Journal of Business, Social and Technology
Volume 7, Issue 3, 811-827
e_ISSN: 2807-6362
https://bustechno.polteksci.ac.id/index.php/jbt/index
DOI: doi.org/10.59261/jbt.v7i3.712

Community Resilience in Facing Fire Risk Case Study: RW 08, Penggilingan Village, Cakung District

***Anastasia Chandra Lalita Meliala**
Universitas Indonesia, Indonesia

Ayomi Dita Rarasati
Universitas Indonesia, Indonesia

Antony Sihombing
Universitas Indonesia, Indonesia

***Corresponding author:**
Anastasia Chandra Lalita Meliala, Universitas Indonesia, Indonesia.
✉anastasiacl30@gmail.com

Article Info:

***Article history*:**
Received: June 05, 2026
Revised: July 01, 2026
Accepted: July 02, 2026

***Keywords*:**
Fire Disaster; Resilience; Settlement Planning; Spatial Planning

Abstract

Background: The concept of urban spatial planning should become the foundation for urban development and growth, as it determines the arrangement of communities, activities, buildings, infrastructure, and resources within a region. However, the aspect of fire disaster risk is often overlooked in residential area planning. In East Jakarta, particularly in Penggilingan Village, which has a high population density, the risk of fire disasters is considerably high.
Objective: This study aims to examine community resilience through aspects of social resilience, economic resilience, and infrastructure and utility resilience.
Methods: This study employed a convergent mixed-methods design. A total of 374 household heads (10% of 3,736 households across 15 RTs) were selected using proportional random sampling, while RT heads and officials from the East Jakarta Fire and Rescue Department (Gulkarmat) were recruited through purposive sampling. Data were collected through questionnaires and in-depth interviews, then analyzed using SPSS descriptive statistics and Miles and Huberman's thematic analysis.
Results: Most RTs exhibited low social resilience, whereas economic and infrastructure-utility resilience were generally moderate. Low social resilience was mainly associated with limited community knowledge and fire preparedness, while inadequate hydrants and road access under 2 m reduced infrastructure resilience. Overall, community resilience was predominantly moderate (7 RT; 46.67%), followed by low (6 RT; 40.00%) and high (2 RT; 13.33%).
Conclusion: Community resilience to fire disasters in RW 08 is generally moderate but requires further improvement. Strengthening hydrant availability, road accessibility, and community fire-preparedness programs should be prioritized to enhance resilience in densely populated neighborhoods across East Jakarta.

To cite this article: Meliala, A. C. L., Rarasati, A. D., & Sihombing, A. (2026). Community Resilience in Facing Fire Risk Case Study: RW 08, Penggilingan Village, Cakung District. *Journal of Business, Social and Technology*, 7 (3), 811-827. https://doi.org/10.59261/jbt.v7i3.712

INTRODUCTION

Fires are one of the disasters that often occur in urban areas and have a great impact on people's lives (Calkin et al., 2023). Based on Law Number 24 of 2007 concerning Disaster Management, disasters can be caused by natural, non-natural, or human factors that result in casualties, environmental damage, property losses, and psychological impacts on the community. One form of disaster that occurs in urban areas is residential fires. Fires not only cause physical damage in the form of loss of buildings and community assets, but also affect the social, economic, and psychological conditions of affected residents. Therefore, fire is an important problem that

needs attention in urban planning and management (Abrar et al., 2025; Naser & Kodur, 2025).

Statistical data from the Indonesian National Board for Disaster Management (BNPB) indicates that fire disasters account for a significant proportion of urban disasters in Indonesia, with the Greater Jakarta area recording an average of 1,200–1,500 fire incidents annually over the 2019–2023 period (Purwanto et al., 2022). In East Jakarta specifically, data from the Regional Fire and Rescue Service (Dinas Gulkarmat DKI Jakarta) reveal a persistent increase in fire incidents in densely populated kelurahan such as Penggilingan, with 56 incidents recorded in the 2019–2024 period, underscoring the urgency of fire resilience research in this area.

The relationship between population growth, building density, and fire risk follows a compounding pattern: as population increases, demand for housing intensifies, and in land-constrained urban areas, this drives informal densification of the built environment (Mahtta et al., 2022). Research has demonstrated that neighborhoods with building densities exceeding 50 units per hectare are significantly more susceptible to rapid fire spread due to reduced inter-building distances and restricted emergency vehicle access (Falola et al., 2024; Noori et al., 2023). Consequently, the combined effect of uncontrolled population growth, increasing building density, and inadequate fire mitigation infrastructure creates a multiplicative escalation of urban fire risk.

The phenomenon of fires in urban areas is generally related to high population density, building density, unorganized residential conditions, and lack of fire control facilities and infrastructure (Falola et al., 2024; Nyimbili et al., 2023). Areas with high building density tend to have very close distances between buildings so that fires can quickly spread from one building to another. In addition, narrow environmental road access is also an obstacle for the mobility of fire fighting vehicles when the handling process takes place. This condition is exacerbated if settlements are not equipped with fire protection facilities such as hydrants, light fire extinguishers (APAR), emergency water sources, or electrical installation systems that meet safety standards. Densely populated settlements with low building quality and irregular layouts have a high level of vulnerability to fire risk (Noori et al., 2023).

DKI Jakarta Province as the center of government and national economic activity has a very large population and continues to increase every year. High population growth has led to an increase in the need for residential land (Awuah & Abdulai, 2022; Mahtta et al., 2022). However, limited land in urban areas results in the emergence of informal settlements and densely populated areas that develop without optimal planning. Based on data from the Jakarta Central Statistics Agency (BPS), the population of Jakarta in 2020 reached 10.68 million people and continues to increase in the following years. The high number of residents has caused the density of housing in various areas of Jakarta to increase. This condition is one of the factors that triggers an increase in the potential for fire disasters in residential areas.

Among the five administrative areas in DKI Jakarta Province, the East Jakarta Administrative City is the area with the largest population. In 2020, the population of East Jakarta reached 3,037,139 people and increased to 3,083,988 people in 2026. The high number of people has an impact on the high level of population density in this region. Based on the BNPB Disaster Risk Assessment in the Regulation of the Head of BNPB Number 2 of 2012, an area is categorized as having high density if it has more than 1,000 people per square kilometer. Meanwhile, East Jakarta has a population density of 16,622 people per square kilometer, so it is classified as very dense. The high population density has an effect on increasing the vulnerability of the area to fire risk, especially in dense residential areas that have inadequate physical environmental conditions.

In addition to population density, building density is also an important factor that affects the level of fire risk in residential areas (Bispo et al., 2023). The high density of buildings causes the space between buildings to become very narrow, accelerating the spread of fire when a fire occurs. The adjacent buildings also complicate the evacuation process of residents and hinder firefighters' access to the fire point (Templeton et al., 2023). Under certain conditions, the use of flammable building materials and electrical installations that do not meet standards also increase the potential for fires. Therefore, areas with high building density have a greater level of vulnerability than areas with more regular building arrangements and adequate open space.

Based on data from the Jakarta Provincial Fire and Rescue Service in 2015–2024, East

Jakarta is recorded as the area with the highest number of fire incidents compared to other administrative areas in DKI Jakarta. One of the sub-districts that has a fairly high frequency of fire incidents is Cakung District. In the last five years, Penggilingan Village has become one of the areas that has experienced the most frequent fires with a total of fifty-six incidents. Among the residential areas in Penggilingan Village, RW 08 is an area with a high level of population density and building density and has a high risk of fire. The dense residential conditions, limited road access, and close distance between buildings make this area vulnerable to fire spread when a fire occurs.

The high potential for fires in densely populated areas requires people to have the ability to adapt and survive the threat of disasters. This ability is known as community resilience. Community resilience is the ability of individuals and community groups to face, respond, and recover after a disaster (Dandoulaki et al., 2023; Villaverde Canosa et al., 2024). In the context of residential fires, community resilience can be realized through residents' preparedness, the ability to evacuate, concern for environmental safety, and cooperation between residents in reducing the risk of fire. Communities that have a high level of resilience tend to be better prepared for disasters and are able to minimize the impact they cause.

Research on community resilience to fire risk is important to be conducted, especially in dense residential areas such as RW 08 Penggilingan Village. This research can provide an overview of the environmental conditions of settlements, factors that cause fires, and the ability of communities to deal with the threat of fire disasters. In addition, this research is also expected to be a consideration for the government in formulating policies to mitigate fire risks and improve the quality of urban settlements. Fire risk reduction efforts not only require the provision of physical facilities and infrastructure, but also require increased awareness and community participation in creating a safe and disaster-resilient environment.

Community resilience, as conceptualized by Cutter (2016), is a multidimensional construct encompassing social, economic, institutional, infrastructure, and community capital dimensions. In the context of fire disaster, resilience is understood as the capacity of individuals and communities not only to withstand and absorb the impacts of fire incidents, but also to adapt and recover in ways that maintain the essential structures and functions of the community (Sharifi, 2016). Peng (2017) further emphasize that resilience must be understood as dynamic and place-specific, varying significantly across spatial scales and socioeconomic conditions a perspective that justifies the granular, neighborhood-level assessment approach adopted in this study.

Despite the growing body of literature on community resilience to disasters, a critical research gap exists at the micro-scale: most existing studies assess resilience at the district or city level Villaverde (2024) and Dandoulaki (2023), leaving intra-neighborhood variation particularly within individual RW units largely unexplored. Studies on fire-specific resilience in Indonesian informal urban settlements are especially limited. The novelty of this research lies in its application of a multi-indicator, weighted scoring system that simultaneously assesses social, economic, and infrastructure-utility dimensions of resilience at the RT (neighborhood unit) level within a single RW, providing a granular mapping of resilience heterogeneity. This approach enables local governments and community leaders to identify the most vulnerable sub-units within a neighborhood and design targeted, prioritized mitigation interventions a contribution that is methodologically and empirically distinct from prior macro-scale resilience assessments.

Thus, research on community resilience to fire disaster risk in RW 08 Penggilingan Village, Cakung District, East Jakarta is relevant to be conducted. This research is expected to be able to contribute to the development of regional and urban planning science, especially related to fire disaster mitigation in densely populated residential areas. In addition, the results of the research are expected to be input for local governments and communities in an effort to increase the resilience of residential areas against the threat of fire in the future.

METHOD

Research methods are stages or procedures that researchers use to achieve research objectives in a systematic and directed manner. The research method functions as a guideline in the process of data collection, data processing, and data analysis so that the results of research can be scientifically accounted for. In this study, the research method was used to assess community resilience to fire disaster risk in densely populated residential areas in RW 08 Penggilingan Village, Cakung District, East Jakarta.

Research Approach

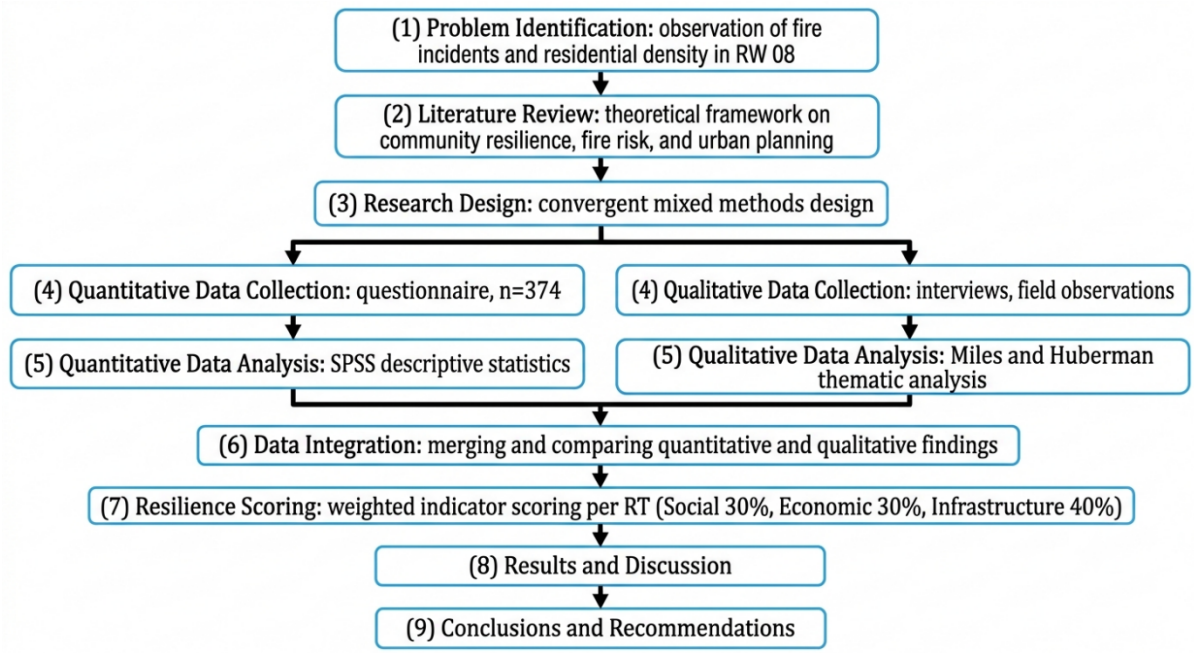

Figure 1. Research Flowchart

This study employs a mixed-methods approach using a sequential or convergent mixed-methods design. This design was chosen to gain a comprehensive understanding by combining numerical and descriptive data, in which quantitative and qualitative data are collected simultaneously, analyzed independently, and integrated during the interpretation stage (Creswell & Plano Clark, 2018). The quantitative approach was used to measure the community's level of resilience based on social, economic, and infrastructure and utility aspects through the distribution of questionnaires. Meanwhile, the qualitative approach was applied to explore residents' perceptions, experiences, social conditions, and adaptation strategies regarding fire risks through field observations and in-depth interviews with neighborhood association (RT) leaders, Dasawisma leaders, and local community leaders. All systematic stages, from problem identification to drawing conclusions, are summarized in the research flowchart in Figure 1.

Research Location

The research location is in RW 08 Penggilingan Village, Cakung District, East Jakarta Administrative City. This area was chosen because it is one of the densely populated residential areas that has a high level of fire risk. In addition, RW 08 is also an area with a high building density and environmental conditions that are vulnerable to the spread of fire when a fire occurs. The research location includes 15 Neighborhood Units (RT) located in the RW 08 area. This area has the characteristics of dense settlements, narrow environmental road access, and a lack of fire protection facilities so that it has the potential to increase the risk of fire.

Quantitative justification for selecting RW 08 as the research location includes the following data: (1) building density of approximately 85.6 units/hectare, which exceeds the critical threshold of 50 units/ha associated with high fire spread risk; (2) an average building

setback distance of less than 1.5 m, significantly below the safe minimum of 3 m; (3) 56 documented fire incidents during 2019–2024, representing the highest frequency among all RWs in Penggilingan Village; and (4) road widths of less than 2 m in 11 of 15 RTs, rendering firefighting vehicle access effectively impossible in most sub-units (Dinas Gulkarmat DKI Jakarta, 2024). These conditions collectively establish RW 08 as the highest-risk sub-area warranting priority research attention.

Population and Research Sample

The population in this study is all heads of families located in RW 08 Penggilingan Village. The sample was determined using purposive sampling techniques for qualitative approaches and proportional sampling for quantitative approaches. In the qualitative approach, informants are selected based on certain considerations, namely individuals who are considered to understand environmental conditions and have experience related to fire incidents. The informants in this study include the head of RT, the head of the dasawisma, and residents who have experienced fire incidents.

In the quantitative approach, the number of samples is determined at 10% of the total heads of families in each RT. Based on data on the number of heads of families in RW 08 as many as 3,736 families, a sample of 374 families was obtained, which was then added to a reserve of 10%. The 10% proportional sampling rate applied in this study is consistent with the Slovin formula ($n = N / (1 + N \cdot e^2)$) with a margin of error e = 5%, which for N = 3,736 yields n ≈ 361, rounded up to 374 with a 10% reserve to account for non-response, thereby ensuring a statistically adequate sample size (Sugiyono, 2019). The samples were distributed proportionally to 15 RTs in order to represent the conditions of the entire research area. With this method, the data obtained is expected to be able to describe the overall condition of community resilience.

Data Types and Sources

This study uses two types of data, namely primary data and secondary data. Primary data was obtained directly from the field through observation, interviews, and the distribution of questionnaires to the community. Primary data includes the social conditions of the community, the level of knowledge and preparedness for fires, the economic conditions of households, and the condition of infrastructure and utilities in residential environments.

Meanwhile, secondary data was obtained from various related agencies such as the Central Statistics Agency (BPS), Cakung District Office, Penggilingan Village, and the East Jakarta City Administrative Fire and Rescue Service. Secondary data included population data, building density, land use, area area, and data on fire incidents that had occurred in the research area. In addition, secondary data is also obtained from literature, journals, official documents, and previous research relevant to the research topic.

Data Collection Techniques

The data collection techniques employed in this study consisted of field observation, in-depth interviews, questionnaires, agency surveys, and literature review. Field observations were conducted to document the physical characteristics of the residential environment, including building density, road width, accessibility for fire-fighting vehicles, and the availability of fire protection facilities such as fire extinguishers, portable fire extinguishing equipment (APAB), hydrants, and water reservoirs. These observations also served to verify the physical conditions reported by respondents and to support data triangulation.

In-depth interviews were conducted with purposively selected informants, including neighborhood (RT) heads, community leaders, and residents with experience of fire incidents, to explore community perceptions of fire risk, preparedness practices, adaptation strategies, and challenges in responding to fire emergencies. The interview transcripts and field observation notes were subsequently analyzed using the Miles and Huberman (2014) interactive model, consisting of data reduction, data display, and conclusion drawing/verification. During this process, the qualitative data were coded and organized into thematic categories representing key dimensions of community resilience, and the resulting themes were compared with the

quantitative findings through methodological triangulation.

Questionnaires were distributed to household heads to collect quantitative data on community resilience across the social, economic, and infrastructure–utility dimensions. Responses were measured using predefined indicators and scoring criteria developed for this study. In addition, agency surveys were conducted to obtain official information on demographic characteristics, settlement conditions, and historical fire incidents from relevant government institutions. A literature review of scientific publications, official reports, and policy documents related to fire disasters, community resilience, and disaster mitigation was also undertaken to establish the theoretical framework and support the interpretation of the research findings.

Data Analysis Techniques

Data analysis is carried out through several stages, namely editing, coding, data entry, data cleaning, tabulation, and weighting of resilience indicators. Qualitative data obtained from in-depth interviews and field observations were analyzed using the Miles and Huberman (2014) interactive model, comprising three concurrent activities: (1) data reduction, through which interview transcripts were condensed into key themes related to community preparedness, fire causes, and adaptation strategies; (2) data display, in which thematic patterns were organized into descriptive summaries and visual matrices; and (3) conclusion drawing, where interpretive conclusions were drawn and verified against field observation data (triangulation).

The integration of quantitative and qualitative results was conducted using a convergent parallel design, wherein both data streams were analyzed independently before being merged for comparison and synthesis at the interpretation stage a procedure that enhances the validity of findings through methodological triangulation (Creswell & Plano Clark, 2018). The quantitative data obtained from the questionnaire was processed using SPSS software version 23 to facilitate the statistical analysis process. Descriptive statistical analysis was used to describe the social, economic, and infrastructure conditions of the community in the research area.

This study uses three main aspects in measuring community resilience, namely social aspects, economic aspects, and infrastructure and utility aspects. Social aspects include indicators of age, gender, population density, education, knowledge, attitudes, and community preparedness for fires. Economic aspects include employment, income, and health insurance ownership. Meanwhile, infrastructure and utility aspects include building quality, building density, road access, distance between buildings, hydrant facilities, fire extinguishers, APAB, and water reservoirs.

Each indicator is given a score and weight based on the degree of its impact on community resilience. The weighting scheme applied in this study draws from established resilience assessment frameworks: the Social aspect (30%) reflects the foundational role of human capital and community capacity in disaster response, consistent with the Social Vulnerability Index (SoVI) framework (Cutter et al., 2016); the Economic aspect (30%) captures households' financial capacity to absorb losses and recover, aligned with economic resilience dimensions identified by Sharifi (2016); and the Infrastructure and Utility aspect (40%) receives the highest weight because physical infrastructure conditions particularly road access, building density, and fire protection facilities are the primary determinants of fire spread velocity and suppression effectiveness in dense urban settlements (Bispo et al., 2023; Noori et al., 2023). The relative weights were determined through expert judgment informed by a review of the above literature and validated against local field conditions in RW 08. The score results are then calculated to determine the level of community resilience in each RT in RW 08. Furthermore, the level of resilience was classified into several categories based on the interval value obtained from the weighting results. The results of the analysis were used to determine the level of community resilience to fire disaster risk and identify factors that affect the level of resilience in the research area.

Table 1. Weighting Value of Community Resilience Indicators and Aspects

Aspects	Indicator	Remarks	Score	Weight	Weighted Score
Social (30%)	Age	Age 0-4 years and >=65 years old	1 2	3	3 6
		Age 5-14 years old	3		9
		Ages 15-64			
	Gender	Male-to-Female Ratio < 100%	1	3	3
		Male Female Ratio ≥ 100%	3		9
	Density	Population ≥ 200 people/ha.	1 2	3	3 6
		Population 150 –200 people/ha,	3		9
		Population <150 inhabitants/ha			
	People per household	Number of people ≥5 people	1 2	3	3 6
		Number of people 3-4 people	3		9
		Number of people 1-2 people			
	Education	Primary Education (not school, elementary)	1 2	2	2 4
		Secondary Education (Junior High School, High School)	3		6
		Higher Education (Academy/PT)			
	Knowledge	Score <60%	1	2	2
		Score 60-79%	2		4
		Score 80-100%	3		6
	Attitude	Score <60%	1	2	2
		Score 60-79%	2		4
		Score 80-100%	3		6
	Preparedness	Score Value <= 2	1	3	3
		Score 3-4	2		6
		Score Values 5-6	3		9
Economy (30%)	Jobs	Not Working	1	2	2
		Work	3		6
	Revenue	Income < UMR	1	2	2
		Opinion >= UMR)	3		6
	Health Insurance	Not Have Insurance	1	2	2
		There is insurance	3		6
Infrastructure and Utilities (40%)	Disaster-Resistant Buildings	Non-Permanent House Buildings	1 2	3	3 9
		Semi-permanent House Buildings	3		
		Permanent Buildings			
	Land Use	Residential and	1	3	3

	Business Use Pure Settlement Use	3		9
Land Ownership	Land of Houses Not Owned by Own Own House Land	1 3		3 9
Building Density	Building ≥ 50 units/ha Building< 50 units/ha	1 3	3	3 9
Distance Between Buildings	Distance < 2 m Distance 2-3 m Distance > 3 m	1 2 3	3	3 6 9
Access to the Fire Truck	Impassable Passable	1 3	3	3 9
Location of the house from Main Street	Distance > 100 m Distance 21-100 m Distance < 5 m-20 m)	1 2 3	3	3 6 9
Driveway Width	Road width < 2 m Road width Distance 2-3 m Road width > 3 m	1 2 3	3	3 6 9
Hydrant Facilities	No Hydrants There is a hydrant	1 3	3	3 9
Fire extinguishing facilities	No Fire Extinguishers There is a fire extinguisher	1 3	3	3 9
APAB Facilities	No APAB There is an APAB	1 3	3	3 9
Tandon Water Facilities	No water reservoir There is a water reservoir	1 3	3	3 9

Source: Author's processing, 2026

RESULTS AND DISCUSSION

Results

Overview of Research Locations

The research location is in RW 08 Penggilingan Village, Cakung District, East Jakarta Administrative City. Penggilingan Village is one of the areas in Cakung District which has an area of about 4.49 km^2 or 10.62% of the area of Cakung District. Administratively, Penggilingan Village is bordered by West Cakung Village to the north, Pulo Gadung Village to the east, Duren Sawit District to the south, and Jatinegara and Rawa Terate Villages to the west. Penggilingan Village consists of 20 RWs and 253 RTs, where RW 08 is one of the largest areas with a percentage of around 11.8% of the area of the village.

RW 08 has an area of about ±52.30 hectares and consists of 15 RTs. This area is a densely populated settlement with a high level of building density and access to mostly narrow neighborhood roads. This condition causes this area to have a fairly high potential fire risk. In addition, the relatively close distance between buildings and the limited fire protection facilities are factors that increase the vulnerability of the area to the spread of fire when a fire occurs.

Social Resilience Level Assessment

The assessment of social resilience is carried out based on several indicators, namely age, gender, population density, number of family members per household, education level, knowledge about fires, attitudes towards fires, and community preparedness. The assessment was carried out on 406 heads of families spread across 15 RTs in RW 08 Penggilingan Village.

Table 2. Social Resilience Assessment of 15

RT	Score										
	Age	Gender	Population Density	Number of People/RT	Education	Knowledge	Attitude	Preparedness	Total Social Score	Average Score	Social Resilience Level
RT 01	6	3	3	6	4	2	6	3	33	4,1	Low
RT 02	6	3	3	6	4	2	6	3	33	4,1	Low
RT 03	6	3	6	6	4	2	6	3	36	4,5	Medium
RT 04	6	3	9	6	4	2	6	3	39	4,9	Height
RT 05	6	3	3	6	4	2	6	6	36	4,5	Medium
RT 06	6	3	3	6	4	2	6	3	33	4,1	Low
RT 07	6	3	9	6	4	2	6	3	39	4,9	Height
RT 08	6	3	3	6	4	2	6	3	33	4,1	Low
RT 09	6	1	6	6	4	2	6	3	34	4,3	Medium
RT 10	6	3	6	6	4	2	6	3	36	4,5	Medium
RT 11	6	3	3	6	4	2	6	3	33	4,1	Low
RT 12	6	1	3	6	4	2	6	3	31	3,9	Low
RT 13	6	3	6	6	4	2	6	3	36	4,5	Medium
RT 14	6	3	3	6	4	2	6	3	33	4,1	Low
RT 15	6	1	3	6	4	2	6	3	31	3,9	Low

RTs in RW 8 Penggilingan Village, Cakung District, East Jakarta
Source : Author's processing, 2026

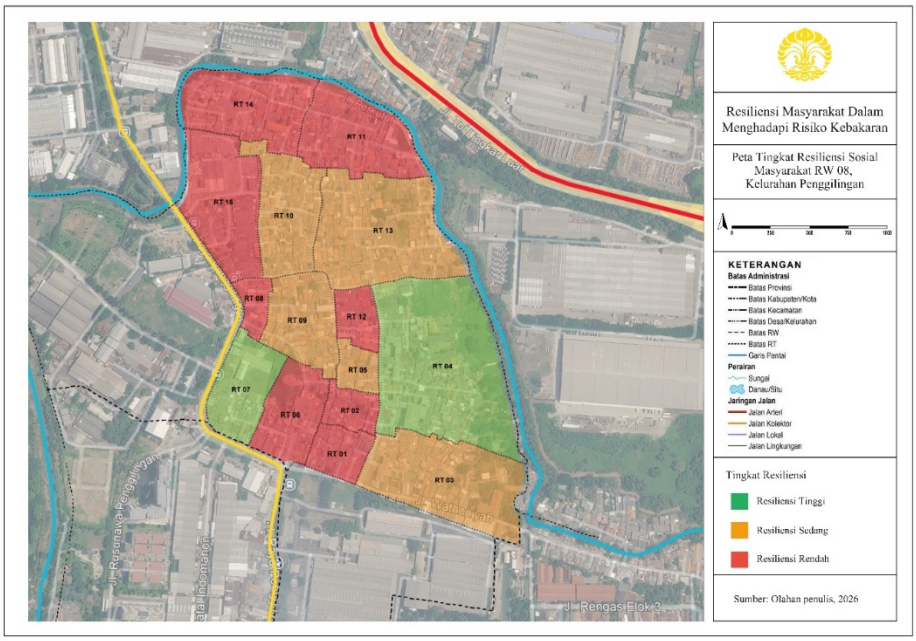

Figure 2. Map of Social Resilience Levels in RW 08, Penggilingan Village

The results showed that most RTs had a low level of social resilience. Of the 15 RTs studied, only 2 RTs had a high level of social resilience, while 5 RTs were in the medium category and the

rest were in the low category. RT 04 and RT 07 are the areas with the highest level of social resilience, while RT 12 and RT 15 have the lowest level of social resilience. This condition shows that the social capacity of the community in dealing with the threat of fire is still not optimal.

The low social resilience of the community is influenced by several factors, one of which is the low public knowledge about fire hazards and mitigation measures that must be taken when a fire occurs. Based on the results of the interview with the head of the RT, fire socialization and training activities are still very limited and have not been carried out regularly to the community. Information about fire mitigation is generally only received by the head of the RT and has not been fully forwarded to the residents. In addition, the high number of vulnerable groups such as toddlers and the elderly is also a factor that affects the low social resilience of the community.

This condition shows that the community in RW 08 still needs to increase social capacity through education, disaster training, and increased community participation in fire disaster mitigation activities. Strengthening social capacity is important because the community is the first party to face risks when fires occur. With good knowledge and preparedness, the community is expected to be able to reduce the impact of losses due to fires.

Economic Resilience Assessment

The assessment of economic resilience is carried out based on indicators of employment, income, and health insurance ownership. The results show that most RTs in RW 08 have a moderate level of economic resilience. Of the 15 RTs studied, there were 4 RTs in the high category, 7 RTs in the medium category, and 4 RTs in the low category. RT 01, RT 07, RT 09, and RT 14 have a high level of economic resilience, while RT 02, RT 10, RT 11, and RT 15 are in the low category.

Table 3. Economic Resilience Assessment of 15 RTs in RW 8 Penggilingan Village Cakung District, East Jakarta

RT	Score					
	Jobs	**Revenue**	**Health Insurance**	**Total Economic Score**	**Average Score**	**Economic Resilience Level**
RT 01	6	6	6	18	6,0	Height
RT 02	2	6	2	10	3,3	Low
RT 03	2	6	6	14	4,7	Medium
RT 04	2	6	6	14	4,7	Medium
RT 05	6	6	2	14	4,7	Medium
RT 06	2	6	6	14	4,7	Medium
RT 07	6	6	6	18	6,0	Height
RT 08	2	6	6	14	4,7	Medium
RT 09	6	6	6	18	6,0	Height
RT 10	2	6	2	10	3,3	Low
RT 11	2	6	2	10	3,3	Low
RT 12	2	6	6	14	4,7	Medium
RT 13	2	6	6	14	4,7	Medium
RT 14	6	6	6	18	6,0	Height
RT 15	2	6	2	10	3,3	Low

Source : Author's processing, 2026

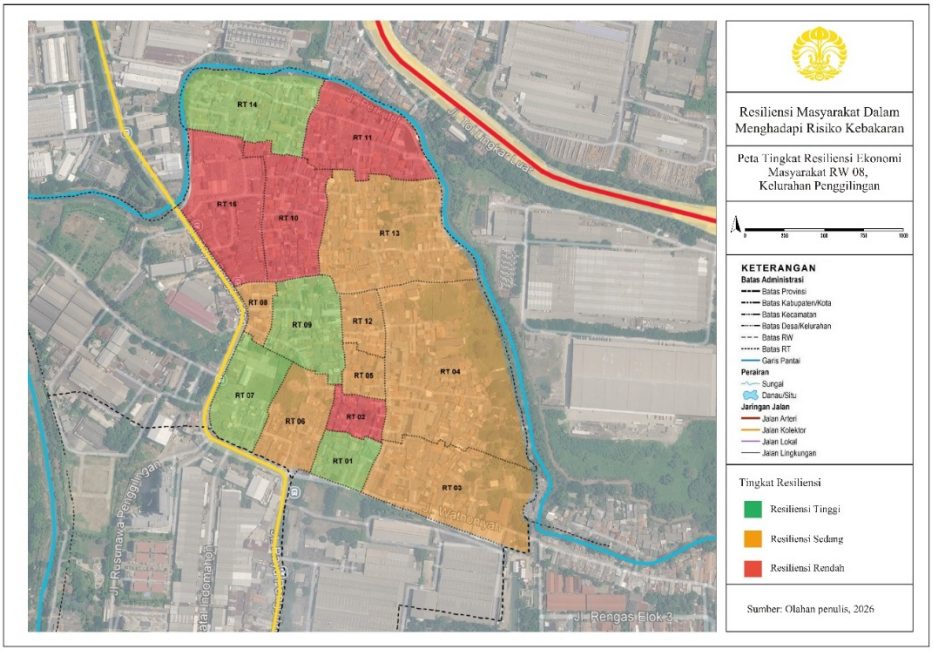

Figure 3. Map of Economic Resilience Levels in RW 08, Penggilingan Village

The results of the study show that the economic conditions of the community in RW 08 are relatively homogeneous. Most people have different types of jobs and income levels. This causes the range of economic resilience values between RTs to be not too large. People who have a high level of economic resilience generally have a more stable income, a steady job, and better health insurance ownership than other RTs. Good economic conditions allow the community to have greater ability to recover after fire disasters.

In contrast, RTs with low economic resilience tend to have limited financial ability to deal with losses due to fires. The low income of the community causes limitations in repairing damage to houses, buying safety equipment, and meeting basic needs after a fire. In addition, some people also do not have health insurance, increasing economic vulnerability when disasters occur.

This condition shows that the economic aspect has an important role in increasing community resilience to fires. Societies with better economic conditions tend to be better prepared to face risks and have faster recovery capabilities after disasters occur.

Infrastructure and Utilities Resilience Level Assessment

The assessment of infrastructure and utility resilience is carried out based on indicators of building quality, land use, land ownership, building density, distance between buildings, road access of fire vehicles, location of houses to main roads, width of entrances, and the availability of hydrant facilities, fire extinguishers, APAB, and water reservoirs.

Table 4. Infrastructure and Utility Resilience Assessment in 15 RTs in RW 8 Penggilingan Village, Cakung District, East Jakarta

RT	Score														
	Disaster-Resistant	Land Use	Land Ownership	Building Density	Distance Between	Access to the Fire	Location of the house from the main road	Driveway Width	Hydrant Facilities	Fire extinguishing	APAB Facilities	Tandon Water	Total Infrastructure and Utilization Score	Average Score	Infrastructure and Utility Resilience Levels
RT 01	9	9	3	3	3	3	9	3	3	3	3	3	54	4,5	Low
RT 02	9	9	3	3	3	3	9	6	3	3	3	3	57	4,8	Low
RT 03	9	9	3	3	3	3	9	3	3	3	3	3	54	4,5	Low
RT 04	9	3	3	9	3	9	3	3	3	3	3	3	54	4,5	Low
RT 05	9	3	3	3	3	3	9	6	3	3	3	3	51	4,3	Low
RT 06	9	9	3	9	3	9	6	3	3	3	3	3	63	5,3	Medium
RT 07	9	3	3	9	3	9	9	6	3	3	3	9	69	5,8	Height
RT 08	9	3	3	3	3	9	9	9	3	3	3	3	60	5,0	Medium
RT 09	9	3	3	9	3	3	6	6	3	3	3	3	54	4,5	Low
RT 10	9	9	9	9	3	9	9	3	3	3	3	3	72	6,0	Height
RT 11	9	9	3	3	3	9	9	3	3	3	3	9	66	5,5	Height
RT 12	9	9	3	3	3	9	6	3	3	3	3	3	57	4,8	Low
RT 13	9	9	3	9	3	9	9	3	3	3	3	3	66	5,5	Height
RT 14	9	9	3	3	3	9	9	6	3	3	3	3	63	5,3	Medium
RT 15	9	3	3	9	3	9	6	3	3	9	3	3	63	5,3	Medium

Source: Author's processing, 2026

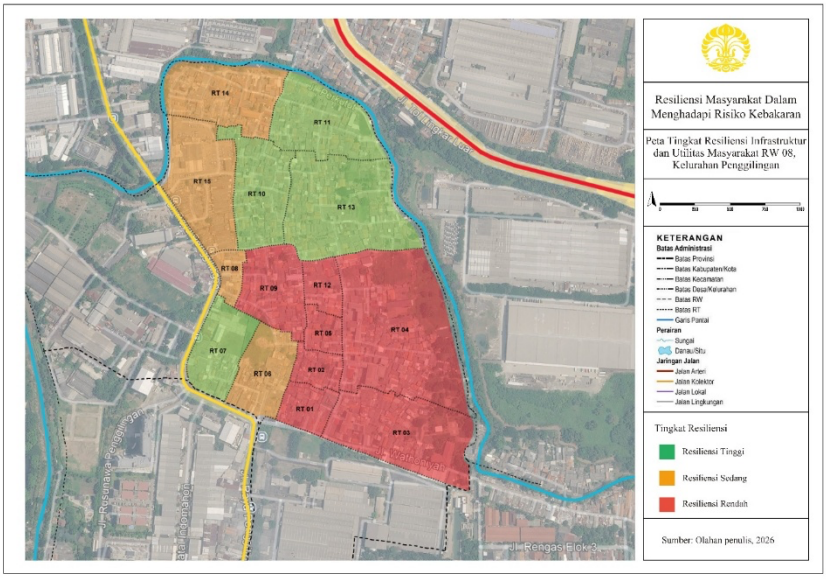

Figure 4. Map of Infrastructure and Utility Resilience Levels in RW 08, Penggilingan Village

The results showed that most RTs in RW 08 have a moderate level of infrastructure and utility resilience. There are 4 RTs in the high category, 7 RTs in the medium category, and 4 RTs in the low category. RT 07, RT 10, RT 11, and RT 13 have the highest levels of infrastructure and

utility resilience. This condition shows that some areas already have good enough facilities and infrastructure to support fire management.

However, there are still various infrastructure limitations that can hinder the fire handling process. Most areas have narrow environmental roads, making it difficult for fire engines to access the scene. In addition, the very close distance between buildings causes the fire to easily spread to other buildings. The availability of fire protection facilities such as hydrants, fire extinguishers, and APABs is also still very limited in most RTs.

Inadequate infrastructure conditions show that the RW 08 area still has a high level of vulnerability to fire. Therefore, it is necessary to improve the quality of residential infrastructure through widening road access, providing firefighting facilities, and structuring buildings that are safer against fire risks.

Community Resilience Level Assessment

Community resilience assessments are carried out by combining three main aspects, namely social, economic, and infrastructure and utility resilience.

Table 5. Community Resilience Assessment in 15 RTs in RW 8 Penggilingan Village, Cakung District, East Jakarta

RT	Average Social Response Score (Weight 30%)	Average Value of Economic Reciprocity (Weight 30%)	Average Value of Infrastructure Reciprocity & Utilization (Weight 40%)	Resilience Values	Community Resilience Rate
RT 01	4,1	6,0	4,5	4,8	Medium
RT 02	4,1	3,3	4,8	4,1	Low
RT 03	4,5	4,7	4,5	4,6	Medium
RT 04	4,9	4,7	4,5	4,7	Medium
RT 05	4,5	4,7	4,3	4,5	Low
RT 06	4,1	4,7	5,3	4,8	Medium
RT 07	4,9	6,0	5,8	5,6	Height
RT 08	4,1	4,7	5,0	4,6	Low
RT 09	4,3	6,0	4,5	4,9	Medium
RT 10	4,5	3,3	6,0	4,7	Low
RT 11	4,1	3,3	5,5	4,4	Low
RT 12	3,9	4,7	4,8	4,5	Low
RT 13	4,5	4,7	5,5	5,0	Medium
RT 14	4,1	6,0	5,3	5,2	Height
RT 15	3,9	3,3	5,3	4,3	Low

Source : Author's processing, 2026

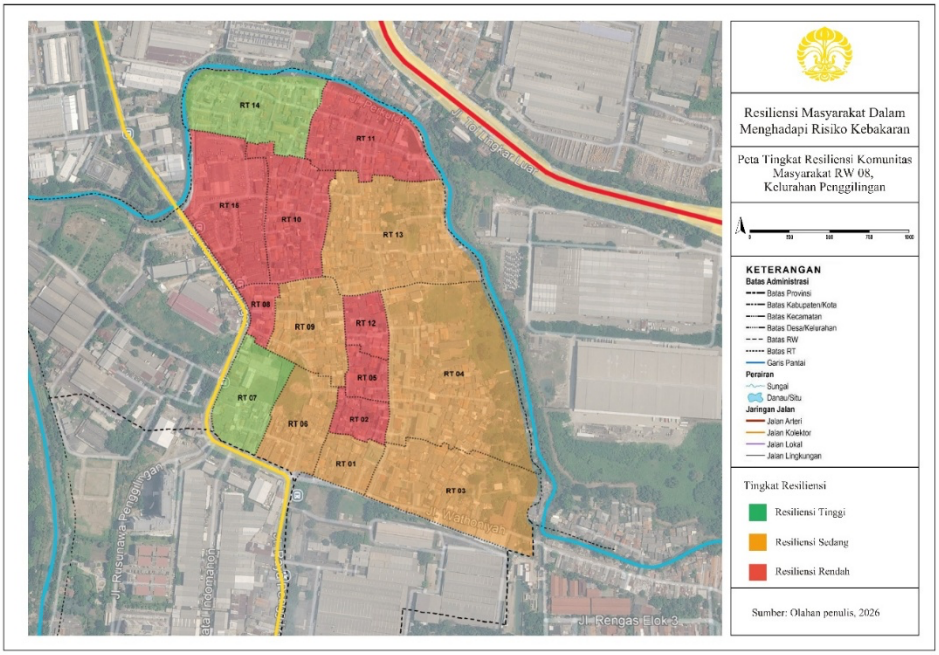

Figure 5. Map of Community Resilience Levels in RW 08, Penggilingan Village

The results showed that most RTs in RW 08 had a moderate level of community resilience. Of the 15 RTs studied, as many as 7 RTs were in the medium category, 6 RTs were in the low category, and only 2 RTs were in the high category, namely RT 07 and RT 14.

RT 07 and RT 14 have the highest level of resilience because they are supported by relatively better economic conditions and more adequate infrastructure than other RTs. The two RTs have better road access, relatively safer building conditions, and higher economic capacity of the community. This condition allows the community to have better ability to deal with and recover from the impact of fires.

On the other hand, RTs that have a low level of resilience generally have weaknesses in economic and social aspects. Low community income, limited knowledge about fire mitigation, and lack of fire protection facilities make people more vulnerable to the impact of fire. In addition, low community participation in disaster mitigation activities is also a factor that affects the low level of community resilience.

Discussion

Overall, the results of the study show that the level of community resilience to fire disasters in RW 08 Penggilingan Village is still in the medium category. This condition shows that the community has basic capacity to deal with fire disasters, but still needs improvement in various aspects. Efforts to increase community resilience can be carried out through increasing community economic capacity, providing fire management facilities and infrastructure, increasing disaster mitigation education and training, and strengthening coordination between residents and related institutions (He & Cha, 2022; Wen et al., 2025).

These findings are broadly consistent with prior studies on urban community resilience in developing-country contexts. Fatemi (2017) demonstrated that social vulnerability indicators particularly education level and disaster preparedness are the most influential determinants of low resilience scores in low-income urban communities, which aligns with the predominantly low social resilience observed in RW 08. Similarly, the dominance of moderate infrastructure-utility resilience echoes findings by Noori (2023) in Iranian urban neighborhoods, where moderate scores were driven by adequate building permanence but offset by insufficient fire protection infrastructure. However, this study diverges from Dandoulaki (2023), who found that community social capital and inter-institutional coordination were sufficient to elevate overall resilience above the moderate threshold even in structurally deficient neighborhoods a condition not

observed in RW 08, likely due to the limited reach of socialization programs noted by RT heads during interviews. The finding that only 2 out of 15 RTs (RT 07 and RT 14) achieved high resilience underscores the hyper-local variability of urban fire resilience, a pattern consistent with Cutter (2016) who argue that resilience scores can vary significantly even within contiguous neighborhoods due to micro-scale differences in infrastructure and social capital.

Qualitative data from in-depth interviews with RT heads reinforced the quantitative findings. The head of RT 02, one of the lowest-scoring units, stated: "We have never received any formal fire training from the kelurahan. When a fire happens, we just throw water and hope for the best we have no extinguishers and the road is too narrow for fire trucks anyway." This statement directly corroborates the low scores on the knowledge (score 2/6), preparedness (score 3/9), and access indicators (score 3/9) for RT 02. Conversely, the head of RT 07 the highest-scoring RT noted: "Our RT has a water reservoir that was built through a community self-help program (swadaya). We also conduct a fire drill at least once a year, which makes residents more confident in responding." These qualitative insights enrich the quantitative findings and demonstrate that community agency and social organization, even at the micro-scale, can meaningfully elevate resilience scores in the absence of top-down government provision.

The results of this study are in line with the theory of Cutter (2016) which states that community resilience is a multidimensional concept influenced by social, economic, and infrastructure aspects. Increasing community resilience must be carried out comprehensively through reducing vulnerability, building community capacity, strengthening social support, and developing better mitigation systems (Yani & Santosa, 2026). Therefore, increasing community resilience to fires in RW 08 needs to be carried out in an integrated manner so that the community is able to deal with fire risks more effectively in the future.

More specifically, the moderate overall resilience observed in RW 08 can be interpreted through the lens of the Pressure and Release (PAR) model Fatemi (2017), which posits that disaster risk is the product of hazard exposure and social vulnerability. In RW 08, while the fire hazard exposure is uniformly high across all 15 RTs (given the shared physical characteristics of dense building arrangement and narrow roads), the variation in resilience scores reflects differences in the vulnerability dimension—particularly in economic capacity, education levels, and access to fire protection infrastructure. The two high-resilience RTs (RT 07 and RT 14) effectively reduce their vulnerability through relatively better economic conditions and infrastructure, while low-resilience RTs remain trapped in a cycle of high exposure and high vulnerability with insufficient capacity to recover. This interpretation underscores that fire resilience interventions in RW 08 must simultaneously address both vulnerability reduction (through economic empowerment and disaster education programs) and hazard mitigation (through infrastructure improvement and spatial reorganization).

CONCLUSION

This study concludes that community resilience to fire disasters in RW 08, Penggilingan Village, is generally at a moderate level, indicating that most neighborhoods possess sufficient basic capacity to anticipate, respond to, and recover from fire emergencies, although important vulnerabilities remain. Neighborhoods with stronger socioeconomic conditions and better infrastructure demonstrated higher resilience, whereas those with limited social capacity, economic resources, and supporting infrastructure were more vulnerable to fire risks. These findings highlight substantial variations in resilience across neighborhoods and emphasize the importance of targeted interventions to strengthen preparedness, improve emergency infrastructure, and enhance community capacity.

This study contributes to the disaster resilience literature by proposing a weighted multi-indicator resilience assessment framework at the RT level, providing a replicable approach for assessing resilience in densely populated urban settlements. The findings support policy priorities such as expanding the availability of fire hydrants and portable fire extinguishers (APAR), improving emergency access through road widening or dedicated emergency corridors, and implementing regular community-based fire preparedness programs. Nevertheless, this study is limited by its proportional sampling design, expert-based weighting scheme, cross-

sectional approach, and relatively limited qualitative coverage. Future research should incorporate longitudinal and spatial analyses, validate indicator weights using methods such as the Analytical Hierarchy Process (AHP) or Delphi technique, and extend the assessment to multiple urban areas to develop a more comprehensive and generalizable community fire resilience index.

ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to the residents of RW 08, Penggilingan Village, Cakung District, East Jakarta, for their willingness to participate in this study. The authors also thank the neighborhood (RT) leaders, community representatives, and the East Jakarta Fire and Rescue Department (Dinas Penanggulangan Kebakaran dan Penyelamatan/Gulkarmat) for their valuable assistance, data support, and cooperation throughout the research process. Their contributions were essential to the successful completion of this study.

AUTHOR CONTRIBUTION STATEMENT

A. C. L. Meliala: Conceptualization, methodology, investigation, data curation, formal analysis, visualization, writing original draft preparation. A. D. Rarasati: Conceptualization, methodology, supervision, validation, and editing. A. Sihombing: Supervision, validation, project administration, and editing. All authors contributed to the interpretation of the findings, critically reviewed the manuscript for important intellectual content, approved the final version of the manuscript, and agreed to be accountable for all aspects of the work.

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