International Journal of GEOMATE, Jan. 2019, Vol.16, Issue 53, pp.95-100
Geotec., Const. Mat. & Env., DOI: https://doi.org/10.21660/2019.53.67606
ISSN: 2186-2982 (Print), 2186-2990 (Online), Japan

PATCHOULI PLANT DEVELOPMENT IN TRENGGALEK REGENCY

Achmad Tjachja Nugraha[1], *Gunawan Prayitno[2], Chairul Maulidi[2], Shely L. Jahra[2], and *Lily Montarcih Limantara[3]

[1]Department of Agribusiness, Faculty of Science and Technology, Syarif Hidayatullah State Islamic University (UIN) Jakarta, [2]Department of Urban and Regional Planning, Faculty of Engineering, Universitas Brawijaya, Malang, [3]Department of Water Resources, Faculty of Engineering, University of Brawijaya, Malang

*Corresponding Author, Received: 15 Aug. 2018, Revised: 16 Oct. 2018, Accepted: 20 Nov. 2018

ABSTRACT: This study was conducted to determine the development of patchouli plants, based on market price analysis (supply chain analysis) and social factors (social capital) analysis. Social capital analyzes the rate of participation (ROP), density and centrality. The result of supply chain analysis showed that farmers sell the product directly to the refiners. The price varies between Rp 1,500 - Rp 5,000 for wet patchouli, while the dry patchouli is Rp 10,000. The rate of participation (ROP) indicates that farmers in Jombok and Tanggaran Village belong to moderate category (join in three institutions), and Pakel Village is in the lower category (only join in one institution). The result of the density analysis shows that the village of Jombok and Tanggaran have a high density. This means that the relationships among the respondents in these two villages are very close, where Pakel Village has a moderate density indicating a distant relationship among the respondents. The centrality analysis shows that the village of Jombok and Tanggaran have a high degree of centrality and the village of Pakel has a moderate degree of centrality. The relationship between the economic and social aspects of patchouli agriculture can be seen in the production process. This relationship can help the farmers to obtain seeds and fertilizers due to their close relationships or social networks, and they can deepen their knowledge about the patchouli production.

Keywords: Supply chain, Social relation, Participation, Social capital

1. INTRODUCTION

Trenggalek Regency is committed to developing its potential for regional development. One of the products is patchouli (*Pogostemon cablin* Benth), which is then extracted into patchouli oil (a type of essential oil). Globally, the plants that produce the essential oils are patchouli, scented roots, lemongrass, and perfumes. These four plants can increase the volume and quality of production by using the high-quality seeds and appropriate treatment methods [1].

The Regency Government, in collaboration with the University of Brawijaya, is building the STP (Science Techno Park) Dilem Willis, to develop the patchouli agribusiness. However, many farmers have decided to plant the other crops because of fluctuations in patchouli prices and price manipulation by intermediaries. Another problem is the presence of fungi that attack the patchouli plants, wilting and hindering the oil removal during distillation; and farmers face the issues in the declining productivity of crops, previously harvested 2 to 3 times but now can only be harvested once.

In addition to the problems mentioned above, the low participation of communities in the agricultural activities by the Department of Agriculture also decreases the chance for a solution. Farmer participation in formal and non-formal institutions is needed to develop regional development. The existence of active participation will influence the success rate of the program [2]. Communities in villages generally still have a high level of participation, kinship, cooperation, ties and high social norms that are related to social capital.

The concept of social models embedded in the community is an untapped source to facilitate adaptation and innovation [3]-[4]. Understanding the dynamics of social capital in patchouli farmers can improve policies and practices [5]-[6] in increasing patchouli production. Farmers have an essential role in increasing patchouli production. However, the low level of participation causes low adoption of innovation and technology that limits their potential. Our study in 2017, found that there is a relation between the rate of participation and social capital [7].

This study aims to improve the understanding of how the social capital exists in the farming community and the influence on the program development. We use the Social Network Analysis (SNA) to understand and measure the structural dimensions of social capital [8]-[9]. However, the Supply chain analysis was adopted to calculate the

production process and the market for patchouli plant development [10].

2. RESEARCH METHOD

The research uses the concept of social capital, supply chain and social network analysis (SNA) [11].

2.1. Data Collection and Processing Stage

At this stage, a primary and secondary survey was carried out in Trenggalek District. This second survey was conducted for the Regional Research and Planning Agency (BAPPEDA) and the Department of Agriculture. The secondary data are as follow; 5-yearly patchouli production, 5-yearly patchouli area, patchouli productivity trend, number of patchouli farmers, and basic physical data of Trenggalek District [12].

2.2. Data Analysis and Interpretation Phase

At this stage, the analysis is carried out by using the previously collected data. The analysis is carried out using the Supply chain, Social Network Analysis (SNA) which consists of the rate of participation, density, and centrality. SNA calculation is done by the UCINET software [8].

2.3. Conclusions and Recommendations

This stage is the last stage of this research. Conclusions and the preparation of several suggestions are generated during the research process.

3. RESULTS AND DISCUSSION

3.1. The Condition of Patchouli Agriculture in Trenggalek Regency

The current annual Patchouli agricultural production has decreased. The patchouli agricultural production decrease is caused not only from the price fluctuations but also by the low patchouli production. Table 1 shows that the productivity of patchouli in 2012 was 19.20 quintal/hectare, but currently, it only reaches 14.20 quintal/hectare.

3.2. Supply chain

The patchouli agricultural supply chain is seen from the capital, seeds, and fertilizer, workforce, process, production, and marketing results.

3.2.1. Capital

Many farmers use their own capital to start their farming activities (on the farm and out of the farm). In the Pule District, three farmer groups scattered in three villages use distilled tools provided by the government. This group of farmers has formal legality. By using the agricultural tools provided by the government, the patchouli farmers in the three villages can continue to produce the patchouli.

3.2.2. Seeds

The seedlings which are used by the patchouli farmers in Trenggalek Regency are the Javanese Patchouli. The average speed that is needed for 1 ha of land is 10,000 seeds. This lack of certified seeds causes that there are no standards in the supply of the quality of seeds which impacts the production.

Regarding the farmer's opinion, the use of Javanese patchouli seeds lowers the patchouli price that is the quality of oil that is released by this type of patchouli seed, is lower compared to the Acehnese Patchouli type. The absence of certified seeds causes that there is no standards in the supply of quality seeds.

3.2.3. Fertilizer

The fertilizers which are used by the patchouli farmers are the urea and chemical fertilizers with a ratio of 5:1, where every 1 ha of patchouli land will be given ten quintal of urea fertilizer and two quintal of chemical fertilizer. This fertilizer is obtained by farmers from the farmer groups and cooperatives.

3.2.4 .Workforce

There are 621 Patchouli farmers in the Pule District of Trenggalek Regency. The workforce derives from the immediate family and each farmer have small land ownership (in average: one farmer has 0.5-acre land).

3.2.5. Process

The process starts with planting seeds on the prepared land which is then fertilized after one month. The first harvest is done when the patchouli is about seven months. After this first harvest, it is fertilized again. The next harvest can be done 2-3 months later. After that, the land is prepared again for the next planting.

3.2.6. Production

The total area of patchouli plantation in the Pule District is 64,50 hectares. The productivity of wet leaves is 14.20 quintal per hectare, and the total production is 91.59 tons.

3.2.7. Marketing

Patchouli agricultural production is marketed in three types of products, namely wet patchouli,

dried patchouli, and dried patchouli leaves. The wet patchouli price in the market is Rp. 1,500 to Rp. 2,000, while dried patchouli is sold at Rp. 3,500 to Rp. 5,000 while dried patchouli leaves are sold for Rp. 10,000.

The patchouli agricultural products sold by the farmers are then sold to intermediaries. However, there are also farmers who directly sell to refiners or even the farmers themselves who directly refine the oil from the patchouli leaves. The farmers sell to the refiners, especially for the wet patchouli.

3.3. Social Network Analysis (SNA)

Social Network Analysis (SNA) is carried out in the three stages, namely the rate of participation is for assessing the level of participation of patchouli farmers, the density is for seeing the density of patchouli farmers and the centrality is for finding out the central figure in increasing the patchouli production.

3.3.1. Rate of Participation

The results of the Rate of Participation calculation explain that each patchouli farmer in the Jombok and Tanggaran Villages is in average follows the three institutions. This value is categorized in the moderate category. Whereas in Pakel Village, each patchouli farmer on average is following one institution. This value is categorized in the low category.

The highest form of participation of respondents in the Jombok Village is helping the older people. While the lowest form of participation is being involved in political parties.

The highest form of community participation in Tanggaran Village is RT / RW or village and subdistrict level meetings, religious activities, cooperation in cleaning roads, pavement, social activities and helping older people. None of the respondents participated in the cooperative meeting.

The highest form of community's participation in Pakel Village is in religious activities, delivering food to each other and helping older people.

3.3.2.Density

Density analysis is used to determine the density relationship on the relationships among the respondents in the research area. The density value is in the range of 0-1, where the value of 1 can be meant that respondents in the research area have at least one or more similarities in participation in the existing activities.

In this study, the density calculation was carried out in the Jombok Village, Tanggaran Village, and Pakel Village to see the density of patchouli farmers in increasing patchouli production in Pule District. However, as the patchouli farmers in these three villages were involved in a farmer group and had a weekly prayer group, the researchers issued both types of institutions in the calculation. The involvement of patchouli farmers in increasing patchouli production is shown through the participation of farmers in every institution they follow.

Table 1 Density value for each group

Location	Density value	Category
Jombok village	0,806	High
Tanggaran village	1,000	High
Pakel village	0,472	Moderate

Table 1 shows that Jombok and Tanggaran Village have a high density. Thus the relationship among the respondents in these two villages is very close. While Pakel Village has a moderate density which indicates the relationship among the respondents is also moderate.

3.3.3. Centrality

Centrality analysis is done to find out the central figure in an organization. The centrality analysis which is carried out in this research is divided into three types, namely Degree of Centrality, betweenness centrality, and closeness centrality to know the strength of the community ties and which can also be as one of the drivers for increasing the patchouli production. For the calculation of the Degree of Centrality and betweenness centrality, all respondents are used regardless of whether they are in an isolated group or not. Meanwhile, the calculation of closeness centrality use the respondents included in the network.

The calculation of a group's centrality reaches the maximum value, which is 0 to 1 and is divided into three categories, namely low (0-0,333), moderate (0,334 - 0,667) and high (0,668-1).

a. Jombok Village

Jombok village has a high degree of centrality (0.75), a high level of closeness (0.82) and a low level of betweenness (0.03). The result is presented as in Table 2.

Table 2 Centrality Calculation Result of Patchouli Agriculture Development in Jombok Village

	Farmers involved= 10		
Centrality	Cd	Cc	Cb
Mean	0.75	0.82	0.03
Std. Dev.	0.19	0.11	0.03
Variance	3.65	1.32	0.10
Min	0.33	0.6	0
Max	1	1	0.1
Classification based on respondents			
0 – 0,33	6	0	10
0,34-0,67	3	1	0
0,68-1	1	9	0

Table 2 shows that only one respondent had a high degree of centrality; nine respondents had a high level of closeness, and none of the respondents had a high level of betweenness. This can be seen in the net draw formed below.

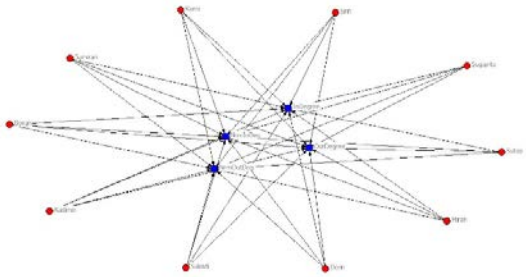

Fig. 1 Netdraw of Patchouli Farmers in Jombok Village based on Degree of Centrality

Fig. 1 shows that based on the degree of centrality, all respondents entered the existing network even though there were still respondents who had a low degree of centrality.

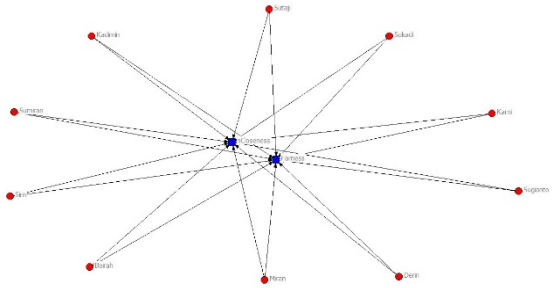

Fig. 2 Netdraw of Patchouli farmers in Jombok Village based on Closeness Centrality

Fig. 2 shows that all respondents were in the same institutions and no respondents were isolated.

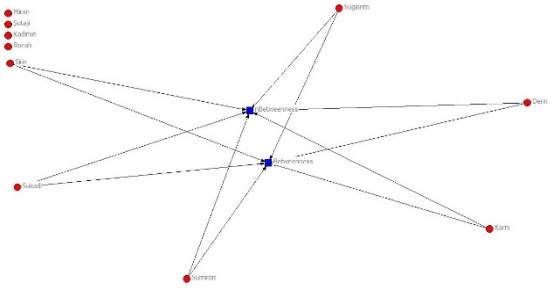

Fig. 3 Net draw of Patchouli farmers in Jombok Village based on Betweenness Centrality

Fig. 3 shows the betweenness level of farmers in Jombok Village. Only 6 respondents entered the network, and the remaining four respondents cannot enter the network because they have a value of 0 togetherness.

Based on the degree of centrality, four respondents were chosen as key figures. The profile of each key figure can be seen in the following table (Table 3). (ES: elementary school), JHS: Junior High School).

Table 3 Profile of Key Figures of Jombok Village

Name	Age	Education	Leng of Business
Sukadi	59	ES	>15 Years
Derin	47	JHS	<1 Years
Sugianto	62	ES	10-15 Years
Sirin	53	ES	10-15 Years

b. Pakel Village

Pakel village has a moderate degree of centrality (0.47), a high level of closeness (1.00) and a low level of betweenness (0.00). The table below provides more details. Classification based on respondent shows that only two respondent is in the range of 0-0,33 and the rest are in the range of 0,34-0,67.

Table 4 Centrality Calculation Result of patchouli agriculture development in Pakel Village

	Farmers involved= 7		
Centrality	Cd	Cc	Cb
Mean	0.47	1	0
Std. Dev.	0.30	0	0
Variance	9.07	0	0
Min	0	1	0
Max	0.66	1	0
Classification based on respondents			
0 – 0,33	2	0	7
0,34-0,67	5	0	0
0,68-1	0	5	0

Table 4 shows that five respondents have a moderate degree of centrality, five respondents have a high level of closeness and none of the respondents have a high level of betweenness. This can be seen in the net draw formed below.

Fig. 4 shows that based on the degree of centrality, only five respondents enter into the existing networks. The other two respondents did not enter the network due to the 0 degree of centrality because they did not belong to any group.

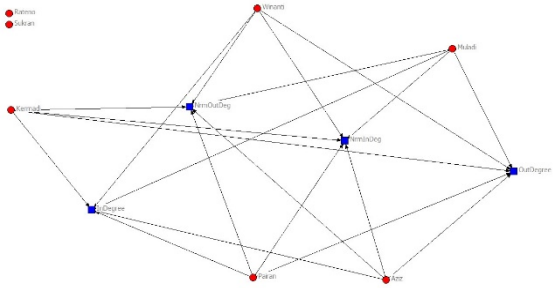

Fig. 4 Netdraw of Patchouli farmers in Pakel Village based on Degree of Centrality

In Fig. 5, we can see that five non-isolated respondents belong to the same institutional set. The next draw for betweenness centrality in Pakel Village cannot be formed because the betweenness centrality value is 0.

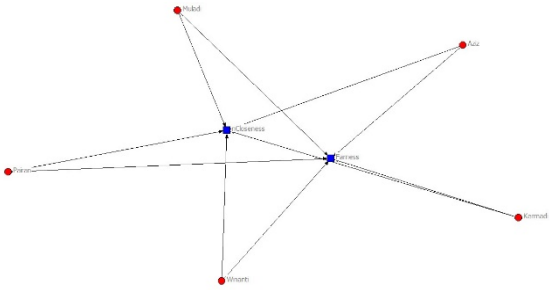

Fig. 5 Netdraw of Patchouli farmers in Pakel Village based on Closeness Centrality

Based on the degree of centrality between respondents, five respondents were chosen as key figures. The profile of each key figures can be seen in the following table.

Table 5 Profile of Key Figures in Pakel Village

Name	Age	Education	Length of Business
Muladi	52	ES	5-10 years
Kermadi	51	ES	5-10 years
Aziz	48	JHS	1-5 years
Winanti	49	ES	10-15 years
Pairan	62	ES	10-15 years

c. Tanggaran Village

Tanggaran Village has a high degree of centrality (1.00), a high level of closeness (1.00) and a low level of betweenness (0.00). The following table provides more details.

Table 6 Centrality Calculation Result of Patchouli Production in Tanggaran Village

Farmers involved= 10			
Centrality	Cd	Cc	Cb
Mean	1	1	0
Std. Dev.	0	0	0
Variance	0	0	0
Min	1	1	0
Max	1	1	0
Classification based on respondents			
0 – 0.33	0	0	10
0.34-0.67	0	0	0
0.68-1	10	10	0

Table 6 shows that all respondents have a moderate degree of centrality, all respondents have a high level of closeness and none of the respondents have a high level of betweenness. This can be seen in the netdraw formed below.

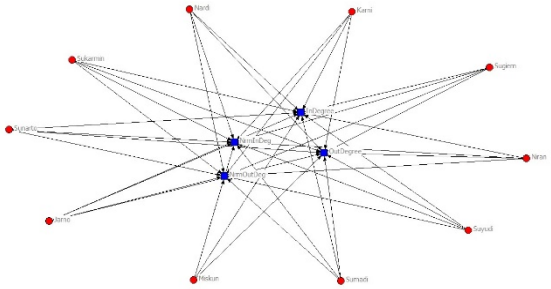

Fig. 6 Netdraw of Patchouli farmers in Tanggaran Village based on Degree of Centrality

Fig. 6 shows that based on the degree of centrality all respondents enter into the existing network.

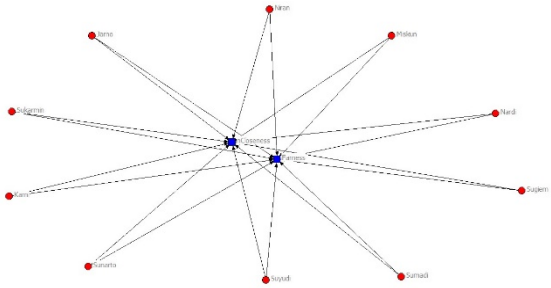

Fig. 7 Netdraw of Patchouli farmers in Tanggaran Village based on Closeness Centrality

Fig. 7 shows that five non-isolated respondents were included in several of the same institutions. The next draw for betweenness centrality in Pakel Village cannot be formed because the betweenness centrality value is 0.

Based on the degree of centrality between respondents, ten (10) respondents were chosen as key figures. The profile of each key figures can be seen in the following table (Table 7). Education level less than elementary school (ES), Elementary School and Junior High School (JHS).

Table 7 Profile of Key figures in Tanggaran Village

Name	Age	Education	Length of Business
Suyudi	-	No	>15 years
Nardi	-	No	>15 years
Miskun	50	ES	1-5 years
Niran	53	JHS	1-5 years
Jarno	-	JHS	1-5 years
Sugiem	48	JHS	1-5 years
Sumadi	55	ES	>15 years
Karni	56	JHS	5-10 years
Sunarto	50	ES	1-5 years
Sukarmin	-	ES	> 15 years

3.3.4. The relationship between Supply Chain dan SNA

The relationship between economic and social analysis and patchouli agriculture in the Pule District of Trenggalek Regency can be seen in the production process and marketing of patchouli products.

In the production process, social networks are needed by farmers in dealing with various problems, such as meeting the demand for seeds and fertilizers. There is a social network of patchouli farmers in Pule District; each respondent can easily obtain seeds and fertilizer as they utilize the institutions such as farmer groups and cooperatives.

Also, with the help of agricultural tools from the government to farmer groups, farmers sell not only patchouli leaves but also patchouli oil. Patchouli farmers use social networks to obtain knowledge on how to refine patchouli.

The existing social network in Pule District is unable to help farmers market the product. There is still price manipulation by middlemen. A better network to contact different markets is expected to increase sales value.

4. CONCLUSION

The conclusion of this study is as follows: the results of the Rate of Participation calculation explain that each patchouli farmer in Jombok and Tanggaran Villages on average is following the three institutions. This value is included in the moderate category. Whereas in Pakel Village, each patchouli farmer on average is following one institution. This value is included in the low category.

The relationship between economic and social aspects and patchouli in Pule District, Trenggalek Regency can be seen in the production process and distribution of patchouli products, which the farmers utilize the existing social networks to obtain seeds and fertilizers, and they can increase their knowledge in the patchouli production.

5. ACKNOWLEDGMENTS

The authors gratefully acknowledged the support received from Institute Atsiri (IA) Universitas Brawijaya for sponsoring for field survey in Trenggalek Regency.

6. REFERENCES

[1] Rusli, M. S., Sukses memproduksi minyak atsiri (Success in producing essential oils), PT Agro Media Pustaka, Bogor, 2010

[2] Prayitno, G. and Subagiyo A., Membangun desa (Village development), UB Press, Malang, 2018

[3] Pretty, J. and Ward, H., Social capital and the environment, World Development 29(2), 2001, page 209-227.

[4] Folk, C., Hahn T., Olsson P., Norberg J., Adaptive governance of social ecological systems. Annual Review of Environmental and Resources. Vol. 30, 2005, page 441-473, 21 November 2005.

[5] Adger, W. N., Social capital, collective action, and adaptation to climate change, Economic geography 79(4), 2003, page 387-404

[6] Swamy, M.K. and Sinniah, U.R., Patchouli (Pogostemon cablin Benth.): Botany, Agrotechnology and Biotechnological Aspects, Industrial Crops and Products Journal. Volume 87, September 2016, page 161-176

[7] Prayitno, G. and Syaifurridzal, M., Social capital and public participation on planning in coastal area development, IOP Conf., Series: Earth and Environment Science 79, 2017.

[8] Scott, J., Social network analysis: A handbook, 2nd Edition, SAGE, 1991.

[9] Wasserman, S. and Faust, K., Social network analysis: methods and applications, Cambridge University Press, 1994.

[10] Juniardi, M. T., Antara, M., and Handayani, Analisis produksi nilam dan dan nilai Tambah penyulingan minyak atsiri di Kecamatan Banawa Selatan Kabupaten Donggala (Analysis of patchouli production and adding distillation of essential oils in South Banawa District, Donggala Regency), Jurnal Sains dan Teknologi Tadulako, Volume 4, Nomor 2, 2015, page 68-78.

[11] Ari, I.R.D., Participatory approach to community based water supply system. Kyoto University, Kyoto, 2011

[12] Regional planning board of Trenggalek (Bapeda). Trenggalek in Figure, 2017.