and sharing knowledge in the development of agroforestry can increase environmental and economic benefits for society (Fisher & Vasseur, 2002). In Lampung region, Indonesia, agricultural

training and education could motivate farmers to adopt new crops and change rural institutions (Pratiwi & Suzuki, 2019).

The centrality analysis, based on the measurements of degree centrality, betweenness centrality, and page rank, shows similar findings in Instagram and Facebook networks. Some influential nodes in both networks are *#petanimuda* (young farmers), *#pertanianindonesia* (Indonesian agriculture), *#petaniindonesia* (Indonesian farmers), *#petani* (farmers), *#petanimilenial* (millennial farmers), *#petanimodern* (modern farmers), *#urbanfarming* (urban farming), and *#hidroponik* (hydroponics). These nodes are significant since they could connect users within the Instagram network so that they can start a conversation regarding agriculture-related issues. Interestingly, in the Facebook network, the Indonesia's Ministry of Agriculture and Pastoral Farm, an enterprise located in West Java, consistently advocate young people to work in agriculture. It shows that the Indonesian government and society have helped promote the agriculture sector to young people by disseminating agricultural information using social media.

The community analysis indicates that Instagram creates a more cohesive network. This means that people in the Instagram network could easily pass information through the network. A study concerning the effectiveness of social media usage as a media campaign also found that Instagram was proven effective as an outreach medium than Facebook among young generations (Lam & Woo, 2020). Instagram delivered more impressions and created more engagements to targeted audiences (Lam & Woo, 2020). Perhaps, there are several reasons why Instagram seems to develop a more cohesive network among young people. First, it was found that young people spend more time on Instagram than on Facebook (Alhabash & Ma, 2017). It was also reported that users had more favorable

affective and cognitive attitudes toward Instagram than Facebook (Alhabash & Ma, 2017). Additionally, although Facebook remains popular among young adults, young people are moving to use Instagram rather than Facebook (Duncan, 2016; Lang, 2015; Matthews, 2014).

However, both social media platforms are powerful to reach young people and perhaps can become great tools to connect young people with experts in agriculture and other resources. Through showcasing the successful stories of farmers in agriculture, young people are expected to have a better understanding of the potentials of the agriculture sector for their life. Therefore, they can develop their entrepreneurial motivations to address the problem of aging farmers and farmer regeneration in the country.

Implications

One main takeaway from the results of the study is that young people are found to engage in conversations regarding agricultural matters. Agricultural production, for example, is one of the topics that young people are comfortable to talk with other peers in the network of Instagram and Facebook. They also consider about the importance of sustainable agriculture (e.g., organic farming and eco-farming) and precision agriculture to support Industrial Revolution 4.0. However, external motivation is still required for youths to increase their entrepreneurial skills to enter agribusiness and Industrial Agriculture 4.0

Empowering youth in agriculture for the future is essential for farmer regeneration. Young people are engines that can drive the development in the field to address issues in the food system. These are not limited to reducing food insecurity and increasing access to healthy, nutritious food, but also to guarantee the sustainability of the agriculture sector that faces threats regarding aging farmers. As Indonesia will expect to benefit from the

demographic dividend, **youths are** expected to bring hopes for the future of agriculture. Perhaps Franklin D. Roosevelt has a quote that really describes the need to invest youth in agriculture. He voiced, "We cannot always build the future for our youth, but we can build our youth for the future," when he addressed the University of Pennsylvania on September 20, 1940 (The Franklin Delano Roosevelt Foundation, 2021). This shows the potentials of youth to bring about positive impacts for the nation, especially economic development (Khanal et al., 2021). Based on topological analysis it was also found that young people have contributed to the invention of agricultural technology. An Instagram user @evofarm.id said "This Combine Harvester comes from the work of young Indonesians. This proves that young Indonesians could compete with other youths in other countries…please support the work of our young generations".

Gwayna (2008) explained that youth had shown their contribution to reform land and agriculture. With the use of social networking platforms, young people have more access to information available online and, therefore, could increase their literacy (Khanal et al., 2021). Provided that, youth are capable of being the main engine in fostering agribusiness development which involves on-farm and off-farm business that can subsequently open more job opportunities for other young people (Khanal et al., 2021). However, Technical Centre for Agricultural and Rural Cooperation (CTA) (2017) reported that although youths have potentials in developing agribusiness, opportunities for them to build entrepreneurial skills remain limited, especially in developing countries.

Youth Engagement and Disengagement in Agriculture

Although the result of the study depicts that young people have concerned in agricultural-related topics, there are some factors that can hinder or motivate young people

to propose agricultural works. One Instagram user @juragan_tani.id explained, “the number of youths who work in farms may be counted on the fingers, many factors influence it…Come on, young people, let’s grow and develop Indonesian agriculture”. Khanal, Dhital, & Christian (2021) explain three aspects that can be barriers for youth to participate in agriculture: social, economic, and technical elements. In terms of the economic aspect, lack of access to credits and markets challenges young people to work on farms. From an economic perspective, young people tend to be attracted to the agriculture field when they think the business will be profitable, competitive, and dynamic (Kaini, 2019).

The social challenge involves an inadequate support system from the government, lack of extension program services, and negative stigmatization of being farmers due to low profitability. Through his Instagram account, @erwin,yunaz posted, “the enthusiasm of young people will be stronger if supported by the government. Hopefully, you all could develop our agricultural industry…”.

Linked to social factor, psychological aspect could also influence youths’ choice of career. Youths are more likely to consider agriculture as their career when they find no other job opportunities in fields other than agriculture, have a family background in agriculture, and realize an increased value of land (Khanal et al., 2021). Crop production, horticulture, cattle or buffalo rearing, farming business, agri-marketing, and farm labor become Nepali young people’s priorities when involved in agri-enterprises (Khanal et al., 2021). A study conducted by Khanal et al. (2021) on rural youth in Nepal also depicts that the positive attitudes toward agriculture developed by youth are about the high contribution of the agricultural sector to rural areas, acceptability of farming as a way of life, employment creation by the agriculture sector, opportunity to develop agri-enterprises, and

beneficial venture. However, they found barriers that make youth unwilling to engage in agriculture since working on farms is burdensome, reduces their prestige, gains fewer incentives from the government, is suitable for aged people, represents a negative image in the society, and is difficult to obtain credit provision and technological support in rural areas. An Igram user @sanuri3indra posted, "there is nothing wrong by being a farmer's child, what is wrong is our mindset that feels inferior and does not boast of the most noble profession in the world…".

Lastly, the technological barrier that can hinder youth's participation in agriculture comprises limited access to modern technology and modern facilities especially in rural areas. Therefore, Khanal et al. (2021) suggest that in order to increase their involvement in agriculture work, several initiatives are needed. These include providing more agricultural extension programs and financial supports targeting youngsters. This is because young people in many developing countries have less knowledge and experience that hinder them from working as farmers (Khanal et al., 2021).

Importance of Youth to Join the Community

One thing that young people could benefit from joining the community is the opportunity to acquire knowledge and skills from sources of information and be inspired by them. Gumelar Bayu Fadilah has run hydroponic-based agribusiness and actively provided webinar sessions targeting young people in his community, Youth Organization of Cibeunying Kidul Village, Bandung, West Java, so that they can be interested in agriculture work (Saudi et al., 2021). Through their study, it was found that young people are nurtured with information such as how to grow vegetables and build hydroponic-based agribusiness as an alternative way to work during the COVID-19 pandemic. A study about

dynamic relationships between risk perception and behavior in response to the COVID-19 pandemic conducted by Qin, Sanders, Prasetyo, Syukron, & Prentice (2021) found that perceived harmfulness of COVID-19 infection increased people's preventive action (e.g., staying at home more often) to reduce the chances of getting infected. Hence, developing hydroponics and doing home gardening can be seen as an opportunity for young people to fill their spare time to do their hobby and create a profitable business while protecting themselves from the risk of being infected by the COVID-19 outbreak.

In addition, the technology-facilitated interactions are also helpful for community members to voice their minds regarding their interest and hesitations to work in the agriculture sector. As a result, the community could also increase young people's entrepreneurial motivation to start a hydroponic business (Saudi et al., 2021). A Facebook user @Sofyan Adi Cahyono noted in the following, for instance:

> …Sofyan Adi Cahyono is the head of the Citra Muda Farmers Group which is a millennial farmer group. Starting from an anxiety seeing the condition of young people who are reluctant to farm then forming a farmer group with various programs to invite young people to farm organically by utilizing various information and technology to advance their farms… The full video is on the YouTube channel of the Ministry of Agriculture.

This Facebook post states the importance for young generations to join an agriculture-based community. Through programs developed by such community, young people are taught by the practice of organic farming while learning how to better use of ICTs to support their farming development.

Family Support and Expectations, Family Background, and Living in Agriculture-Dependent Communities

Parents play significant roles in directing their children's career options and involvement in society. Parents can be role models for their kids so their children can be embedded in the norms, attitudes, and principles that their parents hold (Hanks & Eckland, 1978; Janoski & Wilson, 1995). In the Instagram network of *#petanimuda, @banuatanaturhidroponic* pointed out as follows:

> Banuata has guests from Adzkiya Balikpapan Study House. Very happy to be able to teach gardening to children so that later they could care about the environment. Accompanied by four supervisors and parents, these 26 children from the Adzkiya Learning House learned how to do gardening from planting seeds, caring for them to harvesting vegetables at the Banuata Garden. Wow, it's really fun, our activities with our little friends today are really excited when they practice planting mustard greens in their polybags and harvesting in the garden…

A study about youth in Iowa and Families Project verified that farmers' children and those living in agriculture-dependent communities are more likely to be active in civic groups (Chan & Elder, 2001). When their parents have some agriculture work background, there is an increased chance that their children will be close to 4-H and FFA activities (Ganong, 1993). This is because their parents will likely invite their children to the organizations when they become part of them (Chan & Elder, 2001). It is suggested that in Indonesia, family expectations and aspirations have an association with youth education and career aspirations (Nilan, Parker, Bennett, & Robinson, 2011). The higher aspiration that their parents have, the higher education their children will have, so children will have an

increased expectation of what they will pursue in their work (Krahn & Taylor, 2005). As Indonesian youth education levels have increased following higher parental expectations, it has been observed that Indonesian youth move away from the agricultural sector to manufacturing and industry sectors (Nilan et al., 2011; Robertson, Brown, Pierre, & Sanchez-Puerta, 2009).

Training and Education

Agriculture training and education programs are also essential for younger generations to immerse themselves in agriculture careers and agriculture development. One study conducted by Bosire et al. (2017) found that aquaponics (a farming method combining hydroponics and aquaculture) educational programs at schools help young people gain exposure to food-related issues so they will have better food, sustainability, environmental, and agriculture literacy and understanding in school subjects such as the physics, social science, math, geometry, and biology. They explained that agriculture-related education facilitates young generations to develop active learning and inspires them to consider agriculture work as their profession (Hambrey, Evans, & Pantanella, 2013). An Instagram user @balaitani reposted a prominent figure who are the Mayor of West Java Province @Ridwankamil who said:

> This Millennial Farmer has a program launched by Ridwan Kamil for agricultural development in West Java. In this program, Ridwan Kamil invites young people, especially people from West Java to live in the village, farming with technology. Please note this program has been run since last March… Millennial farmers are slowly becoming a solution for Indonesia's future young generation so that Indonesia can ensure food security and prosperity. Millennial farmers have the

spirit: "Living in the village (far from pandemic), city fortune and global business (because it's digital & 4.0)".

In addition, a study in Lamongan Regency, East Java, Indonesia, found that socialization and training of hydroponics targeting rural youth communities could bring about benefits to their villages. In addition, Kaufman & Bailkey (2000) studied how agriculture training offered by youth communities such as YMCA opens young people's minds to pursue careers in the agriculture sector as they are trained how to grow food through planting projects and how to market agriculture and aquaculture products such as vegetables, cut flowers, and fish.

Rebranding the Image of Agriculture using Communication Technologies and Social Media

The proliferation of technological communication is a great way to open opportunities for young people to connect with other people and get involved in the agriculture sector. Young generations still assume that working in agriculture is time-consuming, risky, and not profitable. Moreover, the negative social perceptions of careers in agriculture create barriers for them to participate in agriculture. Despite other constraints, parental expectations also hinder young people from pursuing agriculture as a career option, especially when their children are well educated so that they could propose non-agriculture occupations such as in industries and services. Hence, the long-held belief that young people have regarding the miserable future of their life when pursuing agriculture can be rebranded using information technology and social media. These social media can contribute to changing youth perceptions of young people by depicting successful stories of professional entrepreneurs. One Instagram user @pappasuryadi posted,

> Come on, many richest people in Indonesia have been caught in the agricultural business. So, for those of you who are interested in agriculture or those who have a hobby and are now critical of the agricultural business, keep your spirits up.

Hence, information, technology, and social media should be employed to change youth perceptions regarding the face of agriculture and connect them with professionals and other helpful resources. Provided that, they will be aspired to consider agriculture as their career path.

Internet and the development of technological information have contributed to the development of agriculture, and young people can connect with one another via social media. Young people's participation in agriculture can be increased since social media create a space for them to post and share information in their online communities (Irungu et al., 2015). Irungu, Mbugua, & Muia (2015) conducted research about how information and Communication Technologies (ICTs) and the internet, computers, and GPS could increase youth's participation in lucrative agricultural business in Kenya. They found that youth farmers spend a considerable amount of time on their smartphones searching for information and connecting with other fellow digital farmers. In their online community, they do not only use social media and the internet to obtain market information such as price changes and trends, but also employ social media such as Facebook to help other farmers who ask questions regarding farming. Young Kenyans utilized Facebook and created a community where young people have opportunities to post pictures and videos, discuss agricultural issues, and engage in discussions with other youths that have strong motivation to work in agriculture. Besides that, Facebook and websites are used for marketing and expanding networks because young farmers can respond to their client's

queries. Thus, the development of ICTs serves as a hub among farmers, young entrepreneurs, the community, and society in general.

ICT-savvy young farmers have the potentials to help transform their communities and attract more young people to agriculture. They can be consultants for other youth by assisting young farmers in obtaining up-to-the-minute information about price and market. Professional farmers have an opportunity to change the perception of youth regarding agriculture using ICTs (Irungu et al., 2015). Social networking tools such as Facebook, Twitter, YouTube, and SMS are proven successful in increasing youth participation in agriculture through educational programs and dissemination of information so that they become more aware of what farming activities are (Irungu et al., 2015). An Instagram user @dididikcom shared a post to boost youths' encouragement to get involved in agriculture in its post,

> Indonesia is known as an agricultural country…However, with the development of … professional technology in the agricultural sector, the younger generation is less interested in it because it is considered less profitable. So how do you attract the interest of the younger generation? Or is there a way to improve the agricultural sector? Let's see the story of Febi Agil Ifdillah as a CEO of Neurafarm in Sharing Screens (Sailing) program with Dididik: "Young People Dare in Agriculture: Who's Afraid?" Saturday, 29 May 2021 at 16.00 WIB on IG @dididikcom. Don't miss it.

In this case, young farmers utilize social media and ICTs to reach more youth community members while promoting agriculture. Users can interact with one another by asking questions and responding to their inquiries regarding the new techniques used in agriculture, market information, and agricultural activities. Rather than being idlers, youth

can become professionals in agriculture since they have an opportunity to acquire knowledge, information, and skills from the community in social media they relate to.

Peer-to-peer advising is also helpful to open youths' minds about starting careers in the agriculture sector. They could meet with their friends or new people who share the same interest in pursuing a career in agriculture. As people have chances to join the community, youth connect not only with their close friends but also with social entities, special groups, and other users that they feel more comfortable to share their ideas and hesitations. These are great resources for youths to truly accept agriculture as a prospective field for their future. Through discussion with people and their community, it is expected that they will gain acceptance from their society if they decide to propose a job in agriculture areas. They have an opportunity to expand their networks by linking with webpages from private sectors, government organizations, and other communities, so they will benefit from the latest updates of agricultural information. Finally, the tech-savvy youths, with connection with and aids from their friends and communities on social media, will not only become better young farmers that understand how to be great traders or agricultural players, but they would also fill the gap that aging farmers encounter, especially when catching up with the adoption of new agricultural technologies to support their farming businesses.

The Future of Social Media Use to Increase Youth Participation in Agriculture

Although social media and ICTs promise huge benefits for the development of agriculture, there is still a hindrance that youths have encountered. Young people do not have equal opportunities to access information on the internet and relate to communities in social media due to lack of ICTs infrastructure, skills, and electricity, ownership of smartphones, and other resources. This especially happens for rural youth, and access to

the internet should be made available for users in languages that can be understood by them (Irungu et al., 2015).

Social media provides hope for the development of agriculture, especially to increase youth participation in the sector. Not only will social media link young people with significant resources in the agricultural community, but they will also expand the agricultural extension coverage. Subsequently, information can be disseminated easily without having geographical barriers as traditional extension methods often face. Information can be easily spread from many sources and can be accessed by young people. They will have opportunities to join any groups that they feel comfortable and interested in. In their community, professional farmers can share what they are doing on their farms while other ranchers may show the animals they are raising.

The use of social media can also reshape the face of agriculture. Agriculture is not seen as a prospective to pursue their professional development because it requires hard work but does not pay well. Because of that, young people search for more decent job opportunities outside the field, such as in industry and services. Besides economic motives, social acceptance from their friends, parents, community, and society regarding agriculture hinders their engagement in farming-related activities. The use of social media by the younger generation is then perceived as advantageous since young people who do not find agriculture a promising place for their future could change their minds. This is because young people will stay connected with their peers who are more experts in running agribusiness. Young professionals can be role models for their friends by educating their peers in their community. Connections made with professional farmers, private sectors, extension workers, and other social entities in the online community make it possible for

young people to realize the beauty of agriculture. There are many successful entrepreneurs who own their farms, and they could make their own living. The portrayal of such fame, although no guarantee that young people could change their minds for a second, provides youths with some ideas and help them realize that being farmers can be successful and have a bright future.

Efforts for supporting farmer regeneration can be realized through the use of social media. The networks that young people have made with their friends through social networking sites are powerful enough to connect professional farmers, ranchers and institutions, and youths. In the networks, professional farmers have rooms to showcase their successes in the agribusiness they manage, and this could draw the younger generation's attention to what makes them successful and prosperous. Technology-facilitated interactions allow youths to engage and discuss any issues that they are interested in. In these opportunities, professional growers could depict their successful stories so young people could see that the agriculture sector can be profitable, breaking their long-held belief that working in agriculture cannot make a good livelihood. Thus, young people are facilitated with a social space where they can express their feeling and anxiety regarding the careers they want to pursue. Experienced farmers have the capability to assist young people when they want to become farmers. Through knowledge and skill transfer facilitated by information exchange in social media networks, it is possible that young people can better understand opportunities in agriculture work from experts.

CHAPTER VI

CONCLUSIONS

This chapter is divided into three parts, namely (1) summary of key findings, (2) contributions of the research, (3) limitations and suggestions for future research.

Summary of Key Findings

After conducting social network analysis through Gephi, this study found striking results based on the topology, centrality, and community analyses of Instagram and Facebook networks of *#petanimuda*. The first research objective aimed to describe the major topics discussed by young people in both Instagram and Facebook networks. Themes appearing in the Instagram network were associated with agricultural production (e.g., hydroponics, agricultural inputs, challenges in farming, and aquaculture), agricultural innovation (e.g., smart farming), and agricultural movement (e.g., urban farming, eco- and organic farming, consuming local products, and home gardening). The network of young farmers in Instagram also depicted the need for increasing youths' entrepreneurial skills, mainly in entering agribusiness. According to the finding, young farmers also demand helpful resources to start farming, such as agricultural training and financial support. With more specified clusters than the Instagram network, the Facebook network of *#petanimuda* revealed several critical themes in young people's conversations. These topics are agricultural production (e.g., home gardening and urban farming, farming techniques, hydroponics, and agricultural inputs), sustainable agriculture and scientific farming (e.g., farming that promotes ecological conservation and precision farming), and encouragement for youth to involve in agriculture and agripreneurship such as the use of a jargon "*#janganmalujadipetani*" (do not be shy to be farmers).

Based on the centrality analysis, influential nodes in both Instagram and Facebook network of *#petanimuda* were #pertanianindonesia (Indonesian agriculture), #petaniindonesia (Indonesian farmers), #petani (farmers), #petanimilenial (millennial farmers), #petanimodern (modern farmers), #berkebundirumah (home gardening), and #urbanfarming. Those nodes generally have a higher degree of centrality, betweenness centrality, and page rank, which have more connections with other nodes and serve as essential mediators among nodes in the networks. These nodes are significant to connect and channel one node and another. Interestingly, the Facebook network of *#petanimuda* showed important actors concerning agricultural development, namely Indonesia's Ministry of Agriculture and Pastal Farm (an agricultural enterprise). These two actors have extensively created Facebook posts to promote agriculture-related activities.

The community analysis concluded that Instagram generally has more cohesive network compared to Facebook's. Instagram network of *#petanimuda* has a shorter average path length, smaller clustering coefficient but higher network density. Thus, Instagram has a more cohesive network, meaning that generally, people in the Instagram network have a more effective communication process to disseminate information from one to another. This result is supported by the typological analysis, which showed that the Instagram network created one big cluster rather than generating various clusters such as that in the Facebook network of *#petanimuda*.

Social network analysis provides valuable insights to understanding how young people are connected in both Instagram and Facebook networks by seeing the topics discussed, essential nodes in the networks, and the effectiveness of social media in network formation. However, the findings of this study imply that some aspects need to be

considered to increase more youths' participation in agriculture. Supports from family, community, stakeholders, and governments (e.g., agricultural training and education) are helpful to not only change youths' perceptions regarding agriculture work and develop their agripreneurial skills and facilitate them to enter Industrial Revolution 4.0 with emphasis on digital and smart farming. Finally, rebranding the image of agriculture is possible and can be done through social media so that young people will be more aware of the issues in agriculture so that they will be more willing to participate more in agriculture.

Contributions of the Study

This research attempts to help the Indonesian government, policymakers, non-governmental organizations, stakeholders, and academic community by exploring youths' agriculture-related social networks that have been established using social media, namely Facebook and Instagram. By using user-generated content connected to the campaign of *#petanimuda* (young farmers), this research aims to contribute to youth participation in agriculture. Overall, the significance of the research will be elaborated on as follows.

First, through using quantitative analysis and internet study, the study tries to fill the gap in existing literature regarding the analysis of the campaigns on Facebook and Instagram targeting young people. This study broadens and advances the literature related to farmer regenerations issues, youth engagement and disengagement in agriculture, and youth aspirations in working in this sector. Kerry (2015) noted that although there are a plethora of studies focusing on the use of social media for industry marketing, the connections between social media and agriculture are underexplored. Based on user-generated contents, this study searches for the connections among Instagram and Facebook users and the contents discussed in the networks they have developed.

Moreover, related to the study of social media, this work adds insights to the literature regarding how social media campaigns could affect people's perceptions, attitudes, and behaviors. Namkoong, Nah, Record, & Van Stee (2017) explained that little attention had been given to the study of Social Networking Services (SNSs) to change people's behavior, perceptions, and attitudes. This study used the *#petanimuda* (young farmers) campaign on Instagram and Facebook by analyzing people's posts on the platforms. Based on topology and centrality analysis, there are many topics discussed by young people. This will inform the perceptions and attitudes of youth toward working in agriculture or choosing agriculture as their career path and provide insights on how young people behave based on the contents, they post on social media platforms. The typological analysis also revealed themes of interest to young people. These include the intention for adopting hydroponics, aquaponics, smart farming, precision agriculture, organic farming, and eco-farming. The emergence of the topic of ecology and conservation in agriculture also explains the tendency of young people to support environmental protection, not solely about economic matters, when they start farming. Based on this study, it is also known that young people need to be motivated to enter agribusiness and agripreneurial activities. Ridha, Burhanuddin, & Wahyu (2017) suggested that to increase agripreneurial intentions among young people, supports (e.g., from family, friends, and professional agricultural workers and consultants), socialization and promotion of agriculture to parents and community, and agricultural training and workshops are needed to shape and direct young people's agripreneurial skills.

The centrality analysis suggests that there are potential actors in social networks that could be helpful to attract youths to agriculture. Thus, the Indonesian government and

local governments could help these actors better facilitate campaigns targeting youths to make it easier to obtain young people's attention. The Indonesia Ministry of Agriculture and one of the agricultural enterprises, Postal Farm, have become two significant actors in the network to advocate and promote young people to work in agriculture through their social media accounts. Therefore, the information can be directed to targeted audiences. This research is then helpful for policymakers, government, and stakeholders to find the right channels to disseminate information and promote agriculture to young people.

Additionally, the findings of the research also will be helpful for policymakers when planning strategies to increase youth participation in agriculture. This is mainly associated with the use of social media as a campaign tool to reach more young people. Any agricultural information such as training, education, financial opportunities, workshops, and other valuable information can be passed through social media channels. Policymakers and practitioners could also employ social media when planning to encourage young populations to be involved in agriculture-related work. Finally, this study can help with the development of strategic communication plans, so that policymakers and practitioners can propose better communication strategies to reach young people about agriculture-related issues. This research will also be helpful for extension workers when developing extension programs and marketing agricultural programs targeting younger generations.

Finally, the research can aid the government and policymakers in finding the right programs and direct future agricultural development targeting young generations. Based on the research findings, young people in the networks discuss some advanced agricultural innovations such as hydroponic and aquaponic systems, smart farming, sustainable

agriculture, and precision agriculture. Thus, policymakers can develop agricultural programs that address specific needs of young generations. This is to ensure that young people will be more involved in the programs that they are interested in.

Limitations and Suggestions for Future Research

Future research can build on this preliminary research on social media network analysis, but some cautions must be carefully taken into account. A similar study conducted by Grandjean (2016) about social networks in Twitter noted that the jurisdiction of geographical locations, cultural, and language distribution need to be warranted. There is a bias potential where networks are dominated by certain groups that would affect the network structures (Grandjean, 2016). Thus, this study also does not warrant any possibility of over-or under-representation of specific communities in the networks, although the campaign of *#petanimuda* is intended to reach young Indonesian communities. Although this research attempts to analyze the Facebook and Instagram networks in Indonesia, people who use such campaigns in other countries could also be included in the networks since geographical filters were not provided by the ScrapeStorm, a platform used to scrape Instagram and Facebook posts from users. People from different countries that use Indonesian and Malay languages such as Malaysia, Singapore, Brunei, East Timor, Singapore, southern Philippines, and parts of Thailand can also engage in the networks due to the similarity of languages used in those countries. Thus, this research can be improved by more advanced software or highly selective software when extracting posts in those social networking channels so that only the targeted youth community will be presented in the networks.

A big portion of this study used a quantitative approach, although the qualitative method was applied for thematic analysis by employing internet research on social media. Future studies can add depth to the analysis by conducting a comprehensive qualitative or mixed methods approach to describe critical themes discussed in the networks and evaluate to what extent young people intend to work and be involved in agriculture. Nooraie et al. (2020) noted that researchers conducting SNA studies need to consider the fusion of qualitative and quantitative methods when analyzing social networks. The mixing may involve the data collection, analysis, and interpretation of graphs and visuals so that the translation from numbers to words would be more meaningful without affecting the overall network structures (Nooraie et al., 2020). Both quantitative and qualitative approaches help understand the complexity of people's changing roles in social networks.

There is also an opportunity to enhance the comprehensiveness of social network analysis on social media by integrating other approaches compatible with social network analysis. Erlin et al. (2008) explained that the content analysis approach is robust to evaluate the quality of the technology-mediated discussions by providing an in-depth analysis of information not situated at the surface level. Benefits of using this technique include filtering unrelated messages and nodes from the discussion content, creating more reliable network structures, and opportunities to evaluate the roles of nodes and their level of participation in the community (Erlin et al., 2008). Hence, it provides a chance for researchers to conduct follow-up studies using social media content analysis to understand better the social process and interactions happening within the community.

The use of other approaches will also be helpful, especially in the communities where ICTs and social media are underused or when the infrastructure of ICTs has not been

well developed so that social media research cannot be created. Based on the findings from this research, follow-up research questions can focus on to what extent social media can increase youth participation in agriculture since this issue is not explored in this study. It is also beneficial to study how young people can obtain access to social media and the internet, especially for rural youth, considering the limited ICTs infrastructure in rural areas. Besides, future research projects may investigate the pattern of interactions among nodes in the network to understand the flow of information and how relationships among nodes can be enhanced. Social network-related research will also be more useful when incorporating the analysis of power relations among nodes in the networks.

Moreover, future research can extend this analysis by shedding light on the factors associated with youth aspirations to work in agriculture, community, and family support for young people, and barriers for young generations to engage in agriculture. Additionally, there is an opportunity for researchers to replicate and advance this study, mainly in countries facing aging farmers, such as the United States (Reed & Claunch, 2015), Japan (Poungchompu et al., 2012), India (Milovanovic et al., 2020), China (Zou et al., 2018). Thus, the findings will be more informative for policymakers to formulate policies addressing the shortage of young agricultural workers and farmer regeneration. Finally, exploration of similar topics in other popular social media platform such as Twitter, YouTube, WhatsApp, and LinkedIn can also be proposed as this study only focuses on Facebook and Instagram. Should access to social media and the internet become an issue due to the lack of ICTs infrastructure, the study can be done in a real community context of social networks.

APPENDIX

Appendix 1. Glossary of Nodes in the Facebook and Instagram Networks

No.	Nodes	Nodes Glossary
1	AgenHayati	biological agents
2	agribisnis	agribusiness
3	agriculturelife	agriculture life
4	agropreneur	agropreneur
5	agrotechnology	agrotechnology
6	allotmentgarderner	allotment gardener
7	anggrek	orchid
8	anggrekpetaniIndonesia	Indonesian orchid farmer
9	anthurium	anthurium
10	anthuriumcrystallinum	anthurium crystallinum (a species of flowering plants)
11	anthuriummagnificum	anthurium magnificum (a species of flowering plants)
12	aquaponic	aquaponics
13	aquaponicsystem	aquaponic system
14	ayoberkebun	let's garden
15	bahanpangan	foodstuffs
16	banana	banana
17	bandung	Bandung (a city in West Java, Indonesia)
18	banggabuatanindonesia	proud made in Indonesia
19	basil	basil
20	basilgenovese	genovese basil
21	bawangmerah	shallots
22	belajarhidroponik	learning hydroponics
23	benih	seed
24	benihjagung	corn seeds
25	benihjagunghibrida	hybrid corn seed
26	benihsayuran	vegetable seeds
27	berkebun	gardening
28	berkebundilahansempit	gardening in small plot
29	berkebundirumah	home gardening
30	berkebunorganik	organic gardening
31	bertani	farming
32	bibit	seeds
33	bibitbuah	fruit seeds
34	bibitbuahunggul	superior fruit seeds

No.	Nodes	Nodes Glossary
35	AgenHayati	biological agents
36	bibittanaman	seed plant
37	bibitunggul	quality seeds
38	biofloc	biofloc
39	bioflok	biofloc system for fish farming
40	biologi	biology
41	Bios44	Bios 44 (an organic fertilizer)
42	Bios44Deco	Bios 44 (an organic fertilizer)
43	biroren	Biro Perencanaan (the Planning Bureau of the Indonesia Ministry of Agriculture)
44	birorenkementan	Biro Perencanaan Kementerian Pertanian (the Planning Bureau of the Indonesia Ministry of Agriculture)
45	bisi	PT Bisi International Tbk (an agriculture company established in Indonesia)
46	bisi18	Bisi 18 (a hybrid corn seed brand produced by PT Bisi International Tbk)
47	bisiinternational	PT Bisi International Tbk (an agriculture company established in Indonesia)
48	bisisahabatpetani	PT Bisi International Tbk as farmers' partner
49	buah	fruit
50	buahbuahan	fruits
51	budidaya	farming
52	budidayaikan	agricultural technology
53	budidayaikanairtawar	freshwater fish farming
54	budidayaikannila	nile tilapia farming
55	bunga	flowers
56	bungahias	ornamental plants
57	bungatelang	butterfly pea
58	cabai	chilli pepper
59	cabairawit	cayenne pepper
60	catfish	catfish
61	chilli	chilli
62	CiliBara	cili bara (a brand of chili pepper seeds)
63	Cucumber	cucumber
64	dinaspertanian	Department of Agriculture
65	ecofarming	ecofarming
66	ekologi	ecology
67	farm	farm
68	farmer	farmer

No.	Nodes	Nodes Glossary
69	farmersofinstagram	farmers of Instagram
70	farming	farming
71	farminglife	farming life
72	fertilizers	fertilizers
73	flos	Flos (an agricultural social enterprise based in Central Java, Indonesia)
74	flowergarden	flower garden
75	foodindonesia	Indonesian food
76	fruit	fruit
77	fruitgarden	fruit garden
78	fruits	fruits
79	garden	garden
80	gardener	gardener
81	gardenerlife	gardener life
82	gardening	gardening
83	gardenlover	garden lover
84	gardentotable	garden to table
85	gogreen	go green
86	greenhouse	greenhouse
87	grower	grower
88	growyourown	grow your own
89	growyourownveggies	grow your own veggies
90	guava	guava
91	healthyfood	healthy food
92	healthylifestyle	healthy lifestyle
93	hidroponik	hydroponics
94	hidroponikindonesia	Indonesian hidroponics
95	hidroponikjakarta	hydroponics in Jakarta, Indonesia
96	hidroponikmudah	easy hydroponics
97	hidroponikmurah	affordable hydroponics
98	hidroponikpemula	beginner hydroponics
99	hidroponikrumahan	home hydroponics
100	hidroponiksederhana	simple hydroponics
101	hidroponiksukabumi	Sukabumi hydroponics
102	hidroponiksurabaya	hydroponics in Surabaya, Indonesia
103	hidroponikuntuksemua	hydroponics for all
104	hobitanam	planting as a hobby
105	homedecor	home decor
106	homegarden	home garden

No.	Nodes	Nodes Glossary
107	homegardening	home gardening
108	homegrownfood	home grown food
109	homegrownveggies	home grown veggies
110	houseplants	houseplants
111	hydroponic	hydroponic
112	hydroponicfarming	hudroponic farmning
113	hydroponicfarminghidroponikindonesia	hydroponic farming, Indonesian hydroponics
114	hydroponics	hydroponics
115	hydroponicsystem	hydroponic system
116	ikanairtawar	freshwater fish
117	ikannila	nile tilapia
118	indonesia	Indonesia
119	indonesiaberkebun	Indonesian gardening
120	indoorplants	indoor plants
121	infopertanian	agricultural information
122	infopertanianterkini	latest agricultural information
123	ip200	IP200 (a rice seed brand with high productivity)
124	jagung	corn
125	jagunghibrida	hybrid cord
126	jagunghibridasuper	super hybrid corn
127	jagungmanis	sweet corns
128	jambu	guava
129	jambubiji	guava
130	jambukristal	crystal guava
131	jamur	mushroom
132	jamurcrispy	crispy mushroom
133	jamurtiram	oyster mushroom
134	JanganMaluJadiPetani	do not be shy to be a farmer
135	kacangpanjang	long beans
136	kaktusmini	mini cactus
137	kebunhidroponik	hydroponic garden
138	kebunku	my garden
139	kebunorganik	organic garden
140	kebunorganiktelang	butterfly pea organic garden
141	kebunsayur	vegetable garden
142	kembangtelang	butterfly pea
143	kementerianpertanian	Indonesia Ministry of Agriculture

No.	Nodes	Nodes Glossary
144	kentang	potato
145	kolam	pond
146	kolambundar	round fish farming pond
147	kolamikan	fishpond
148	kolamterpal	tarpaulin fishpond
149	komposorganikindonesia	Indonesia organic compost
150	kompost	compost
151	konservasi	conservation
152	kuliner	culinary
153	kulinerindonesia	Indonesian cuisine
154	kursus	training
155	ladang	field
156	lahanku	my fields
157	lithopslover	lithops lover
158	majumandirimodern	advanced, independent and modern
159	makanansehat	healthy food
160	menanam	menanam
161	menanamsayur	growing vegetables
162	monstera	monstera
163	mudaberkarya	young people work
164	mushroom	mushroom
165	ngeboon	A farm garden located in West Java, Indonesia
166	nila	nile tilapia
167	nilahitam	black nile tilapia
168	nilamerah	red nile tilapia
169	nutrisihidroponik	hydroponic nutrition
170	organic	organic
171	organicfarmer	organic farmer
172	organicgardener	organic gardener
173	organik	organic
174	organisasi	Organization
175	p32singa	P32 Singa (Pioneer 32 Singa, a corn seed brand)
176	panen	harvest
177	panenraya	peak harvest season
178	panganuntuknegeri	food for the nation
179	pastalfarm	Pastal Farm (a farm located in West Java, Indonesia)

No.	Nodes	Nodes Glossary
180	pastalhorti	Pastal Farm (a horticultural farm based in West Java, Indonesia)
181	pelatihanhidroponik	hydroponic training
182	pembudidaya	growers
183	pembudidayamuda	young farmers
184	perkebunan	plantation
185	pertanian	agriculture
186	pertanianindonesia	Indonesian agriculture
187	pertanianindonesiamaju	advanced indonesian agriculture
188	pertaniankreatif	creative farm
189	pertanianmasakini	modern agriculture
190	pertanianmodern	modern agriculture
191	pertanianorganik	organic agriculture
192	pertaniantangguh	strong agrculture
193	petani	farmer
194	petanibawangmerah	shallot farmers
195	petaniberdasi	modern farmers
196	petanibuah	fruit farmers
197	petanicabai	chili farmers
198	petanicabe	chili farmers
199	petanicerdas	smart farmers
200	petanihebat	great farmer
201	petanihidroponik	hydroponic farmers
202	petaniindonesia	Indonesian farmer
203	petaniindonesialuarbiasa	Indonesian farmers are amazing
204	petanijagung	corn farmers
205	petanikeren	cool farmers
206	petanikopi	coffee farmers
207	petanikota	city farmers
208	petanilokal	local farmers
209	petanimakmur	prosperous farmers
210	petanimilenial	millennial farmers
211	petanimillenial	millennial farmers
212	petanimodern	modern farmers
213	petanimuda	young farmers
214	petanimudaindonesia	Indonesian young farmers
215	petaniorganik	young farmers
216	petanipadi	rice farmers
217	petanipintar	smart farmers

No.	Nodes	Nodes Glossary
218	petanirumahan	home growers
219	petanisawit	palm oil farmers
220	petanisayur	vegetable farmers
221	petanisejahtera	prosperous farmers
222	petanisukses	successful farmers
223	peternakan	livestock
224	pisang	bananas
225	plantcommunity	plant community
226	planters	planters
227	plantsmakepeoplehappy	plants make people happy
228	probiotikikan	probiotics in aquaculture
229	pupuk	fertilizer
230	pupukbuah	fruit fertilizer
231	pupukcair	liquid fertilizer
232	pupukorganik	organic fertilizer
233	pupukorganikcair	liquid organic fertilizer
234	pupukperangsangbuah	fruit stimulant fertilizer
235	pupukpertanian	agricultural fertilizer
236	pupuktanaman	plant fertilizer
237	sahabatbisi	PT Bisi International Tbk as farmers' partner
238	sayuran	vegetables
239	sayuranhidroponik	hydroponic vegetables
240	sayuranhijau	green vegetable
241	sayuranorganik	organic vegetables
242	sayurhidroponik	hydroponic vegetables
243	sayurorganik	organic vegetables
244	sayursegar	fresh vegetables
245	sayursehat	healthy vegetables
246	scientificfarming	scientific f+E63arming
247	selfsustaining	self-sustaining
248	sheelbiotechltd	Sheel Biotech Ltd. (an agriculture company)
249	smartandscientificfarming	smart anfd scientific farming
250	smartfarming	smart farming
251	SobiAgree	SobiAgree (a platform to support agribusiness)
252	sustainablefarming	sustainable farming
253	tabulampot	fruit plant in pot
254	tanamanbuah	fruit plant

No.	Nodes	Nodes Glossary
255	tanamancantik	beautiful plant
256	tanamanhias	decorative plants
257	tanamankoleksi	collection plant
258	tanamanrumah	houseplants
259	tani	farmer
260	teknikpertanian	agricultural engineering
261	telang	butterfly pea
262	TemanBertumbuh	Buddies for growing
263	temantani	farm buddies
264	terpal	tarpaulin
265	tilapia	tilapia
266	Timun	cucumber
267	tomat	tomato
268	tomatoes	tomatoes
269	traktor	tractor
270	untukpangankamiberkarya	for food we work
271	urbanfarming	urban farming
272	urbangardener	urban gardener
273	urbangardening	urban gardening
274	urbanjungle	urban jungle
275	urbanjunglebloggers	Urban Jungle Bloggers (a global tribe of plant lovers)
276	vegetables	vegetables

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VITA

Muh. Syukron is a first-generation college student. He was born in Pekalongan, Central Java, Indonesia, in 1995. He attended Gadjah Mada University (UGM) in the Special Region of Yogyakarta Province, Indonesia. He received his bachelor's degree in Agriculture with a major in Agricultural Extension and Communication in 2017 with a scholarship provided by the Indonesia Ministry of Research and Technology of the Republic of Indonesia. During his undergraduate program, he became an exchange student at the Tropical Agriculture International Program (TAIP) at Kasetsart University, Bangkok, Thailand, through the ASEAN Exchange Mobility for Students (AIMS) program funded by the Indonesia Ministry of Research and Technology of the Republic of Indonesia. He also served as the coordinator of student assistants at the Bachelor of Agricultural Extension and Communication Study Program. Later, he was awarded the best graduate in the Faculty of Agriculture, Gadjah Mada University, in 2017.

After graduating from UGM, in 2019, he started a master's study in Rural Sociology while enrolling in the Graduate Certificate of Society and Sustainability at the University of Missouri-Columbia, United States. For continuing his master's study, he obtained a scholarship from the Indonesia Endowment Fund for Education (LPDP), Ministry of Finance. While progressing toward a master's degree, he could take great opportunities by joining several organizations, including Missouri Indonesian Student Association (MISA) and Missouri International Student Council (MISC), becoming a volunteer at the Tiger Pantry and Truman's Closets (TPTC), and University of Missouri (MU) African Interdisciplinary Studies Hub, and working for the MU Campus Dining Services.