



# Building climate-resilient urban communities through public space adaptation

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## ABSTRACT

**Background:** Climate change poses critical challenges to urban communities, particularly in densely populated areas where the quality of life is highly vulnerable to environmental disruptions. This study aims to analyze the impacts of climate change on health, socio-economic, and environmental dimensions within urban neighborhoods while assessing the community's adaptive capacity in responding to these challenges. **Methods:** A descriptive qualitative approach was employed through in-depth interviews, field observations, and analysis of secondary data from meteorological, statistical, and policy sources. **Findings:** The results reveal tangible consequences such as health risks from flooding and extreme heat, economic disruptions affecting small businesses, and environmental degradation that heightens disaster vulnerability. While public awareness of climate issues is relatively strong, adaptive capacity remains constrained by limited resources, insufficient climate education, and minimal participatory policy support. **Conclusion:** The study highlights the need for community-based adaptation strategies that integrate climate-sensitive urban design, enhanced climate literacy, participatory policy frameworks, and technology-driven innovations. Strengthening these aspects is crucial for fostering climate-resilient public spaces and promoting community well-being. **Novelty/Originality of this article:** Unlike studies that approach climate change from a broad regional perspective, this research emphasizes community-level resilience by integrating health, socio-economic, and environmental dimensions into the discourse of urban design and placemaking. The findings contribute context-specific strategies that bridge participatory planning, education, and technology with sustainable public space design to support low-carbon development and urban resilience.

**KEYWORDS:** climate change adaptation; community resilience; flooding; quality of life; urbanization.

## 1. Introduction

Climate change is a condition characterized by shifting global climate patterns, resulting in unpredictable weather phenomena. It occurs due to continuous changes in climate variables, such as air temperature and rainfall, over an extended period ranging from 50 to 100 years (KLHK, 2004). Climate change is also influenced by unstable weather conditions, such as irregular rainfall, frequent storms, extreme temperatures, and drastic changes in wind direction (Hidayati & Suryanto, 2015).

One of the main indicators of climate change is the change in average temperature within a region, which provides insights into how weather and climate patterns have shifted over time. Understanding temperature trends in a particular area offers valuable information on the impacts of climate change and supports better planning and decision-making. Figure 1 presents the average temperature in Indonesia from 2011 to 2020, based

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on data from BPS (2022). The blue line on the graph illustrates the annual fluctuations in actual temperature during this period. A significant temperature increase is observed from 2011, peaking in 2016, followed by a decline in 2017 and a subsequent rise approaching 2020. On the other hand, the red horizontal line represents the average temperature throughout the 2011–2020 period, which remains relatively stable at around 26.08 degrees Celsius. The dashed line indicates a linear temperature trend, suggesting an overall increase in temperature despite fluctuations over the 10-year period.

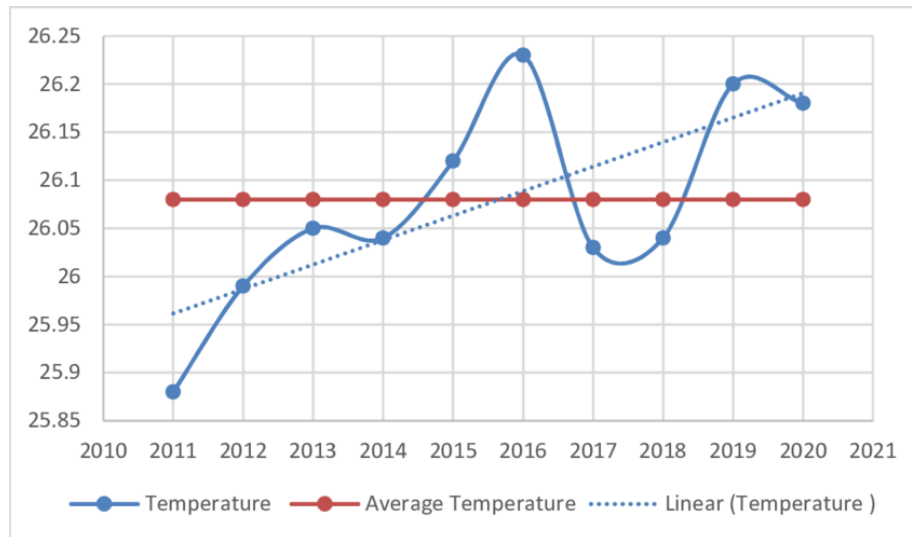


Fig. 1. Average temperature in Indonesia during the 2011–2020 period (BPS, 2022)

Climate change has become an urgent global challenge. The rising Earth's temperature, increasing intensity of extreme weather events, rising sea levels, and threats to ecosystems demand immediate action. Global warming is an increasingly severe and concerning phenomenon within the current context of climate change. The continuous rise in global average temperatures has significantly altered weather patterns and the environmental landscape. One of its major consequences is the increased intensity of extreme weather events, including heatwaves, floods, and more severe storms (Abduh & Siregar, 2024). The impacts of climate change are not limited to the physical environment; they also pose threats to food security, public health, economic stability, and social well-being.

Quality of life is a multidimensional concept that reflects the level of well-being of an individual or group across various aspects of life. In general, quality of life encompasses physical, psychological, social, and environmental dimensions that are interconnected. According to the World Health Organization (WHO), quality of life is defined as an individual's perception of their position in life, influenced by culture, values, goals, expectations, standards, and concerns (WHO, 1996). In other words, quality of life is a subjective measure that reflects how a person evaluates their overall life experience. In other words, quality of life is a subjective measure that reflects how a person evaluates their overall life experience. In the physical dimension, quality of life includes aspects of health such as physical fitness, absence of chronic diseases, and the ability to perform daily activities. The psychological dimension involves mental and emotional well-being, including levels of stress, life satisfaction, and feelings of happiness (Lopez & Snyder, 2004). Meanwhile, the social dimension includes interpersonal relationships, social support, and participation in community life. The environmental dimension comprises external factors such as access to basic resources (clean water and energy), housing conditions, environmental safety, and the quality of air and water.

Quality of life is often used as an indicator to assess the success of regional development or the effectiveness of public policies. In the context of social research and public health, quality of life is considered one of the key variables that can provide a holistic picture of

community well-being (Urifah, 2012). Factors such as educational attainment, economic income, access to healthcare services, and physical environmental conditions can influence a person's quality of life both directly and indirectly (Cruz et al., 2009). However, quality of life is not only shaped by internal factors such as an individual's health or social relationships, but also by broader external factors such as global environmental changes. For instance, climate change has been identified as one of the major threats to quality of life worldwide. Shifts in extreme weather patterns can affect individuals' physical and mental health and disrupt the economic and social stability of communities.

Table 1. Climate change risks to urban areas by 2050

| Risk Factors                      | Estimated number of people affected (million) | Estimated number of cities affected (cities) |
|-----------------------------------|-----------------------------------------------|----------------------------------------------|
| Extreme heat waves                | 1,600                                         | 970                                          |
| Poverty                           | 215                                           | 490                                          |
| Water resource scarcity           | 650                                           | 500                                          |
| Food supply limitations           | 2,500                                         | 1,600                                        |
| Submergence due to sea level rise | 800                                           | 570                                          |
| Electricity resource scarcity     | 450                                           | 230                                          |

(World Economic Forum, 2022)

The data above illustrates the serious threats to the quality of life in urban communities in the future. The projected impacts directly affect various aspects that shape quality of life, ranging from health and economic well-being to access to basic resources. Food shortages, identified as the most prominent risk, threaten urban food security. This condition can trigger malnutrition, hunger, and social instability, all of which significantly reduce quality of life. Extreme heat also poses a direct risk to health by increasing the likelihood of heat stroke, dehydration, and respiratory illnesses particularly among vulnerable groups such as children, the elderly, and individuals with chronic illnesses.

Sea level rise threatens housing and infrastructure in coastal areas, forcing communities to relocate and lose their livelihoods. It can also lead to environmental degradation and the loss of local cultures. Water resource scarcity, on the other hand, limits access to clean water for household, industrial, and agricultural use affecting health, sanitation, and economic sustainability. The increase in poverty driven by climate change can exacerbate social and economic inequalities, reducing access to education, healthcare services, and decent employment. This creates a vicious cycle in which poverty heightens vulnerability to the impacts of climate change, which in turn further worsens poverty conditions. The graph underscores the urgent need for immediate and coordinated action to reduce climate change risks and protect the quality of life in future urban communities.

In Indonesia, the impacts of climate change are very real and affect the quality of life, especially in urban areas such as Jakarta. As the capital city, Jakarta faces various environmental problems worsened by climate change, such as annual flooding, rising temperatures, and deteriorating air quality. Salemba, a densely populated area in Central Jakarta, is one of the most vulnerable regions to the impacts of climate change. With high levels of urbanization and limited green open spaces, Salemba faces serious environmental challenges. Flooding is a major issue in this area due to poor drainage systems and the high intensity of rainfall during the rainy season. Furthermore, the rising air temperature in the urban area creates discomfort for the people of Salemba, particularly for vulnerable groups such as children and the elderly. The densely populated environment also worsens the air quality in this area, increasing the risk of respiratory diseases and other infectious diseases. Another issue faced by the people of Salemba is limited access to clean water during the dry season. Changes in rainfall patterns have caused droughts in several parts of Jakarta, including Salemba, forcing the community to rely on external water supplies. Additionally, frequent flooding contaminates clean water sources and damages local infrastructure, further decreasing the overall quality of life. While the people of Salemba are aware of climate change and its impacts on their daily lives, adaptation measures are still limited. The lack of education on how to adapt to climate change and the insufficient government

support in providing concrete solutions are major barriers to enhancing the community's resilience to climate change impacts.

The impact of climate change on public health in Salemba is significant. The increase in air temperature can cause heat stress, particularly for vulnerable groups such as children and the elderly (WHO, 2020). Changes in extreme rainfall patterns create water stagnation, which becomes a breeding ground for mosquitoes that transmit diseases like dengue fever. Data from the Jakarta Health Office (2022) show that cases of dengue fever in Jakarta significantly increased during prolonged rainy seasons. Additionally, environmental sanitation conditions become a serious issue due to frequent flooding. Flooding not only damages infrastructure but also contaminates clean water sources used by the community. Balogun et al. (2020) and Petzold et al. (2020) indicate that communities in flood-prone areas face an increased risk of respiratory infections due to air pollution and poor sanitation.

Adaptation becomes a key strategy to reduce vulnerability and enhance community resilience to climate change. Adaptation is defined as the adjustment in natural or human systems in response to actual or expected climate stimuli or their impacts, which reduces harm or takes advantage of beneficial opportunities. Maintaining functioning ecosystems, providing ecosystem services, and ensuring healthy human populations in the future will require adaptation strategies. Adaptation strategies are actions that help human and natural systems accommodate change (Lawler et al., 2013). Adaptation strategies can be reactive or anticipatory and can be implemented at various scales, from individual to national levels.

Addressing these challenges requires effective adaptation and mitigation strategies. Adaptation efforts can be carried out through the development of disaster-resilient infrastructure, such as better drainage systems, and increasing green spaces to reduce flood risks (Bappenas, 2023). In addition, public education on disaster risk management is essential to raise awareness and encourage active participation in mitigation efforts. On the other hand, mitigation is necessary to reduce greenhouse gas emissions, the primary cause of climate change. Local governments can promote the use of renewable energy and strengthen regulations related to waste management and air pollution.

Based on this background, this study aims to analyze the impact of climate change on the quality of life of the community in Salemba from various aspects such as health, socio-economic conditions, and the environment. This research will also identify the main challenges faced by the community due to climate change and provide recommendations for adaptation and mitigation policies to enhance community resilience to the impacts of climate change. By understanding the impacts of climate change comprehensively, this study is expected to make a positive contribution to sustainable development planning in Salemba and improve the quality of life of the local community.

## 2. Methods

This study employs a descriptive qualitative approach to explore the impacts of climate change on the quality of life of residents in Salemba, Jakarta. This approach is considered relevant for capturing a comprehensive understanding of how communities perceive and respond to climate change in their daily lives (Creswell & Poth, 2018). Rather than relying solely on numerical data, this method allows space for residents' narratives, contextual interpretations, and the social and environmental dynamics that cannot be fully captured through quantitative approaches.

In the context of climate change characterized by its complexity and multidimensionality the qualitative method helps uncover risk perceptions, firsthand experiences of extreme climate events, and local adaptation strategies that may be spontaneous or rooted in tradition (Leichenko & O'Brien, 2008). This in-depth exploration enables researchers to understand the structures of environmental injustice and the social barriers faced by residents, such as limited access to climate information and restricted participation in the formulation of adaptation policies (Adger et al., 2013).

Through in-depth interviews and participatory observation, this approach also reveals how cultural, social, economic, and political factors interact in shaping the adaptive capacity of urban communities. Ultimately, it offers a crucial contribution to bridging data-driven policy with the needs and voices of those most directly affected by climate change.

### 2.1 Research location

This research focuses on the Salemba area, located in the Senen District of Central Jakarta, Indonesia. Salemba is a densely populated area with a complex environmental landscape, making it an ideal location to analyze the impact of climate change on the quality of life of the community. As one of the major urban areas in Jakarta, Salemba faces various challenges due to climate change, including rising average temperatures, changing rainfall patterns, and increased intensity of extreme weather events such as floods and droughts.

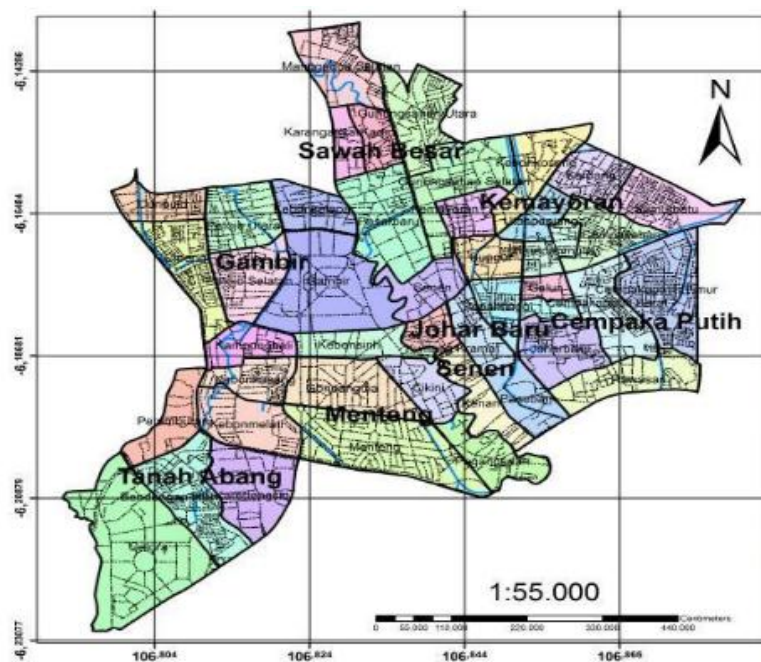


Fig. 2. Research location map

This area is also known for its high population density and lack of green open spaces, which exacerbate the impacts of climate change. The existing infrastructure is often inadequate to handle flooding issues, which are a major concern in the area during the rainy season. Additionally, Salemba has limited access to healthcare and adequate sanitation services, increasing the community's vulnerability to climate change-related diseases.

### 2.2 Methods of data collection

Data for this study were collected using three primary methods to obtain a comprehensive and valid understanding of the social and environmental conditions in the Salemba area. First, in-depth interviews were conducted with five Salemba residents, selected purposively based on their occupational and demographic backgrounds, including informal workers, housewives, and elderly individuals. This method aimed to explore their subjective perspectives and lived experiences related to the environmental and social conditions in the area (Kvale & Brinkmann, 2015). In-depth interviews enabled the researcher to obtain rich and nuanced qualitative data that are not easily accessible through quantitative surveys.

Second, participatory observation was conducted by recording the physical conditions of the surrounding environment, including drainage systems, garbage accumulation, water

puddles, as well as microclimate temperature measurements within the study area. This observation is essential for examining environmental factors that affect residents' quality of life and potential health risks (Gold, 2018). Participatory observation provides direct and contextual empirical data aligned with the phenomena being studied.

Table. 2. Research informants

| No | Name | Category         | Institution                  | Location |
|----|------|------------------|------------------------------|----------|
| 1  | N    | Housewife        | -                            | Salemba  |
| 2  | U    | Community Leader | Salemba Citizens Association | Salemba  |
| 3  | A    | Business Owner   | -                            | Salemba  |
| 4  | M    | Elderly Resident | -                            | Salemba  |
| 5  | A    | Health Worker    | Salemba Public Health Center | Salemba  |

Third, a documentation study was carried out by collecting secondary data from various official sources such as the Meteorology, Climatology, and Geophysics Agency/*Badan Meteorologi, Klimatologi, dan Geofisika* (BMKG), the Central Bureau of Statistics/*Badan Pusat Statistik* (BPS), reports from the Provincial Government of DKI Jakarta, as well as credible scientific journals and online media. The use of secondary data complements primary data and offers a contextual framework as well as validation for field findings (Bowen, 2009). The combination of these three methods is expected to provide a holistic understanding of the social interactions and environmental conditions in Salemba.

### 2.3 Methods of data analysis

Data analysis in this study was conducted thematically, following a systematic process to identify key patterns and themes from the collected qualitative data. The first stage involved verbatim transcription of interview recordings, converting all conversations into full text to ensure data accuracy (Braun & Clarke, 2006). Subsequently, a coding and categorization process was carried out to organize findings into several main themes relevant to the research focus, namely health, economy, environment, and adaptation. This thematic approach allows researchers to systematically organize data, facilitating clearer conclusions (Nowell et al., 2017).

Following this, field findings were elaborated by integrating secondary data and relevant theories such as the Theory of Planned Behavior (Ajzen, 1991), which explains factors influencing individuals' intentions and behaviors, and Community-Based Adaptation (Ensor & Berger, 2009), which emphasizes the role of communities in responding to environmental changes. The integration of these theories enriches data interpretation and provides a robust conceptual framework for analysis.

The final results were presented narratively, including direct quotations from informants as empirical evidence to strengthen the validity of findings. Additionally, data visualizations such as average temperature graphs, rainfall charts, and flood risk maps obtained from Meteorology, Climatology, and Geophysics Agency and the Regional Development Planning Agency (*Bappeda/Badan Perencanaan Pembangunan Daerah*) of DKI Jakarta were used to provide clearer insights into the environmental conditions underpinning community adaptation behaviors (Braun & Clarke, 2019).

This study also applied data triangulation to enhance the validity and reliability of findings. Triangulation was performed by comparing and integrating multiple data sources, including in-depth interviews, participatory observations, and documentation studies (Flick, 2018). This approach aims to reduce subjective bias from any single data source and ensure that the results reflect a more comprehensive and accurate reality (Denzin, 1978). Through triangulation, primary data obtained from residents were supplemented and validated by secondary data from Meteorology, Climatology, and Geophysics Agency and the Central Bureau of Statistics, and other official reports, thus strengthening the analysis and its scientific accountability.

### 3. Results and Discussion

#### 3.1 General overview of the study area

Salemba Subdistrict is a densely populated area located in Senen District, Central Jakarta. Based on participatory observations conducted by the researcher during May-June 2025, this area exhibits environmental characteristics highly vulnerable to the impacts of climate change, such as recurring flooding, elevated microclimate temperatures, and limited green open spaces.

Salemba's drainage system remains suboptimal, exacerbating water stagnation during heavy rainfall events. Furthermore, the dense and cramped housing conditions impede water flow, frequently causing waterlogging that poses potential health hazards. During the dry season, residents face clean water shortages due to declining groundwater levels and a significant deterioration in well water quality.

Observations also revealed that the majority of residents live in semi-permanent houses with minimal ventilation, increasing heat exposure during extreme dry seasons. This situation is worsened by the low awareness among some residents regarding environmental sanitation and healthy living habits, despite a relatively high level of general knowledge about climate change.

#### 3.2 In-depth interview results

To gain a deep understanding of the experiences of Salemba residents in coping with climate change, in-depth interviews were conducted with five key informants from diverse backgrounds; a housewife, a community leader, a business owner, an elderly resident, and a health worker. The results of the interview are presented in Table 3.

Table 3. Interview results

| Informant            | Health                                                                                          | Socio-Economic                                                                     | Environment                                                            | Adaptation                                                        |
|----------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------|-------------------------------------------------------------------|
| N (Housewife)        | Children often experience health issues during the flood season, especially fever and diarrhea. | Family income decreases because her husband cannot work during floods.             | Lives near a river that frequently overflows during heavy rain.        | Participates in local neighborhood greening programs.             |
| U (Community Leader) | Residents are vulnerable to respiratory problems when extreme temperatures rise.                | Economic activities are disrupted as many small shops have to close during floods. | Drainage systems are clogged with garbage, worsening waterlogging.     | Established a flood alert post and local early warning system.    |
| A (Business Owner)   | Business operations are disrupted due to power outages during floods.                           | Business income drastically decreases due to reduced customer visits.              | Difficulty disposing of waste during floods causes waste accumulation. | Raises the position of goods and moves equipment to safer places. |
| M (Elderly)          | Elderly experience difficulty sleeping and shortness of breath during heat waves.               | Limited mobility restricts access to healthcare when the area is flooded.          | Slippery and muddy roads increase the risk of falls.                   | Temporarily relocates to neighbors' houses during severe floods.  |
| A (Health Worker)    | Increase in waterborne diseases                                                                 | Health center services are                                                         | Groundwater becomes murky                                              | Conducts community                                                |

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|                                                           |                                                     |                                           |                                                   |
|-----------------------------------------------------------|-----------------------------------------------------|-------------------------------------------|---------------------------------------------------|
| such as diarrhea and respiratory infections after floods. | disrupted as patients struggle to reach facilities. | and contaminated during the flood season. | education on hygiene and sanitation after floods. |
|-----------------------------------------------------------|-----------------------------------------------------|-------------------------------------------|---------------------------------------------------|

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As part of the qualitative approach, this study presents direct quotes from informants to strengthen the validity of field findings. Several narratives that emerged during the in-depth interviews illustrate the everyday realities faced by the people of Salemba in dealing with climate change.

*“When there’s heavy rain, my children often get fevers and diarrhea because the sewage water enters our house.”* (Informant, N—a housewife).

*“We built our own flood alert post and inform neighbors via WhatsApp groups. The government rarely shows up unless it’s a major flood.”* (Informant, U—a local community leader).

*“During long droughts, the well water smells bad and turns murky. It’s hard to cook, let alone bathe.”* (Informant, M—an elderly resident).

*“After floods, the number of patients coming to the community clinic increases significantly. Many suffer from diarrhea, skin diseases, and respiratory infections.”* (Informant, A—healthcare worker).

These quotes show that the impacts of climate change are not only experienced physically, but also affect the economic, social, and mental health aspects of the community. The interviews provide deep insights into local adaptation practices, such as elevating household furniture, building small embankments from sandbags, and relying on neighborhood social networks for small-scale disaster mitigation.

### 3.3 Impacts of climate change on the quality of life

#### 3.3.1 Impacts on public health

One of the main findings of this study is the impact of climate change on public health in Salemba Urban Village. Based on in-depth interviews with vulnerable groups, such as the elderly and housewives, it was found that the frequent flooding in the area directly correlates with an increase in environmentally-based diseases such as diarrhea, acute respiratory infections (ARI), and skin diseases. This was supported by field observations noting poor drainage systems and stagnant water in various residential areas.

*“After floods, the number of patients coming to the community clinic increases significantly. Many suffer from diarrhea, skin diseases, and respiratory infections.”* (Informant, A—healthcare worker).

Healthcare workers at the Salemba Community Health Center reported a significant increase in ARI and skin disease cases after flooding events. These findings align with the Jakarta Provincial Health Office report (2022), which shows a spike in waterborne diseases during the rainy season. The deteriorating quality of groundwater indicated by changes in color and odor suggests contamination of water sources, especially for households still relying on well water for daily consumption.

In addition, extreme temperatures during the dry season have caused physiological stress, particularly among the elderly. Some informants reported sleep disturbances and shortness of breath during heatwaves. This phenomenon is consistent with WHO (2020)



findings, which noted an increase in cases of heatstroke and cardiovascular problems in urban areas experiencing the urban heat island effect.

Elderly individuals are particularly vulnerable to extreme heat due to reduced thermoregulation capacity, underlying health conditions such as hypertension and respiratory disorders, and limited mobility (Kenny et al., 2010). In low-income urban areas like Salemba, many elderly residents live alone or with limited social support, making it harder for them to access healthcare or even ensure proper hydration and ventilation.

Some informants described simple survival strategies, such as bathing more frequently, using handheld fans, or staying in shaded communal areas during peak heat. However, these strategies are often insufficient, particularly during prolonged heatwaves. As Informant M, an elderly resident, noted:

*"During long dry seasons, the well water smells bad and becomes murky. Cooking becomes difficult, and it's even harder to bathe. I just stay on the porch with a wet towel."* (Informant, M).

These coping mechanisms illustrate the resilience of the elderly but also highlight their unmet needs. Without structural support such as accessible cooling centers, targeted public health messaging, and neighborhood monitoring the elderly remain disproportionately at risk during climate extremes.

Overall, health is the most tangible dimension of climate change impacts felt by the residents of Salemba. Limited access to sanitation facilities and clean water, exacerbated by high population density and poor drainage systems, increases residents' vulnerability to health risks. Although there is a relatively high awareness among residents regarding the link between extreme weather and health, household-based mitigation strategies remain scarce. This highlights the importance of community-based approaches and climate-responsive primary healthcare services, as proposed by Ensor & Berger (2009) through the Community-Based Adaptation (CBA) framework.

### 3.3.2 Impacts on social and economic conditions

Climate change not only affects public health but also has significant social and economic consequences, especially for low-income groups in dense areas such as Salemba. In-depth interviews revealed that frequent flooding disrupts residents' economic activities directly. All of small business, such as food stalls, repair shops, and service businesses, experience substantial revenue drops due to reduced customer access during floods. One informant, a home-based food vendor, reported a 50% drop in revenue over a week during flooding, as customers avoided the area and supply distribution was disrupted. Another informant, a mobile business owner, noted that reduced mobility and poor access during floods led to significant losses due to cancelled visits and damaged goods.

*"Business income drastically decreases because fewer people come to buy, and sometimes I have to move everything to higher ground."* (Informant, A—small business owner).

Similarly, a community leader observed that small neighborhood stores had to shut down entirely during flood events, cutting off a major source of daily income for many households.

*"Many shops can't open during floods. Even if they try, customers don't come. We're forced to rely on savings, if any."* (Informant, U – community leader).

These accounts highlight the widespread economic disruption experienced by urban micro-entrepreneurs, from household vendors to local shopkeepers, illustrating how floods undermine both income stability and service continuity across different livelihood types.

Economic impacts were also felt through damage to productive assets, such as business equipment, inventory, and motorcycles submerged by floodwaters. On the other hand, living costs increased as residents had to purchase bottled water, repair damaged household appliances, and pay for post-flood healthcare. These conditions further strained the limited financial capacity of poor households and increased their economic vulnerability to climate shocks.

Socially, observations and interviews indicated that climate change weakens social networks due to disruptions in outdoor activities. Minor conflicts among residents regarding the use of shared facilities, such as water pumps and drainage channels, increased during water crises and floods. This phenomenon affirms that climate impacts also weaken social cohesion, especially in the absence of adequate institutional interventions.

These findings are consistent with global literature indicating that urban household-level economic impacts of climate change are multilayered, including direct and indirect losses, and create a cycle of vulnerability that is difficult to break without structural intervention (Cruz et al., 2009; Salimi & Al-Ghamdi, 2020). In the framework of the Theory of Planned Behavior (Ajzen, 1991), residents' decisions to take mitigation actions such as saving or insuring assets are not merely driven by intention but also by economic and institutional constraints that limit their perceived behavioral control.

Breaking this cycle of vulnerability thus requires community-based economic adaptation strategies, including climate-resilient livelihood training, access to green microfinance, and protection of residents' productive assets through CSR or community-based insurance schemes.

### *3.3.3 Impacts on the physical environment and infrastructure*

The most visible impact of climate change in Salemba is the degradation of the physical environment. Field observations revealed inadequate drainage systems, with channels clogged by household waste and market debris. These conditions worsen flooding while also deteriorating air quality and creating foul odors during the rainy season.

The reduction of green open spaces in densely populated areas has decreased the ability of the soil to absorb rainwater. Salimi & Al-Ghamdi (2020) emphasized that urban areas with low green space ratios tend to experience more intense urban heat island effects and higher flood intensities due to poor water infiltration. Microclimate data in Salemba shows daytime temperatures reaching 35–36°C, higher than Jakarta's average of 32–33°C (BPS, 2022).

Environmental degradation also affects groundwater quality. Some household wells have shown signs of contamination, such as murky color and foul smell after floods. Zeigermann et al. (2023) reported an increase in groundwater pollution in urban areas during the rainy season due to runoff from domestic waste.

Several residents admitted to being “accustomed” to these conditions, indicating a phenomenon of risk normalization or a psychological acceptance of environmental hazards as a routine part of life. This normalization can be understood as a coping mechanism in high-risk urban environments, where repeated exposure to floods, heatwaves, or poor sanitation leads individuals to downplay or internalize the risks (Grothmann & Patt, 2005).

While this attitude may serve as a short-term mental buffer against chronic environmental stress, it becomes problematic when it diminishes the perceived urgency to take proactive adaptation measures. Residents who normalize risk are less likely to engage in disaster preparedness, demand infrastructure improvements, or participate in collective action (Paton, 2003). Instead, they may resign themselves to “just getting by,” relying on temporary, individual coping strategies such as moving furniture during floods or using makeshift cooling during heatwaves.

This behavior was reflected in statements like, “We’re used to it, every year it floods, so we just lift everything and wait for the water to go down.” Such responses reflect an adaptive stagnation where survival strategies are maintained, but transformational change or political engagement is avoided. The implication is clear: while risk normalization may

help individuals function in unstable conditions, it ultimately undermines community resilience by fostering passive acceptance and weakening both individual and collective motivation for long-term adaptation or policy advocacy.

Structural and technological policy interventions are therefore urgently needed, including the revitalization of drainage channels, provision of integrated waste disposal facilities, and participatory restoration of green open spaces. Community involvement in maintaining environmental infrastructure must be strengthened through educational initiatives and social incentives, as suggested by Lawler et al. (2013).

### 3.3.4 Local adaptation strategies by the community

Despite facing various pressures from climate change, the residents of Salemba have demonstrated notable local adaptation initiatives. Some residents formed flood alert groups that actively assist with evacuation, provide emergency logistics, and clean drainage systems at the neighborhood level. These initiatives are typically led by community leaders or neighborhood association (RW) heads with social influence and strong community ties.

*"We built our own flood alert post and inform neighbors via WhatsApp groups. The government rarely shows up unless it's a major flood."* (Informant, U—a local community leader).

At the household level, simple yet effective adaptations have been made, such as raising furniture above flood levels, building small embankments, and storing emergency supplies. These actions reflect adaptive capacities that have emerged organically through repeated experiences of climate-related disasters. However, most of these strategies remain reactive and lack systematic planning.

From an institutional perspective, there have been few structured efforts by local government to involve residents in the formulation of Local Climate Change Adaptation Action Plans/*Rencana Aksi Daerah Adaptasi Perubahan Iklim* (RAD-API). Most residents reported never being involved in public consultations or climate risk mitigation training, indicating a disconnect between governmental planning and community realities.

These findings underscore the importance of the Community-Based Adaptation (CBA) approach (Ensor & Berger, 2009), which emphasizes the effectiveness of adaptation rooted in local knowledge, active community participation, and community ownership of programs. The grassroots initiatives seen in Salemba have great potential to evolve into urban adaptation models if adequately supported by policy and resources.

### 3.4 Theoretical discussion and policy implications

Based on the thematic analysis above, it can be concluded that the vulnerability of Salemba residents to climate change is not solely caused by natural factors, but also by social, economic, and institutional dimensions. While residents possess a fair level of awareness regarding climate risks, limitations in resources and weak policy support have created a gap between awareness and action. This aligns with the Theory of Planned Behavior (Ajzen, 1991), which posits that intention alone is not sufficient to drive adaptive behavior if individuals feel they lack control over their circumstances.

Figure 3 systematically illustrates how climate change triggers a series of impacts across various aspects of urban life, particularly in vulnerable areas such as Salemba, Jakarta. The diagram presents the causal relationships between climate change and four main categories of impact: flooding and extreme heat, environmental degradation, economic stress, and public health disruptions. Although arranged in a linear sequence, these elements are interrelated within a vulnerability cycle that collectively diminishes residents quality of life.

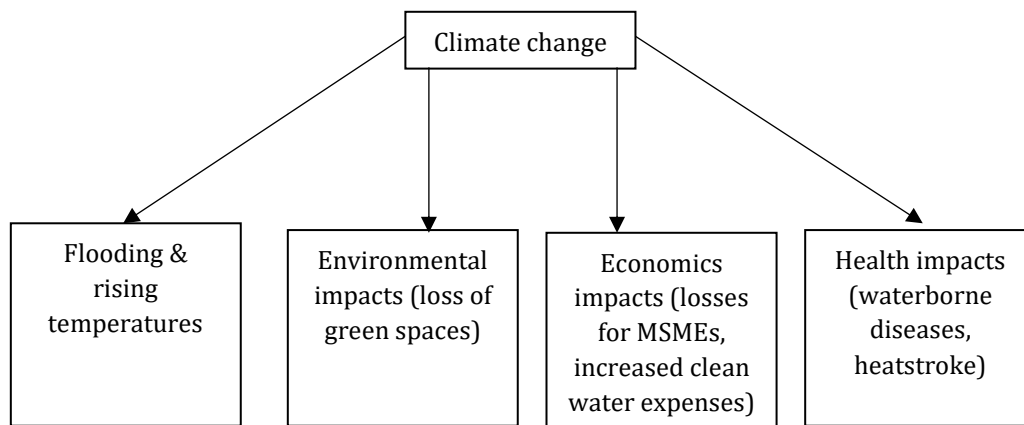


Fig. 3. Flowchart of climate change impacts on health, economy, and environment

In this context, climate change is understood as a condition marked by rising average temperatures and increasingly unpredictable weather patterns that directly affect both social and ecological systems. This phenomenon has become a tangible reality in the daily lives of Salemba residents, with seasonal flooding becoming more severe, rainfall occurring in high intensity over short durations, and daytime temperatures exceeding 35°C. In this study, field observations noted that high microclimate temperatures and poor drainage systems have rendered the area increasingly susceptible to climate-related disasters. These conditions not only reflect physical environmental degradation but also impose psychosocial pressure on communities that live in a constant state of alertness.

One of the most visible impacts of climate change is the intensification of flooding and extreme heat. These two phenomena cause damage to infrastructure, housing, and public spaces, while simultaneously disrupting residents' economic and social activities. Flooding in Salemba routinely leads to water accumulation on major roads, impeding mobility, damaging personal belongings and small businesses, and worsening sanitation conditions. Meanwhile, extreme temperatures affect thermal comfort, especially among vulnerable groups such as the elderly and young children, who have shown increasing symptoms of heat exhaustion and sleep disturbances. These findings are consistent with WHO (2020), which links extreme heat to higher risks of heatstroke and cardiovascular diseases, particularly in urban areas experiencing the urban heat island effect.

Furthermore, flooding and high temperatures accelerate environmental degradation, particularly through the loss of green open spaces and contamination of groundwater. These conditions are exacerbated by community habits of indiscriminate waste disposal, due to the lack of waste management infrastructure during disasters. The accumulation of household waste worsens drainage system damage and creates unhealthy living environments. Environmental quality decline not only threatens ecological sustainability but also weakens community resilience to future climate risks. According to Salimi & Al-Ghamdi (2020), urban areas undergoing ecological degradation tend to have lower adaptive capacity and higher poverty rates, creating mutually reinforcing vulnerability cycles.

Economically, climate change places significant pressure on small business operators and low-income households. During floods, many small business are forced to suspend operations due to limited access and decreased demand. Merchandise gets damaged, logistics distribution is disrupted, and post-disaster recovery costs strain household budgets. In addition, high temperatures increase household energy consumption for cooling and elevate clean water needs, which are often inadequately met during dry seasons. All of these factors lead to higher household expenditures, reduced productivity, and long-term economic instability. From the perspective of environmental economics, these burdens constitute externalities costs not borne by policymakers or corporations, but by poor communities with the least adaptive capacity (Cruz et al., 2009).

On the other hand, the public health impacts of climate change are also of serious concern. Flooding degrades water quality and triggers outbreaks of waterborne diseases

such as diarrhea, acute respiratory infections (ARI), and skin diseases. Information from local health workers indicates a significant increase in patients seeking treatment at community health centers after floods. However, residents' access to healthcare services becomes more difficult due to waterlogged roads and damaged infrastructure. Moreover, extreme heat exacerbates existing health conditions, particularly among those with chronic illnesses such as asthma, hypertension, and heart disease. The health threat is not merely physical but also psychological. Unpredictable weather, fear of flooding, and post-disaster economic stress lead to heightened levels of household stress, which in the long run may contribute to anxiety disorders and declining mental health, as noted by WHO (2020) and Schlosberg & Collins (2014).

What must be emphasized from this diagram is the close interconnection between all these impact categories. Flooding worsens environmental conditions; degraded environments aggravate health issues; deteriorating health reduces economic productivity; and economic stress ultimately impedes residents' adaptive capacities to future risks. This creates a vicious cycle that perpetually reinforces community vulnerability. In other words, climate change impacts are not merely linear, but systemic and interdependent. This is why climate change policies cannot be addressed in a sectoral manner, but must be integrated, cross-sectoral, and based on the needs and capacities of local communities.

Institutionally, the government's role in education, infrastructure facilitation, and community involvement in planning remains limited. Yet, community-based approaches have proven effective in strengthening local resilience in many vulnerable urban areas (Schlosberg & Collins, 2014). To respond to this challenge, reforms in local climate governance are required, including the integration of participatory approaches, green economic incentives, and the use of community-based information technology such as early warning applications or climate risk dashboards.

Furthermore, it is essential to ensure that vulnerable groups such as the elderly, women, informal workers, and business owner become the primary targets of adaptation and mitigation programs. Climate justice must be a key principle in every policy formulation, ensuring that low-carbon development benefits not only elite groups but also enhances the capacity of marginalized communities to face increasingly complex environmental crises.

#### 4. Conclusions

This study aims to understand the impact of climate change on the quality of life of urban communities. A descriptive qualitative approach, conducted through in-depth interviews, field observations, and document analysis, reveals that climate change has affected various aspects of residents lives including health, the economy, the environment, and the community's adaptive responses.

In terms of health, the community faces an increase in environmentally related illnesses such as diarrhea, acute respiratory infections (ARIs), and skin diseases due to poor sanitation following floods and exposure to extreme temperatures. The economic impact is also significant, especially for small business that suffer losses from damaged goods and decreased income during climate-related disasters. From an environmental perspective, densely populated areas with limited green open spaces such as Salemba are experiencing declining air and water quality as well as increased flood frequency. These issues are worsened by inadequate drainage systems and weak enforcement of environmental governance.

The adaptive responses demonstrated by residents show the potential of community capacity in formulating survival strategies. Initiatives such as flood preparedness groups, household-level improvements, and informal participation in environmental management reflect a collective awareness that has not yet been fully supported by government policies. The gap between residents' intentions and actions is largely due to limited resources, lack of access to information, and minimal involvement in policy-making processes. Using the Theory of Planned Behavior and Community-Based Adaptation approaches, this study

emphasizes the importance of adaptation policies that are inclusive, participatory, and rooted in local knowledge. Local governments need to shift from a top-down model to a collaborative model in building urban climate resilience, particularly in highly vulnerable areas such as Salemba.

This study also provides strategic recommendations, including strengthening green infrastructure and drainage systems, increasing climate literacy through public education, developing community-based early warning systems, providing green economic incentives for small business, and creating microfinance models for climate adaptation. Through a comprehensive and climate justice-oriented approach, Salemba is expected to become a model of sustainable urban climate resilience in the face of the global climate crisis.

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The author declare no conflict of interest.

### **Open Access**

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