

Changes in the Characteristics of the Pangreh Village Area Due to the Relocation of Victims of Sidoarjo Mud Disaster in Indonesia

Moch. Shofwan¹ (Universitas 17 Agustus 1945 Surabaya, Indonesia)

V. Rudy Handoko² (Universitas 17 Agustus 1945 Surabaya, Indonesia)

Arif Darmawan³ (Universitas 17 Agustus 1945 Surabaya, Indonesia)

Received: 08-01-2024

e-ISSN : 2987-9140

Accepted: 31-01-2024

Volume : 1 No. 3, (2024)

Published: 01-02-2024

Page : 1-12

DOI: <https://doi.org/10.26740/ijgsme.v1n3.p1-12>

Abstract

Sidoarjo mud disaster in Indonesia forced local residents to flee to a safe place, one of which was Pangreh Village which has an area of 171.78 hectares or 3%. As a result, the population in Pangreh Village has automatically increased. Several cases show that if there is a change or regional development in a location, then in a short time the land around it will also change progressively. The purpose of this study was to determine changes in the area of Pangreh Village due to the relocation of victims of the Sidoarjo Mud Disaster. Collecting data in this study using documentation, observation, questionnaires and literature studies. The analytical method used is quantitative descriptive analysis with a before-after analysis technique. The results showed that overall land use change in Pangreh Village has shown a significant increase which includes 4 factors or characteristics such as livelihoods, level of education, institutions and infrastructure. So it can be concluded that the Sidoarjo Mud Disaster also had an influence on regional changes in Pangreh Village. It is hoped government policies regarding land use and population can be realized in society so that there are no policy deviations starting from population growth deviant land use.

Keywords: Disaster; Characteristics; Change; Relocation; Region

1. INTRODUCTION

One of the disaster phenomena that occurred in Sidoarjo Regency and is still being felt by the local community is the Sidoarjo Mud Disaster. The mud disaster that occurred in Sidoarjo Regency since May 29 2006 was the release of hot gas and mud from the ground with a temperature of 100°C which inundated several villages in Sidoarjo Regency (Shofwan & Rukmana, 2017). The development carried out so far tends to utilize natural resources arbitrarily, without paying attention to existing environmental aspects. As a result, environmental damage and pollution occurs more frequently (Wahyuningsih, 2018). Based on Law No. 30 of 2009 concerning Environmental Protection and Management, sustainable development is a conscious and planned effort that combines environmental, social and economic aspects into development strategies to ensure the integrity of the environment as well as safety, capability, welfare and quality of life of current and future generations (Afriyanti, 2009).

The Sidoarjo Mud Disaster did not directly claim human lives, but it slowly submerged residential areas and rice fields, forcing local residents to flee to safe places. According to Shofwan & Rukmana (2017), This causes the development to sag and sometimes the caldera to be damaged (Evans et al, 2007). Most of the communal settlements of Sidoarjo Mudflow victims live in zone III (minimum distance of 3 km outward from the point of mudflow) which is 66.7%. This population movement is known as forced migration because of the desire to save oneself from danger (Daulay, 2019). As a result, many residents affected by the Sidoarjo

Corresponding Author: E-mail: 1172100012@surel.untag-sby.ac.id

©2023 IJGSME

Mudflow moved to areas that were not directly affected by the Sidoarjo Mud Disaster, one of the villages being targeted was Pangreh Village, Jabon District because it is located directly on the border with Porong District. According to Manga (2007), shows that the earthquake was not significant enough or was too far from Sidoarjo to cause the eruption.

Pangreh Village is one of the villages located in the Jabon District, Sidoarjo Regency, which has an area of 171.78 Ha or 3% of the total area of Jabon District. The population of Pangreh Village is 4,861 people consisting of 1599 heads of families with a population density of 28.29 people/ha. The Sidoarjo Mud Disaster resulted in as many as 10,641 families fleeing or moving locations. As a result of the movement of victims of the Sidoarjo Mud Disaster, the population in Pangreh Village automatically increased. This increase resulted in limited residential land because the need for housing of course influenced the need for land, which ultimately resulted in the use of agricultural land so that the amount decreased. Changing the use of agricultural land into residential areas is common

According to Bastian (2015), a village or hamlet according to the universal definition is an agglomeration of settlements in a rural area (rudal). The form of a village usually has a name, location and territorial boundaries which aim to differentiate the rules of one village from another. Several cases show that if a change or regional development occurs in a location, then within a short time the surrounding land will also change progressively (Iqbal & Sumaryanto, 2017).

2. METHOD

This research is descriptive research using a quantitative approach. Quantitative descriptive is a type of research that aims to describe or describe numbers that have been processed according to certain standards (Sugiyono, 2019). Secondary data collection relied on literature studies to supplement and triangulate the findings from the primary data. This included reviewing previous studies on disaster relocation impacts, land use changes, and regional development in Sidoarjo, particularly those related to the Sidoarjo Mud Disaster. The literature review provided broader insights into the socio-economic and infrastructural transformations triggered by the relocation process. Data analysis was performed using the "Before-After" analysis technique. This method allowed for a comparative study of changes over time by comparing pre-relocation (2005) and post-relocation (2022) data on livelihoods, education, institutions, and infrastructure. By employing this analysis, the study sought to measure and quantify the significant changes in these four factors, which are directly impacted by the population growth and urban development resulting from the disaster relocation.

3. RESULT AND DISCUSSION

The livelihoods of the people in Pangreh Village include civil servants, private employees, TNI/Polri, entrepreneurs or traders, farmers and agricultural laborers. The number of residents who did not/have not worked in 2005 was 2163 people, 18 civil servants, 164 private employees, 4 TNI or Polri people, 186 self-employed people or traders, 124 farmers and 1381 agricultural laborers. . The number of residents who do not/have not worked in 2022 is 2462 people, 23 civil servants, 190 private employees, 10 TNI/Polri people, 162 self-employed/traders, 96 farmers and 1640 agricultural laborers. The livelihoods of the people of Pangreh Village can be seen in Table 1.

Table 1. Livelihoods of Pangreh Village Residents

No.	Livelihood	Year	
		2005	2022
1	Not yet working	2163	2462
2	Government employees	18	23
3	Private employees	164	90
4	TNI/Polri	4	10
5	Self-employed	186	162
6	Farmer	124	96
7	Farm workers	1381	1640
	Amount	4040	4483

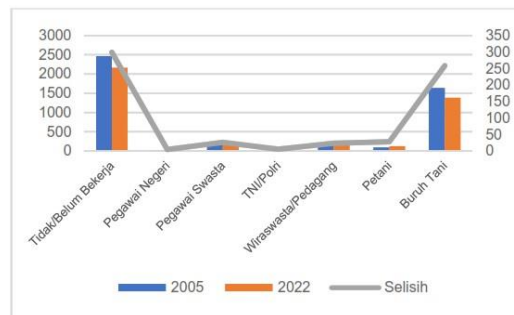


Figure 1. Livelihood Diagram of Pangreh Village Residents

Based on Table 1 and Figure 1, it can be seen that the majority of the population in Pangreh Village in 2005 worked as agricultural laborers with a total of 1381 people or 35.78%, although the number of people who did not or had not worked was classified as more, namely 2163 people. Meanwhile, in 2022, the majority of residents in Pangreh Village will also work as agricultural laborers with a total of 1640 people or 34.18%, although the number of people who do not or have not worked is also relatively large, namely 2462 people. During the period 2005 and 2022, more residents of Pangreh Village work in the agricultural sector because Pangreh Village is an agricultural area in both Jabon District and Sidoarjo Regency.

Level of education

The education level of the community in Pangreh Village consists of those who do not or have not attended school, elementary school graduates, junior high school graduates, high school graduates, diplomas and bachelor's degrees. The number of residents who did not or had not attended school in 2005 was 3524 people, 231 elementary school graduates, 122 junior high school graduates, 148 high school graduates, 8 people with diplomas and 7 graduates. The number of residents who do not or have not attended school in 2022 will be 3326 people, 466 elementary school graduates, 365 junior high school graduates, 247 high school graduates, 89 people with diplomas and 90 graduates. The education level of the Pangreh Village community can be seen in Table 2.

Table 2. Education level of Pangreh Village residents

No.	Education	Year	
		2005	2022
1	No/Not yet at school	3524	3326
2	Elementary school graduate	231	466
3	Middle school graduate	122	365
4	High school graduate	148	247
5	Diploma	8	89
6	Bachelor	7	90
	Amount	4040	4583

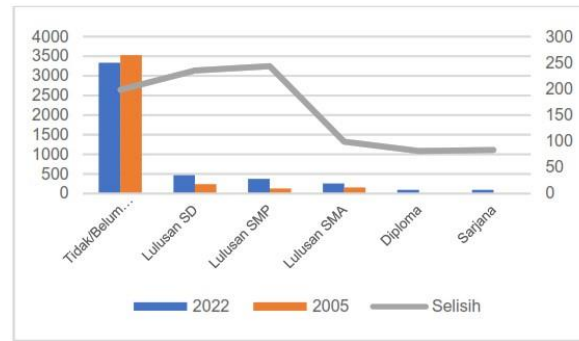


Figure 2. Diagram of Education Level of Pangreh Village Population

Based on Table 2 and Figure 2, it can be seen that the majority of the education level of the population in Pangreh Village in 2005 was not yet or had not attended school with a total of 3524 or 87.23% of the total population of Pangreh Village, while the majority of the education level of the Pangreh Village population in 2022 is not yet or not attending school with a smaller number, namely 3326 or 72.57% of the total population of Pangreh Village.

Institutional

Institutions in Pangreh Village include Rukun Warga (RW), Rukun Tetangga (RT), BPD (Village Consultative Body), Village Community Empowerment Institution (LPMD), Karang Taruna and Family Welfare Development (PKK). In 2005 there were only 2 RWs and 10 RTs in Pangreh Village, then there were 5 BPD members, 6 LPMD members, 14 Karang Taruna members and 9 PKK members. This number will increase in 2022 with details of 3 RWs and 14 RTs, then there are 7 BPD members, 8 LPMD members, 11 Karang Taruna members and 10 PKK members. Institutions in Pangreh Village can be seen in Table 3.

Table 3. Pangreh Village Institutions

No.	Institutional	Year	
		2005	2022
1	RW	2	3
2	RT	10	14
3	BPD	5	7
4	LPMD	6	8
5	Youth Organization	14	11
6	PKK	9	10
Amount		46	53



Figure 3. Pangreh Village Institutional Diagram

In 2022 the number of RWs and RTs will increase from 2 and 10 respectively to 3 and 14, with a percentage increase of 60%. Pangreh Village BPD members also experienced an increase of 2 people to 7 people with a percentage increase of 58.33%, LPMD members also experienced an increase of 2 people to 8 people with a percentage of 58.33%. Karang Taruna members actually decreased by 3 people to 11 people with a percentage decrease of 44.0%, and PKK members also experienced an increase of 1 person to 10 people with a percentage increase of 52.63%.

Infrastructure

1. Education facility

Educational facilities in Panreh Village consist of kindergarten, elementary school, MTs, high school and vocational school. In 2005 in Pangreh Village there was only 1 kindergarten unit and 2 elementary school units, while in 2022 there was the addition of 1 elementary school unit with an increase percentage of 60%, 1 MTs unit with an increase percentage of 100%, 1 high school unit with an increase percentage of 100%. % and 1 vocational school unit with an increase percentage of 100%. So that by 2022 Pangreh Village will have 7 units of educational facilities. Educational facilities in Pangreh Village can be seen in Table 4.

Table 4. Pangreh Village Education Facilities

No.	Education	Year	
		2005	2022
1	Kindergarten	1	1
2	elementary school	2	3
3	MTs	0	1
4	SENIOR HIGH SCHOOL	0	1
5	vocational school	0	1
Amount		3	7



Figure 4. Diagram of Pangreh Village Education Facilities

2. Health facility

Health facilities in Pangreh Village include posyandu, polindes and general practice of midwives or general practitioners. In 2005 in Pangreh Village there were only 2 posyandu units, 1 polindes unit and 1 general practice unit for doctors or midwives. In 2022 there will be the addition of 2 posyandu units with an increase percentage of 66.67%, 2 polindes units with an increase percentage of 75% and 1 general practice

unit with an increase percentage of 66.67%. Health facilities in Pangreh Village are as in Table 5.

Table 5. Pangreh Village Health Facilities

No.	Health	Year	
		2005	2022
1	Integrated Healthcare Center	2	4
2	Polindes	1	3
3	General Practice	1	2
	Amount	4	9



Figure 5. Diagram of Pangreh Village Health Facilities

3. Worship Facilities

The facilities for worship in Pangreh Village consist of a mosque and prayer room. In 2005 the number of mosques and prayer rooms in Pangreh Village amounted to 2 units and 13 units respectively. In 2022 there will be an addition of 2 prayer room units to 15 units with an additional percentage of 53.57 &. Worship facilities in Pangreh Village are as in Table 6.

Table 6. Village Worship Facilities Pangreh

No.	Worship	Year	
		2005	2022
1	Mosque	2	2
2	Prayer room	13	15
	Amount	15	17

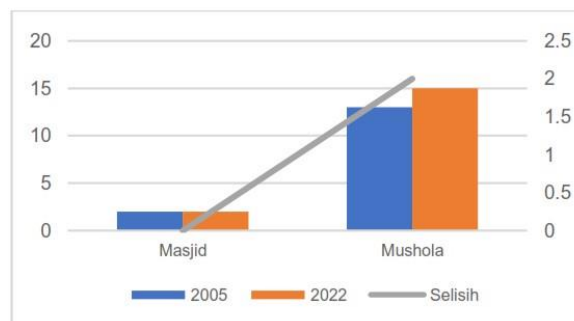


Figure 6. Diagram of Pangreh Village Worship Facilities

4. Trading Facilities and Facilities Services

Trade and service facilities in Pangreh Village are shops and Sunday markets. In 2005 there was a Sunday market which still exists today, so there are no additional trade and

services in Pangreh Village. Trade and service facilities in Pangreh Village are as in Table 7.

Table 7. Trade Facilities and Services in Pangreh Village

No.	Perjas	Year	
		2005	2022
1	Sunday market	2	2
	Amount	2	2



Figure 7. Diagram of Trade Facilities and Services in Pangreh Village

5. Green open space

The green open space facilities in Pangreh Village consist of a cemetery and a field. In 2005 there was only 1 grave unit in Pangreh Village, while in 2022 there was an addition of 1 field unit with a percentage of 100% and there was an addition to the public cemetery with 1 unit for a total of 2 units with an additional percentage of 66.67%. RTH facilities in Pangreh Village are as in Table 8.

Table 8. Green Open Space Facilities in Pangreh Village

No.	RTH	Year	
		2005	2022
1	Field	0	1
2	Grave	1	2
	Amount	1	3

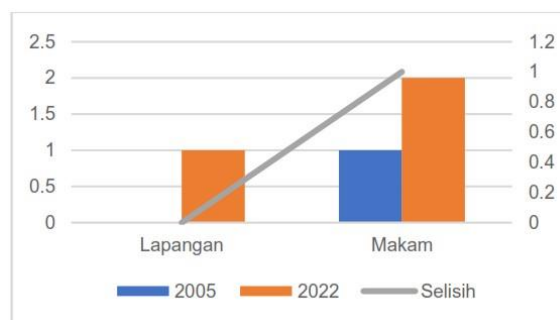


Figure 8. Diagram of Green Open Space Facilities in Pangreh Village

6. Road Network

The road network in Pangreh Village consists of asphalt roads, paving roads and macadam roads. In 2005, the asphalt road in Pangreh Village stretched for 4.86 km, the paving road for 1.92 km and the macadam road for 1.69 km. In 2022 there will be an addition of 7.14 Km of asphalt roads with an increase of 28.83% to 12 Km, 3.08 Km of paving roads with an increase of 27.75% to 5 Km and 0.31 km of macadam roads with an increase of 45. 80% to 2 Km. The road network in Pangreh Village is as in Table 9.

Table 9. Pangreh Village Road Network

No.	Road	Year	
		2005	2022
1	Pavement	4.86	12
2	Paving Road	1.92	5
3	Macadam Street	1.69	2
	Amount	8.47	19

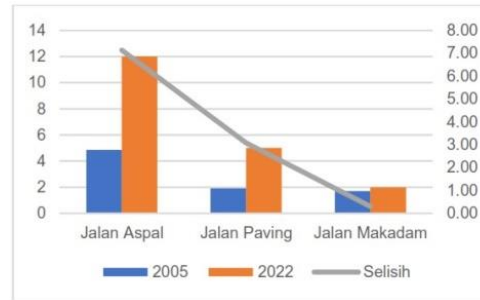


Figure 9. Pangreh Village Road Network Diagram

7. *Electric network*

The electricity network in Pangreh Village can be seen from the number of PLN customers. In 2005 the number of PLN customers in Pangreh Village was 923 families, while in 2022 there was an increase of 635 families with a percentage increase of 62.80% to 1558 families. The electricity network in Pangreh Village is as in Table 10.

Table 10. Pangreh Village Electricity Network

No.	Electricity	Year	
		2005	2022
1	PLN	923	1558
	Amount	923	1558

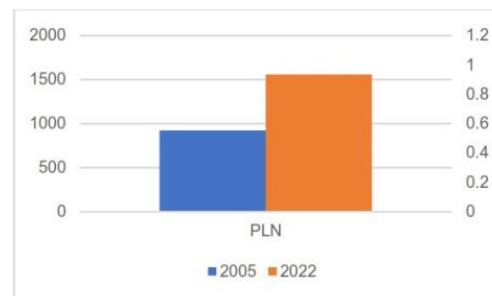


Figure 10. Pangreh Village Electrical Network Diagram

8. *Clean Water Network*

The clean water network in Pangreh Village includes HIPAM, pump wells, dug wells and pipes. In 2005 in Pangreh Village there were only 15 dug wells, 2 pumped wells and 10 piped wells. In 2022 there will be the addition of 1 HIPAM unit, 22 units of dug wells with an addition percentage of 71.15% to 37 units, 1 pump well unit with an addition percentage of 60% to 3 units, and there will be an addition of 5 units of piping with a percentage of 60% to 15 units. The clean water network in Pangreh Village is as shown in Table 11.

Table 11. Pangreh Village Clean Water Network

No.	Clean water	Year	
		2005	2022
1	HIPAM	0	1
2	Dig Well	15	37
3	Pump Well	2	3
4	Piping	10	15
	Amount	27	56

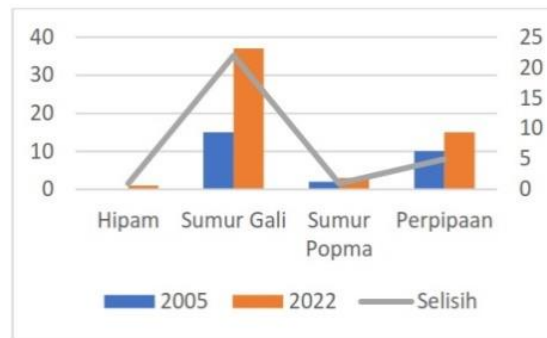


Figure 11. Clean Water Network Diagram for Pangreh Village

9. Telecommunication Network

The telecommunications network in Pangreh Village is in the form of a Base Transceiver Station (BTS). In 2005 there was no BTS in Pangreh Village, while in 2022 there will be 1 BTS in Pangreh Village. The telecommunications network in Pangreh Village is as in Table 12.

Table 12. Pangreh Village Telecommunication Network

No.	Telecommunication	Number of units)	
		2005	2022
1	BTS	0	1
	Amount	0	1

10. Drainage Network

The drainage network in Pangreh Village includes primary channels, secondary channels and tertiary channels. In 2005 the primary channel in Pangreh Village was 0.89 km long and still exists today. The primary canal in Pangreh Village in 2005 was 0.34 km long and there was an addition of 0.65 km or 74.44%, so that in 2022 the length of the secondary canal reached 0.99 km. Likewise with the tertiary canal where there was an increase of 0.24 km or 70% and in 2022 the tertiary canal in Pangreh Village will have a length of 0.42 km. The drainage network in Pangreh Village is as in Table 13.

Table 13. Pangreh Village Drainage Network

No.	Drainage	Amount (Km)	
		2005	2022
1	Primary Channel	0.89	0.89
2	Secondary Channel	0.34	0.99
3	Tertiary Channel	0.18	0.42
	Amount	1.41	2.3

11. Waste

The waste network in Pangreh Village can be seen through the availability of temporary landfill sites or TPS. In 2005 there was no TPS in Pangreh Village, while in 2022 there will already be 1 TPS unit. Waste in Pangreh Village is as in Table 14.

Table 14. Pangreh Village Waste

No.	Telecommunication	Year	
		2005	2022
1	TPS	0	1
	Amount	0	1

A. Changes in the Pangreh Village Area

After obtaining changes in 4 factors which include livelihoods, education level, institutions and facilities and infrastructure, the next step is to analyze changes in the Pangreh Village area through before-after analysis. Before-after analysis regarding changes in the Pangreh Village area due to the Sidoarjo Mud Disaster can be seen in Table 15.

Table 15. Results of Before-After Analysis of Changes in the Pangreh Village Area

No.	Characteristics	Analysis
Livelihood		
1	a. Not yet working	↑ : Increase
	b. Government employees	↑ : Increase
	c. Private employees	↑ : Increase
	d. TNI/Polri	↑ : Increase
	e. Self-employed	↓ : Decreased
	f. Farmer	↓ : Decreased
	g. Farm workers	↑ : Increase
Level of education		
2	a. Not yet in school	↓ : Decreased
	b. Elementary school graduate	↑ : Increase
	c. Middle school graduate	↑ : Increase
	d. High school graduate	↑ : Increase
	e. Diploma	↑ : Increase
	f. Bachelor	↑ : Increase
Institutional		
3	a. RW	↑ : Increase
	b. RT	↑ : Increase
	c. BPD	↑ : Increase
	d. LPMD	↑ : Increase
	e. Youth organization	↓ : Decreased
	f. PKK	↑ : Increase
Infrastructure		
4	a. Education	↑ : Increase
	b. Health	↑ : Increase
	c. Worship	↑ : Increase
	d. Perjas	↑ : Increase
	e. RTH	↑ : Increase
	f. Road Network	↑ : Increase
	g. Telecommunication Network	↑ : Increase
	h. Clean Water Network	↑ : Increase
	i. Electric network	↑ : Increase
	j. Drainage Network	↑ : Increase
	k. Waste	↑ : Increase

Based on the results of the analysis in Table 14, the results can be obtained that overall land changes in Pangreh Village have shown a significant increase which includes 4 factors or characteristics such as livelihoods, education level, institutions and facilities and infrastructure. So it can be concluded that the Sidoarjo Mud Disaster also influenced regional changes in Pangreh Village.

The Sidoarjo mudflats are now in a state of self-organization, where eruptions of mud-water mixing and erosion of subsurface material cause land subsidence and blading. It has been proposed at other mud volcanoes that new faults develop due to collapse of the central region and that they provide new pathways for the flow of the mud-water mixture (Davies & Stewart, 2005). Shallower aquifers may be penetrated by new fault systems.

The condition of the Sidoarjo mudflats and changes in land use in the surrounding area, including Pangreh Village, are basically a shift in the function of land that was previously used for a certain purpose to become a certain (other) use. With this change in land use, the area experienced development, especially the development of the number of physical facilities and infrastructure in the form of the economy, roads and other infrastructure. In its development, land changes will be distributed to certain places that have good potential (Eko & Rahayu, 2021).

4. CONCLUSION

Based on the results of the analysis, it was found that regional characteristics including livelihoods, education levels, institutions and infrastructure will increase in 2022. This increase also shows that the increase in population, one of which is due to the impact of the Sidoarjo Mud Disaster, has also caused regional changes in the village Pangreh..

SUGGESTION

Suggestions that can be given in connection with the results of this research are (1) Policy holders should also pay attention to the ethics of environmental change because it cannot be denied that changes in land use are more directed towards the agricultural sector, this will result in increasingly less food production occurring in Pangreh Village. (2) It is hoped that government policies relating to land use and population can be realized in society so that there will be no policy deviations that originate from uncontrolled population growth and land use that is not in accordance with policy.

REFERENCES

- Afriyanti, F. (2009). Law No. 30 of 2009 concerning. *Environmental Protection and Management*, 2, 1–8.
- Bangun, E., & Asnidar, A. (2014). Analysis of the Development of Mburidi Village, Kutabuluh District, Karo Regency. *JPPUMA: Journal of Governance and Political Social UMA (UMA Journal of Governance and Political Social)*, 2(1), 105-113.
- Bastian, TR (2015). Analysis and Design of Population Data Processing Information Systems at the Sidoharjo Village Office, Air Gegas District, South Bangka Regency (Doctoral Dissertation, STMIK Atma Luhur).
- Daulay, P. (2009). Forced Migration of Disaster Victims: Exploring the Portrait of Survival of Sidoarjo Mudflow Victims in Kedungsolo Village, Porong District, Sidoarjo. In *Talenta Conference Series: Local Wisdom, Social, and Arts (LWSA)*, 2 (1), 1-12.

- Davies RJ, Stewart SA (2005) Emplacement of giant mud volcanoes in the South Caspian Basin: three-dimensional seismic reflection imaging of root zones. *J Geol Soc* 162:1–4
- Davies RJ, Swarbrick RE, Evans RJ, Huuse M (2007) Birth of a mud volcano: East Java, 29 May 2006. *GSA Today*, 17(2).
- Evans R, Davies RJ, Stewart SA (2007) Internal structure and eruptive history of a kilometer scale mud volcano system, South Caspian Sea. *Basin Res*, 19, 153–163.
- Doni, A., Santosa, S., & Endarto, D. (2015). Development of Tourism Potential for Geography Education Using Analysis of the High School Geography Curriculum to Increase Tourist Attraction in Karanganyar Regency in 2013. *GeoEco Journal*, 1(2), 180 – 194.
- Eko, T., & Rahayu, S. (2012). Changes in Land Use and Their Suitability to RDTR in Peri-Urban Areas Case Study: Mlati District. *Journal of Regional and Urban Development*, 8(4), 330-340.
- Iqbal, M., & Sumaryanto, S. (2017). *Strategy for Controlling Agricultural Land Conversion Relies on Community Participation*. Bogor: Center for Socioeconomic Analysis and Agricultural Policy.
- Manga M (2007) Did an earthquake trigger the May 2006 eruption of the Lusi mud volcano? *EOS*, 8, 201
- Moeliono, T.P. (2018). Indonesian Rule of Law: Between Ideas and Reality. *PRO Justitia*, 28(3).
- Shofwan, M & Rukmana, SN. (2020). Urbanization Phenomenon: Spatial Transformation in the Periphery Areas of Sidoarjo Regency. *Tataloka*, 22(3), 393-399.
- Shofwan, M., & Rukmana, SN (2017). Communal Settlement Patterns After the Mudflow Disaster in Sidoarjo Regency. *SNasPPM Proceedings*, 2(1), 51-56.
- Sitorus, SRP, Leonataris, C., & Panuju, DR (2012). Analysis of Patterns of Land Use Change and Regional Development in Bekasi City, West Java Province. *Journal of Soil and Environmental Science*, 14(1), 21-28.
- Stewart SA, Davies RJ (2006) Structure and emplacement of mud volcano systems in the South Caspian Basin. *AAPG Bull*, 90, 771–786
- Sugiyono. (2019). *Educational Research Methods Quantitative, Qualitative and R&D Approaches*. Jakarta: Alfabeta.
- Wahyuningsih, W. (2018). Millennium Development Goals (Mdgs) and Sustainable Development Goals (Sdgs) in Social Welfare. *Bisma*, 11(3), 390. <https://doi.org/10.19184/bisma.v11i3.6479>
- Wicaksono, N. (2018). *Identification of the Hierarchy of Service Centers in Slawi District, Tegal Regency*, (Doctoral Dissertation, UNDIP).