

## INTEGRATION OF GENDER EQUALITY AND SOCIAL INCLUSION (GESI) IN PARTICIPATORY PLANNING OF INFORMAL SETTLEMENTS: CASE STUDY OF TAMMUA URBAN VILLAGE, MAKASSAR

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### ABSTRACT

*RT 002 RW 004, Tammua Urban Village in Makassar City is an informal settlement with the highest level of vulnerability, characterized by high population density, irregular building structures, limited access to clean water, sanitation, and open spaces, as well as overlapping land uses among residential, industrial, and transportation areas. This study evaluates the integration of Gender Equality and Social Inclusion (GESI) principles in the participatory planning of informal settlements through a review of the Tammua Community Settlement Environmental Planning (RPLP) document. Spatial analysis was used to identify correlations between housing density, building feasibility, and access to basic infrastructure with the distribution of vulnerable groups through a GESI lens. Results indicate that the RPLP has attempted to thematically mainstream GESI using the Analysis, Participation, Control, and Benefit (APKM) framework. Thematic maps reveal spatial correlations between housing density, building feasibility, and infrastructure access with the distribution of vulnerable groups. However, participation of vulnerable communities remains limited; housing density reaches 711.11 units/ha, 82 households lack access to clean water, and drainage infrastructure is damaged over 7,359 meters. Due to inadequate sanitation, most residents still rely on dug wells for bathing, washing, and defecation. The study concludes that the integration of GESI in participatory planning in Tammua needs improvement, particularly in substantially involving vulnerable groups, creating adaptive spatial designs, and equitably distributing infrastructure to realize adequate, resilient, and equitable urban housing conditions.*

**Keywords:** *Informal Settlements, Gender Equality, Social Inclusion, Vulnerable Groups, Urban Infrastructure*

## INTRODUCTION

Informal settlements are characterized by poverty, uncertain land ownership status, and illegal building status, established outside the formal process or synonymous with unplanned settlements (Soliman & Soliman, 2022). Informal land use characteristics show a proportion of mixed uses that cause the aggregation of urban space zoning. Preliminary studies have been conducted on informal settlements in Makassar City within the slum delineation of Sapiria Village. This location is dominated by migrants due to its strategic value close to the city's trade node and port area and is traversed by the reform toll road (Amalia, 2018). Informal land use characteristics show a proportion of mixed uses that lead to the aggregation of urban space zoning (Sawira & Rahman, 2018).

A preliminary study was conducted in an informal settlement in Makassar City within the slum delineation of Sapiria Village. This location was predominantly inhabited by migrants in 2018, due to its strategic value near the city's trade node and port area, as well as being adjacent to the reform toll road. The demand for housing among migrants, who often rent homes in the city center for proximity to their workplaces, has led to uncontrolled building development and the creation of slums. Sapiria Village is one of the settlements in Makassar City that is primarily populated by migrants, owing to its advantageous location on the waterfront of the Pannampu Canal, its proximity to the city's distribution service nodes, the availability of educational facilities, and easy access to Paotere Port and the Reformasi Toll Road. Sapiria Village, located in Lembo Village, is one of 103 slum areas in Makassar City, encompassing a slum area of 4.53 ha. The slum locations in Sapiria Village are situated in RW 002 and RW 005, which are categorized as moderate slums. This research aims to identify the slum characteristics of Sapiria Village from the perspective of residential buildings, including building irregularities, density of residential buildings, non-compliance with building technical requirements, and building legality.

The innovation in handling informal settlements implemented in Makassar City is through the national Neighborhood Slum Upgrading Program (KOTAKU) program, funded by a grant from the Department of Foreign Affairs and Trade (DFAT). The main objective of the KOTAKU-DFAT program is to improve access to basic infrastructure and services in urban slums to support the realization of livable, productive, and sustainable urban settlements. One of the pilot program locations with a lowland slum typology is Kelurahan Tammua. The Tammua informal settlement area is designated as a slum based on Slum Decree No. 1301/050.13 of 2021, covering 6 RW and 13 RT over an area of 15.29 hectares. The Tammua slum is located in the urban center and serves as a hub of socio-economic activities, crossed by the Reform Toll Road. The KOTAKU-DFAT program focuses on supporting the 2020-2024 National Medium-Term Development Plan (RPJM), which aims to promote livable, inclusive, and slum-free cities. In 2020, Indonesia faced the challenge of the COVID-19 pandemic, which significantly affected the social and economic lives of people in urban areas.

The 2030 Agenda for Sustainable Development (SDGs) emphasizes the importance of equal access for all, especially the poor and vulnerable, to economic

resources and basic services such as water, sanitation, energy, health, and education (UNDP Indonesia, 2025). This approach prioritizes community participation and public-private partnerships in urban regeneration. In Indonesia, the Gender Mainstreaming (PUG) policy, which began with Presidential Instruction No. 9 of 2000 and was integrated into the 2005-2025 and 2025-2045 RPJN, strengthens the government's commitment to gender equality in accordance with SDG 5. Research on the integration of gender equality and social inclusion (GESI) in participatory planning of informal settlements in Tammua Village, Makassar shows the application of this policy in practice. Evaluation of participatory programs at the planning stage is key to ensuring the involvement and protection of the rights of vulnerable groups, especially women, in urban development.

The concept of inclusivity is examined through participatory design practices in urban planning and architecture. Vainio provides a comprehensive review of the motivations and outcomes associated with participatory research in these fields, indicating that inclusive design practices can facilitate better community outcomes and help to overcome historical inequalities in urban development (Vainio, 2016). This sentiment is echoed by Chidya et al., who discuss the significance of user participation in designing sanitation facilities in Malawi, highlighting how participatory methods can bring about feasible and culturally appropriate solutions that resonate with local populations (Chidya et al., 2016). Challenges remain, as noted by Robertson and Simonsen, who analyze contemporary participatory design practices and highlight the necessity for effective facilitation to ensure that marginalized voices are not only heard but also valued within the design process (Robertson & Simonsen, 2012). Addressing usability issues in participatory activities, as discussed by Aditya, signifies the importance of creating accessible and engaging environments that promote active participation (Aditya, 2010).

Increased productivity and environmental sustainability across sectors can be achieved through the integration of Gender Equality and Social Inclusion (GESI) perspectives in project planning, budgeting, and implementation. By engaging with women, men, and other community groups, the Project Proponent can leverage their diverse perspectives to improve efficiency and achieve programmatic responsiveness. It is essential to ensure that the problems and needs contributed by various individuals and community groups are taken into account, highlighting the importance of emphasizing GESI in every phase of the project.

Addressing gender issues in Indonesia is crucial because the patriarchal culture is deeply rooted, and development processes and outputs are often gender-biased. Discrimination or injustice arises from differences in roles and functions between men and women. Forms of gender injustice include subordination, stereotyping or labeling, marginalization, the double burden, gender-based violence, and inequality. Gender is also relevant to social inclusion, as it is a key attribute. Social inclusion is a process that enhances abilities, opens opportunities, and restores the dignity of individuals or groups who were previously disadvantaged due to attributes or identities that hinder their active participation in society. These identity attributes include gender, disability, ethnic minority status, religion, socioeconomic status, and other specific identities.

Based on these considerations, the problem to be studied is how to innovate the practice of participatory design based on GESI in the regeneration of urban informal settlements dealing with lowland slum typology in Metropolitan City. The research objective is to formulate an innovative conceptual framework for the development of participatory design from the aspect of GESI in urban regeneration of urban informal settlements. This research focuses on cases and loci. The case study will take a sample of the KOTAKU-DFAT program handling intervention program in 2021, with a locus in the slum delineation of Tammua Village, Makassar City, while the case is focused on the implementation of the GESI-based participatory design concept in the planning phase of the slum upgrading program.

This research is important to test the effectiveness of the GESI approach in the KOTAKU-DFAT program to strengthen inclusive policies and achieve SDGs targets, especially in increasing the participation of vulnerable groups and creating equitable settlements in urban slums. This study critically examines the principles of GESI integration in slum planning in national programs, focusing on the participation of vulnerable groups and access to basic infrastructure at the planning stage in 2021, without involving post-implementation evaluation.

## **THEORY / RESEARCH METHODS**

Participatory planning approaches based on Gender Equality and Social Inclusion (GESI) are increasingly gaining recognition in community empowerment. Previous studies have shown that participatory approaches are particularly relevant in the context of structurally marginalized informal settlements.

### **Informal Settlement**

The prominent disparity between developed and developing countries, characterized by a gap between rich and poor nations, as well as between affluent formal districts and impoverished neighborhoods, including self-built cities born from individual initiative and cultural drive, has come to be referred to as informal settlements (Gouverneur, 2014). These settlements have haphazardly expanded into urban environments and are expected to multiply and transform into the dominant mode of urbanization, especially in developing countries. Gouverneur added that the rapid increase in population in urban centers, along with the financial and administrative inability to provide land, infrastructure services, and adequate housing for the poorest populations, has triggered informal settlement practices.

Bayat (1997) argued in a previous study that the formal city was established first, making informality an infiltration practice within the formal framework. He refers to it as the 'silent encroachment of the ordinary' within the formal gap. However, this does not mean that informality can be interpreted merely as another part of the formal city, nor is it easily identified with backwardness, illegality, or poverty. According to Roy (Roy, 2009a), informal practices in urban areas lead to informal urbanization, where elites and the urban poor encroach on land without clear property rights. The term 'urban informality' refers to a lack of governance and encompasses

the unregulated uses and activities of individuals in urban environments. Douglas (Douglas, 2016) highlighted the phenomenon of "informal activities" as a characteristic often found in urban areas. This phenomenon carries global implications, as noted by Turner (Turner, 1967), who stated that informal settlements in developing countries are a by-product of rapid urbanization driven by economic and political change, linked to industrialization and globalization.

Informal practices in establishing informal settlements and activities on the periphery of the city represent an integral part of the cities of the so-called Global South, in economic, social, environmental, and aesthetic terms. The informal is often invisible to the formal city perspective; even Shatkin (2004) suggested that the streets of informal settlements do not appear on maps. According to Shatkin, the relationship between formality and informality can be viewed historically as one in which informality precedes formality. Traditional villages and medieval towns had urban morphologies that were informally generated by micro-adaptations over time (Shatkin, 2004).

Informal settlements as urban micro-ecosystems are physical manifestations of poverty with substandard living conditions and irregular spatial distribution patterns, as well as security of tenure, disaster threats, high density, and poor drinking water and sanitation facilities (Chigbu & Onyebueke, 2021). Challenges in meeting the needs for clean water and sanitation for people in informal settlements, especially in terms of understanding health, accessibility, and potential services, exist (Kim et al., 2022). The study found that there was a large deviation, and during the pandemic, accessibility was limited, and they experienced barriers. This calls for urban policies in the water and sanitation sector to develop public health policies focused on the locations most in need. Informal settlements are the result of organic self-urbanization, growing without formal planning or regulatory compliance (Amalia & Ikaputra, 2024).

Social and functional mixed land use as a settlement spatial planning strategy will have implications for improving the quality, resilience, inclusion, economic, social, and environmental sustainability of urban areas (Iannillo & Fasolino, 2021). The objective of this approach is the coexistence of urban land uses and extracting the relationship between land uses and their opportunities and threats (Management, 2021). Built design dimensions with urban form diversity, such as variety, design, and density oriented for pedestrians from settlements to urban public spaces, should be considered (Cervero & Kockelman, 1997). In addition, another important aspect of accessibility is the satisfaction of clean water and sanitation services as an important utility for people living in informal settlements because it is highly correlated with meeting the needs and spatial diversity of the city, especially the density of buildings and population (Victor et al., 2022).

The diversity of urban form is determined by land use patterns, especially in informal settlements in the old city area, which are high density with road typology, connectivity between complex spaces, and rationality between open and built spaces following the wishes of residents (Arif et al., 2022). A good city has its own urbanity, which tends to be organized; urban culture grows in it, and there are activities and street life (Chigudu, 2021). Urban regeneration as an approach to handling informal settlements has implications for improving the quality and restoration of urban space,

community social harmonization, and stakeholder collaboration in development planning and implementation (Sucahyo & Pradoto, 2020).

Asset development, population density, concentration distribution patterns in some areas, growth movement from the center to the border, irregular buildings, damaged road settlements, far from public service centers, occupancy without Building Permit (IMB), and the fluctuating percentage of poor people are variables that influence the spatial diversity of slums (Adiputra et al., 2022). The limited economic ability to access informal settlements is a driver of community self-help to form informal settlements, so, in general, this expansion also forms a place for the informal sector to grow, but on the other hand, it also plays a role in reviving the city's economic sector. The existence of these informal settlements automatically causes a diversity of activities and socio-economic conditions as casual laborers, but on the other hand, they have resilience in living even though they live in a slum environment. This is due to the factors of length of stay, togetherness, social ties, and proximity to sources of livelihood.

## **Participatory Design**

The process participatory design begins with problem identification, decision-making, and development stages. Participatory design is rooted in democratic theory, which encourages traditional citizen action in public decision-making. It serves as an attitudinal force in creating and managing the environment and represents a movement not limited to specific professions, traditions, or cultures (Sanoff, 2010). A consistent socio-technical approach in the form of technology use practices to the activity process is important in participatory practices. This aligns with the statement (Routledge, 2013), that participatory design is defined as the process of initiating, fostering, and nurturing reciprocal learning among participants in collective reflection and action. Participants often take on the dual role of user and designer, where the user communicates the intended goal and the designer seeks to understand the right technology to achieve it.

According to Hamdan & Sumartinah (2021), the implementation of participatory design is divided into three stages: the exploration of design aspects, called the initial exploration of work stage; the identification of user priorities from both the designer's and user's perspectives, known as the discovery process stage; and the design of prototype products to accommodate user needs, referred to as the prototyping stage (Hamdan & Sumartinah, 2021). The participatory planning cycle, based on research findings by Budiyanto (2011) in the Community-Based Settlement Environmental Management program, includes the workshop preparation and program socialization stages, the community organizing stage, planning review and self-help mapping, determining the vision and mission and ideas of the village, preparing participatory planning documents, identifying priority areas, the physical development stage, and evaluation and monitoring (Budiyanto, 2011).

## Gender Equality and Social Inclusion (GESI)

Gender has been widely discussed in recent years, especially in the context of rural development. Increased awareness of gender inequality between men and women led to the emergence of this term and its use in society. In patriarchal families and societies, it includes the ability to make independent decisions and pursue careers. The concept of gender is crucial because, when applied to social analysis, it reveals how women's subordination (or men's dominance) is socially constructed, predetermined, and not forever fixed (UNESCO, 2012). GESI has become a role model in the struggle against social injustice and insecurity (Kertati, 2019). The GESI framework pays particular attention to gender equality and the involvement of marginalized groups, including women and persons with disabilities (Prasetyo et al., 2021).

Gender is becoming a more general term, and social inclusion is a natural extension of it. Individual integrity and independence are key assets to achieving an ideal quality of life through social inclusion. Gender equality does not seek to compete with men but rather to provide opportunities for women to access education, the economy, culture, and politics, so that women who are victims of discrimination and harassment can have a voice and receive protection from the state. Gender equality, according to Kompak (Community Collaboration and Services for Welfare) (2017-2018), an organization based on cooperation between Indonesia and Australia, means that women, men, children, and boys have equal rights and obligations, and that all needs and aspirations can be respected regardless of gender differences (Nelly, 2021).

Studies on slum improvement interventions in Kenya, Brazil, and Thailand uncovered critical gaps in the integration of Gender Equality and Social Inclusion into participatory planning (Yeboah et al., 2021). In Kenya and Brazil, interventions focused more on physical projects (road repairs, sanitation) without considering the diversity of needs of residents (women, disabilities, vulnerable economic groups). Thailand succeeds because upgrading projects are designed based on social mapping that identifies different needs, Thailand's success is influenced by national policies that require GESI analysis in urban programs (similar to PUGs in Indonesia).

One of the important steps in evaluating GESI in development programs implemented in communities is to conduct a situational analysis to identify women's groups, the poor, and marginalized and vulnerable individuals (International Development Partners Group, 2017). This analysis aims to understand the barriers they face as well as the capacity they have in accessing services and development opportunities.

Previous research on slums in Makassar has highlighted technical issues regarding the calculation of slum levels (Amalia & Fuadillah, 2024; Rudianto et al., 2024; Rumata et al., 2023) as well as strategies and implementation of structuring and improving the physical quality of slums (Harisun et al., 2019; Idris, 2019). In addition, research on the mechanism of community participation in overcoming the slums of their residential environment (Djodding, 2020).

In summary, literature underscores that understanding gender and its intersection with social inclusion is vital for promoting equity, reducing vulnerability, and ensuring that all individuals, particularly those from marginalized groups, have

the opportunity to participate fully in society. In 2022, around 1.1 billion people live in informal settlements with inadequate access to basic services and without certainty of land rights. This figure is expected to increase to more than 3 billion in the next 30 years (Mitlin & Weldeghebrael, 2025). Various structural vulnerabilities faced by urban dwellers, such as insecurity, financial exclusion, inadequate health services, and regional stigma encourage the creation of socially and gender-inclusive urban coalition efforts to strengthen the integration of GESI in participatory planning of urban settlements.

Informal settlements as a product of spontaneous urbanization that grow outside of formal regulation reflect the global inequality between developed and developing regions (Gouverneur, 2014). Its characteristics include high density, uncertainty of land rights, and limited access to basic infrastructure such as water and sanitation (Chigbu & Onyebueke, 2021; Kim et al., 2022). Although often considered "wild", these settlements have an organic spatial logic that is adaptive to the needs of residents (Arif et al., 2022), including a mix of land uses that support socio-economic resilience (Iannillo & Fasolino, 2021). Participatory design is key in the improvement of informal settlements, with community-based approaches such as collaborative planning cycles (Budiyanto, 2011) and user-involved design prototypes (Hamdan & Sumartinah, 2021). However, its effectiveness is often hampered by limited participation of vulnerable groups (women, the elderly, disabled) due to structural and cultural biases. The dominant literature addresses spatial aspects (density, infrastructure, and the informal sector, but rarely examines how vulnerable groups (women, the elderly, disabled) are involved in planning.

**Table 1.** Measures for Integrating GESI in Situational Analysis

| <b>Task/Activity</b>                                                                                                          | <b>Tools/Methods/Measures</b>                                                                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Identify groups who are excluded and vulnerable, along with the factors that contribute to their exclusion and vulnerability. | Utilize methods such as poverty mapping, well-being ranking, social mapping, vulnerability assessments, and other participatory tools to identify women, the poor, excluded and vulnerable groups, as well as the factors behind their exclusion and vulnerability. |
| Carry out an analysis of gender equality and social inclusion.                                                                | Determine key variables for the sector, then gather data on roles, resource access, decision-making authority, and inclusion or exclusion within relevant institutions.                                                                                             |
| Examine existing policies and programs.                                                                                       | Assess if current policies and programs address the barriers faced by women, the poor, the vulnerable, and the excluded; determine the extent of their effectiveness or identify gaps and needed actions                                                            |
| Evaluate current formal and informal institutional structures and processes                                                   | Assess which institutional structures and systems support GESI implementation, how staff diversity aligns with the served population, and the level of GESI competency and commitment among staff.                                                                  |

Sources: (International Development Partners Group, 2017)

The integration of GESI in participatory planning is needed to address this inequality. Situational analysis through vulnerability mapping (Table 1) and rights-based approaches (Roy, 2009b) can identify the specific needs of marginalized groups. For example, women in informal settlements often face the "double burden"



of water access and the risk of violence (McIlwaine, 2023), while disabilities are hindered by non-inclusive spatial designs.

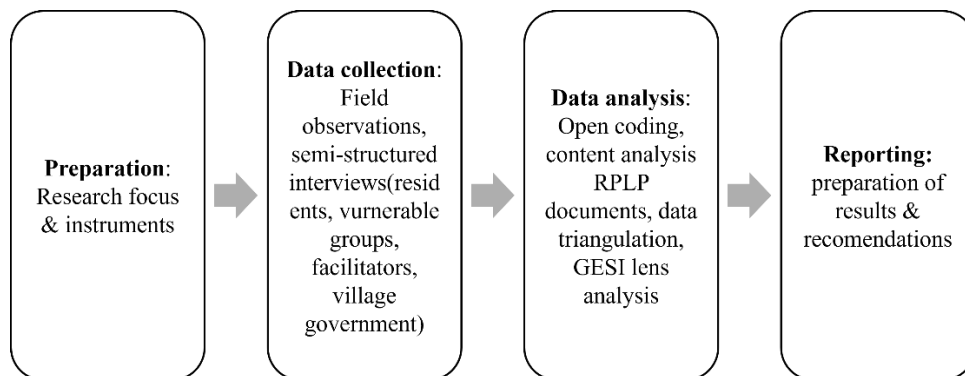
## RESEARCH METHODS

This research employs a qualitative approach aimed at gaining an in-depth understanding of participatory design innovation practices in the implementation of the Kotaku Program, supported by DFAT (Department of Foreign Affairs and Trade), in Tammua Urban Village, Makassar City. This approach was selected because it can portray social reality contextually and holistically, while also allowing for an exploration of the dynamics of interaction between actors, patterns of citizen participation, and the contributions of various parties in the community-based settlement planning process. Field data collection was conducted through direct observation, contextual data exploration, and semi-structured interviews using an open coding approach. This method facilitates a detailed narrative exploration of the perceptions, experiences, and meanings developed by key informants, including citizen representatives, vulnerable groups, program facilitators, municipal government officials, and planning consultants. The interviews are designed to capture collaborative dynamics, local forms of innovation, and adaptive strategies that emerge during the program implementation process.

In addition to the qualitative data, this study also employs a content analysis method on the Tammua Urban Village Settlement Environmental Planning Plan (RPLP) document. This document was prepared by the Community Self-Help Agency (BKM) in collaboration with the KOTAKU Program facilitator team as a result of a participatory planning process at the community level. Through content analysis, the researcher identified both formal and informal narratives within the document, focusing on spatial thematic maps, environmental planning schemes, and community capacity-strengthening strategies. The RPLP document is considered a policy artifact that not only contains a technical development plan but also reflects the social processes involved in formulating citizen-based policies. Therefore, analyzing this document significantly contributes to understanding how participatory design innovations are articulated in written planning and how local communities engage in the process.

This study combines observation, interview, and document analysis techniques to present a triangulation approach that aims to ensure the validity and depth of findings. Thus, the results of the research are expected to provide a comprehensive overview of participatory design innovation practices in the context of residential development in complex urban areas. The research design is presented in detail in

Figure 1 below.



**Figure 1.** Research Design

In this study, the technique of determining informants was carried out using purposive sampling and snowballing sampling methods. Details of the informant determination technique can be seen in Table 2 below.

**Table 2.** Informant Determination Techniques

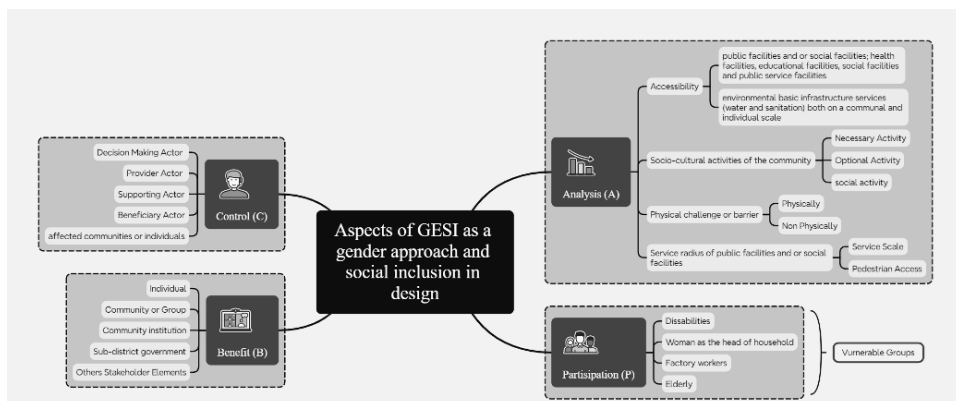
| <b>Informant Determination Techniques</b> | <b>Sum</b> | <b>Gender Details</b>                                                                                                  | <b>Age Details</b>                  | <b>Disability Details</b>                                 |
|-------------------------------------------|------------|------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-----------------------------------------------------------|
| Purposive sampling                        | 20 peoples | Male and female representatives of citizens, including heads of households, elderly women, and other vulnerable groups | Adults to seniors (18-78 years old) | Including people with disabilities (12 people identified) |
| Snowballing sampling                      | 6 peoples  | Members of the Community Self-Help Agency, the Village Participatory Planning Core Team, and the Village Facilitator   | -                                   | -                                                         |

Next, the following are profiles of vulnerable group informants that are the focus of the research:

**Table 3.** Profile of Vulnerable Group informants

| Number | Vulnerable Groups     | Informant Background                                                                   | Livelihood                                                                                                          |
|--------|-----------------------|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| 1      | Former factory worker | Experiencing layoffs during the covid 19 pandemic                                      | The previous profession was factory laborer; His wife works as a school motorcycle taxi driver                      |
| 2      | Elderly & disabled    | Age 69 and 10                                                                          | The previous profession was factory laborer; The current profession is a home business, namely a mixed goods trader |
| 3      | Elderly female        | Age 78, widow without children                                                         | Plastic waste collector                                                                                             |
| 4      | Woman                 | No description                                                                         | Garbage recycling craftsmen and pastry makers                                                                       |
| 5      | Woman                 | Aged 58 years, Supporting and caring for his disabled sister                           | Tailor                                                                                                              |
| 6      | Autis                 | High school equivalent age, school dropout to elementary school, rental housing status | Helping his mother sell at home                                                                                     |

In this study, the GESI analysis lens was used to encode and interpret the data with a focus on the relevant dimensions. Based on the results of the analysis, a GESI-based participatory planning concept framework was formulated as an innovation in participatory planning of informal settlements with slum typologies in Tammua Village. The framework of this concept can be seen in Figure 2 below.

**Figure 2.** GESI Aspects Conceptual Framework as a gender approach and social inclusion in informal settlement planning in Tammua Village Slum Area

## RESULTS AND DISCUSSION

### Overview of Tammua Village

Tammua Village is one of the most densely populated areas located in Tallo District, Makassar City. This area is situated in a lowland region and is geographically bordered by several other villages: Rappokalling Village to the north, North Karuwisi Village to the south, Pampang Village to the east, and Rappojawa Village to the west. On the eastern side, the area is crossed by the Reformasi Toll Road, which serves as an important physical boundary. Land use in this area is dominated by settlements, which occupy 17.58 hectares, or about 47.01% of the total area. The remaining land is utilized for various other functions, such as industrial activities (including factory areas) and educational facilities, reflecting a mixed-use urban environment.

According to the Tammua Village Settlement Environmental Planning Plan (RPLP) document from the KOTAKU Program, the number of vulnerable groups is distributed across each administrative area, as detailed in Table 1. In 2021, the population of Tammua Village was recorded at 8,626 people, consisting of 4,251 males and 4,375 females. Administratively, the area is divided into six Neighborhood Units (RW), each containing several Neighborhood Groups (RT) of varying sizes. The details are as follows: RW 01 covers an area of 5.8 hectares (18.34%) with 5 RTs; RW 02 covers 2.81 hectares (8.89%) with 4 RTs; RW 03 covers 5.83 hectares (18.44%) with 5 RTs; RW 04 is the largest, encompassing 8 hectares (25.30%) and has 4 RTs; RW 05 covers 4.92 hectares (13.47%) with 5 RTs; and RW 06 has an area of 4.26 hectares (13.47%) with 4 RTs. The total area of Tammua Village is 31.62 hectares. Land use in this area is dominated by settlements, which occupy approximately 17.58 hectares, or about 47.01% of the total area. The remaining land is used for various other functions, such as industrial activities including factory areas, and educational facilities, reflecting a mixed-use urban environment.

### Tammua Informal Settlement Typology

#### Typology of Building Condition

Based on Mayor's Decree Number 1301/050.13 of 2021, the informal settlement area in Tammua includes six Neighborhood Units (RW) and 27 Neighborhood Units (RT), with slum areas spread across 13 RTs covering an area of 15.29 hectares or around 48 percent of the total area. This slum area is at the center of social and economic activity, including some areas under the toll road. The population in the slums consists of 2,081 men and 2,190 women, which is half of the total population of Tammua Urban Village living in the area.

The pattern of settlements in Tammua is generally linear following the layout of the road. However, the irregularities of the buildings are quite striking, where many houses do not face the road and are blocked by other buildings. In addition, there are still many residential units that do not meet technical standards as livable houses.

**Table 4.** Residential Building Condition of Tammua Slum Informal Settlement

| No | Criteria                                                         | Volume | Unit          |
|----|------------------------------------------------------------------|--------|---------------|
| 1  | Building regularity                                              | 188    | unit          |
| 2  | Building density                                                 | 711,11 | Units/Hectare |
| 3  | The number of buildings does not meet the technical requirements | 273    | unit          |

Source: Tammua Urban Village Settlement Environmental Planning Plan Document, 2021

Table 4 data shows the condition of slums in the Tammua Slum Area, with 188 units of irregular buildings, very high building density reaching 711.11 units per hectare, and 273 units of buildings that do not technically meet the requirements. These conditions not only reflect physical and spatial problems, but also reflect complex social vulnerabilities, particularly for marginalized groups such as women, children, the elderly, and people with disabilities. From GESI's perspective, this condition indicates unequal access to space and a lack of security guarantees for these vulnerable groups. High density limits room for improvement, increases the risk of gender-based violence, and worsens access to basic amenities such as safe sanitation and women-friendly public spaces.

Figure 3 shows the morphology of slums based on the administrative boundaries of RW. From the map, RW 04 has the largest slum area covering RT 01 to RT 04 with an area of about 6 hectares. Other RWs such as RW 03, RW 06, RW 01, RW 02, and RW 05 also have slum areas with varying areas, indicating that the slums in Tammua are widespread and involve existing RW structures.

The morphology of these slums is divided into two main clusters that are separated longitudinally by the Reformasi Toll Road. On the west side of the toll road, slums are concentrated in RW 03, RW 04, and RW 05 with a very high level of building density and unplanned settlement growth. Meanwhile, on the east side of the toll road, slums are located in RW 01 and RW 02 with similar physical characteristics, namely irregular building layouts and limited road access.

The supporting photographs in

Figure 3 depict the physical conditions of the environment which indicates: buildings with low feasibility conditions, made of mixed materials such as wood and zinc; the irregular layout of the building so that many houses do not face the street, leading to narrow hallways that are difficult to access as well as a lack of lighting and air circulation; As well as the condition of the surrounding roads, most of which have not been paved with open drainage channels that do not function optimally, have the potential to become a source of flooding and disease.



**Figure 3.** Morphology Slum Delineation Map of Tammua Urban Village  
Source: KOTAKU-DFAT FGD Results Tammua Urban Village (2021) & Field Observation (2023)

Overall, the morphology of slums in Tammua Urban Village is very complex, with a typology fragmented by large infrastructure boundaries such as toll roads, as well as wide spatial distribution. Settlements develop organically without formal structured spatial planning, creating a network of narrow, irregular roads, and difficult to access by motorized vehicles. This uninhabitable environmental condition presents a major challenge in terms of building feasibility, sanitation, and spatial order that must be overcome in efforts to organize informal settlements in this area.

### Typology of Neighborhood Road Condition

Tammua area consists of three main types of roads: arterial roads in the form of toll roads crossing the area, local roads connecting Tammua with surrounding villages, and neighborhood roads within the *kelurahan*. Although most roads have been paved with paving blocks, some sections are damaged. The condition of neighborhood roads varies widely, ranging from fairly wide but unpaved gravel roads to narrow alleys only passable by pedestrians and motorcycles. Many neighborhood roads lack sidewalks, covered drainage, and adequate lighting. The irregular and dense building layout further complicates accessibility, especially for vulnerable groups. These

conditions reflect the unstructured morphology of the slum area, with narrow and uneven neighborhood roads.



**Figure 4.** Typology of Road Conditions in Slum Settlements in Tammua Urban Village  
Source: KOTAKU-DFAT FGD Results of Tammua Urban Village (2021) & Field Observation (2023)

The condition of environmental roads in slums varies greatly. Figure 4.1 shows a fairly wide environmental road but has not been paved and is only gravel. This road is also not equipped with adequate closed drainage channels, so it is at risk of flooding and environmental degradation, especially during the rainy season. Figure 4.2 shows a narrow passage between the houses built from impermanent materials such as wood, zinc, and plywood. This lane has no sidewalks, clear drainage, or sufficient natural lighting, so it can only be passed by pedestrians and motorcycles. This condition reflects high density and limited circulation space. Figure 4.3 depicts a small alley that is only enough for one person to walk through. The houses in this alley are very tight with no setback boundaries between buildings and roads, with the rest of the space being used for daily activities. This shows the irregularity of the orientation of the building towards the road network.

Figure 4.4 shows a more open and slightly more organized environmental space. The road surface has been hardened and there is space for residents' activities. However, no spatial planning elements such as closed drainage or green lanes were found, indicating that repair efforts have not been thorough.

Figure 4 reinforces the characteristics of the Tammua slum which has an irregular morphology, where the orientation of the buildings does not follow the direction of the road and the narrow and non-uniform neighborhood roads. The disparity in infrastructure quality between RTs is also evident from the visual documentation, which shows disparities in the condition of roads and their supporting facilities. The diverse environmental road conditions that have largely not met basic infrastructure standards pose a major challenge to the accessibility and mobility of citizens, especially vulnerable groups such as women, the elderly, and people with disabilities. Narrow and irregular roads limit movement space and increase safety risks. The lack of closed drainage and other supporting facilities also increases the risk of flooding and deterioration in environmental quality. Inequality in the quality of infrastructure between regions adds complexity to efforts to improve evenly and sustainably.

### **Typology of Neighborhood Drainage Conditions**

The drainage system in the Tammua slum is in very poor condition. Drainage channels are clogged with sediment and garbage and suffer structural damage such as collapsed walls. The drainage capacity is insufficient to handle runoff given the high settlement density. Household wastewater channels merge with drainage channels, potentially polluting the environment and posing health risks. Visual documentation at several locations reveals open drainage without covers, channels partially blocked by buildings and vehicles, and severely damaged channels that hinder maintenance. Out of a total of 8,807 meters of drainage channels, 7,359 meters (83.5%) are damaged, indicating a very high level of deterioration and presenting a significant challenge for environmental management.

Figure 5 presents a thematic map of drainage conditions across six Neighborhood Units (RW) in the Tammua slum. Visual documentation was taken at four points in RW 04, RW 05, RW 02, and RW 06, indicating that drainage problems are widespread and not confined to a single area but affect nearly all slum clusters on both sides of the Reformasi Toll Road.

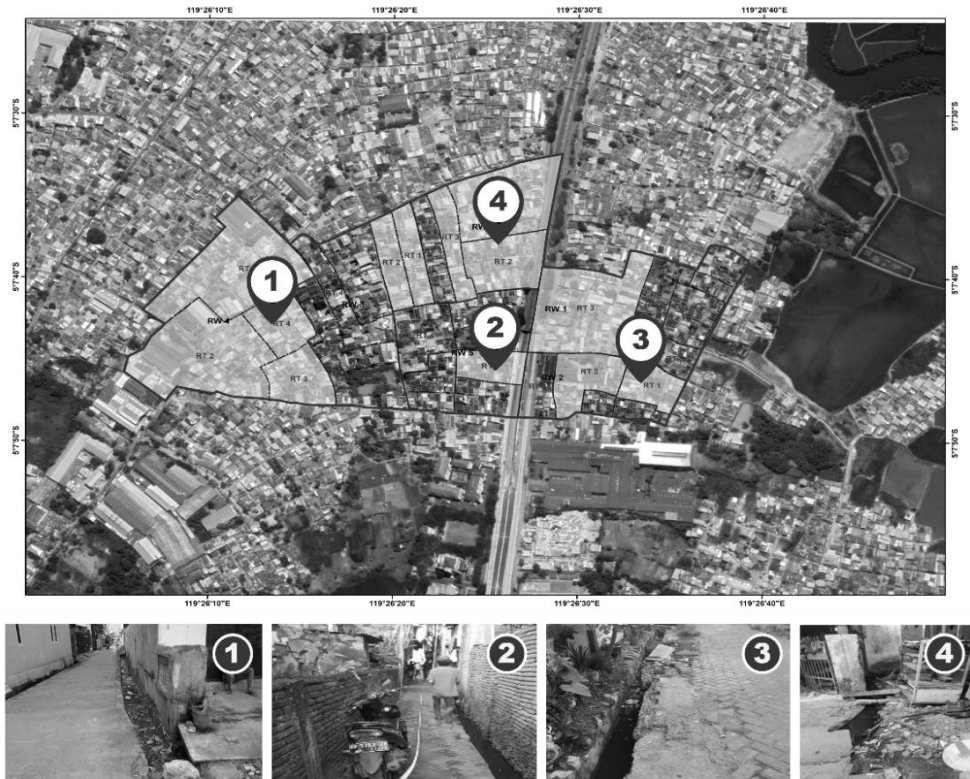
Figure 5.1 shows a narrow road with an open drainage channel integrated with a pedestrian path. Although the channel appears relatively clean, it lacks cover to protect residents' safety. The drainage function is suboptimal due to the risk of clogging by garbage and solid materials. The absence of shade vegetation also reduces environmental comfort.

Figure 5.2 shows the drainage on the side of the road but partially covered depicts drainage along the roadside partially blocked by buildings and parked vehicles, severely limiting maintenance access. The narrow road with almost no clearance between the drainage and traffic space creates a spatial conflict that drastically reduces drainage effectiveness.

Figure 5.3 illustrates an open drainage channel in RW 02 filled with mud deposits and plastic waste. The shallow waterways obstruct water flow. Despite the road being paved with blocks, the drainage condition poses risks of local blockages and flooding during the rainy season, as well as becoming breeding grounds for mosquitoes and diseases.



Figure 5.4 shows a severely damaged water pipe with collapsed canal walls filled with household waste. The cramped buildings around the drainage complicated technical handling. This exemplifies malfunctioning drainage that not only fails to properly channel water but also worsens environmental sanitation.



**Figure 5.** Typology of Drainage Conditions in Slum Environments Tammua Urban Village

The dimensions of drainage conditions are presented in Table 5 below. Table 5 shows that out of a total drainage length of 8,807 meters in the Tammua slum, 7,359 meters (83.5%) are damaged. Damage types include open channels without covers, clogged channels, and structural damage such as collapsed and poorly maintained walls.

**Table 5.** Drainage Condition of Tammua Slum Informal Settlement Environment

| No | Criteria                  | Volume | Unit  |
|----|---------------------------|--------|-------|
| 1  | Drainage Length           | 8.807  | meter |
| 2  | Length of Broken Drainage | 7.359  | meter |

Source: Tammua Urban Village Settlement Environmental Planning Plan Document (2021)

The extensively damaged and widespread drainage conditions pose significant challenges for environmental management in the Tammua slum. Massive

deterioration hampers the drainage system's ability to control runoff and domestic waste, increasing risks of flooding, environmental pollution, and public health issues. Additionally, limited space and maintenance access caused by dense building layouts complicate rehabilitation and sustainable upkeep efforts.

### Typology of Drinking Water Condition

Based on data concerning the fulfillment of drinking water needs in the Tammua slum, 82 household heads have not accessed adequate drinking water, while 801 household heads have received drinking water services. Although the majority of the population is served, disparities in the provision of this basic service still exist. These inequalities potentially have a significant impact on quality of life, especially for vulnerable groups living in areas with limited infrastructure. Most residents still rely on dug wells as the primary source of water for bathing, washing, and latrine (MCK) needs. This condition reflects the limitations of adequate sanitation facilities and poses serious environmental health risks. To give a clearer picture, this condition is presented in Figure 6 below.



**Figure 6.** Distribution of Digging Wells in Tammua Slum Locations

Figure 6 shows the distribution of clean water sources in the form of dug wells across various RW locations in the Tammua slum: Point 1 is located in RW 01 (RT

03), east side of the toll road; Point 2 is in RW 04 (RT 03), west side of the toll road; Point 3 is in RW 02 (RT 01), east side; Point 4 is in RW 06 (RT 02), northwest side. Figure 6.1 shows an unprotected dug well located very close to the kitchen and household activity areas, without any protection system against contamination. This greatly increases the risk of water contamination from domestic waste or polluted surface water. Figure 6.2 shows a traditional water storage facility without adequate treatment or cover, making it highly susceptible to dust, insects, and other contaminants. These facilities do not guarantee water quality suitable for consumption, indicating limitations in clean water technology in the area.

Figure 6.3 depicts a water facility in an outdoor toilet area where water is drawn by bucket from a well connected to a simple toilet. Fragile wooden floors and unsealed soil surfaces indicate a high potential for fecal waste seepage into water sources, reflecting poor sanitation and hygiene practices. Figure 6.4 shows residents collectively accessing water in a narrow alley that also serves as a traffic lane and wastewater disposal. Water is channeled into open buckets and containers without proper management, indicating limited individual household access to clean water and dependence on unhygienic public facilities.

These conditions illustrate the complex challenges of sanitation and access to clean water in the Tammua slum. Disparities in drinking water access, dependence on unprotected dug wells, and poor sanitation practices increase the risk of waterborne diseases such as diarrhea and cholera. Furthermore, inadequate water and sanitation facilities worsen the quality of life and health of the community, especially vulnerable groups.

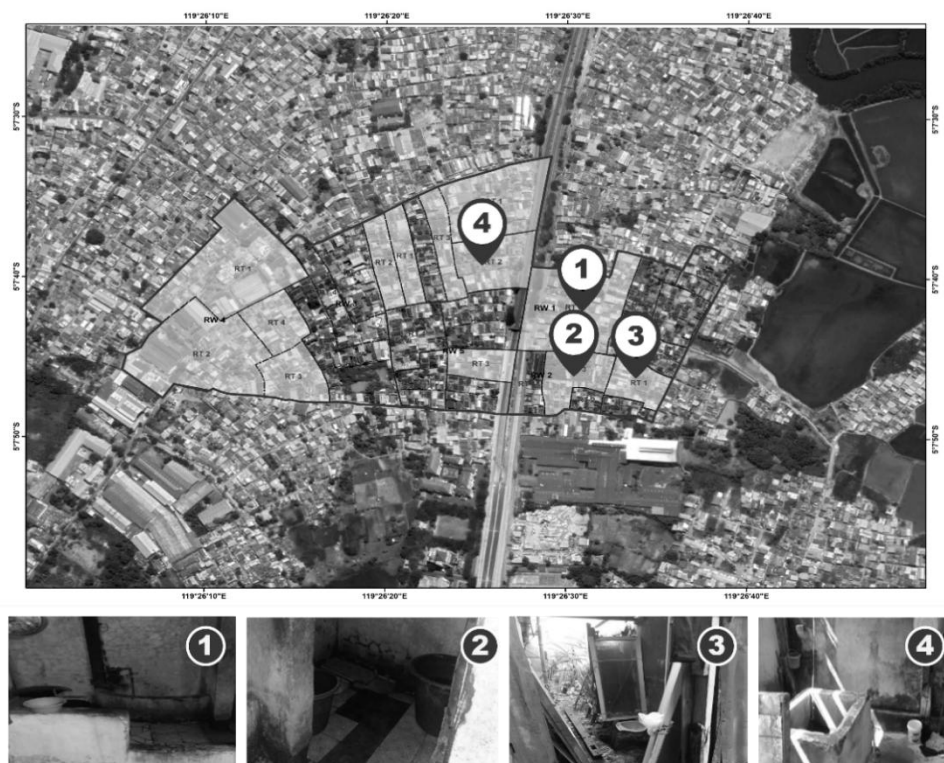
### **Typology of Household Waste Disposal Conditions**

The wastewater disposal system in Tammua consists of two types: communal Wastewater Disposal Plants (WWDP) and individual sanitation. There are three WWDP units built in the area, with a capacity to accommodate around 50 households. Two units are located in the slum area of RT 02 RW 06, and one unit is in RT 03 RW 05.

The communal WWDP in RW 06 is not functioning optimally, with only five households connected to the WWDP network. This is due to residents' concerns arising from previous incidents where household sewage connections to the WWDP caused flooding, resulting in water overflowing through the WWDP channels into their homes. Consequently, many disconnected their pipes and reverted to using individual sanitation systems.

Figure 7 illustrates the condition of wastewater sanitation at various points within the Tammua slum zone. The eastern zone has more communal sanitation systems compared to the western zone, which has only one point. Visual documentation reveals several concerning sanitation conditions: (1) Figure 7.1 shows kitchen wastewater being discharged directly onto the floor without a closed drainage system. The stagnant dirty water is not connected to septic tanks or the city's drainage system, mixing with activity areas and posing health hazards; (2) Figure 7.2 depicts a bathroom and toilet with floors that are not waterproof and lacking a closed wastewater drainage system. Water retention buckets and damp walls indicate poor

sanitation and potential fecal contamination of the surrounding environment, especially if waste seeps directly into the soil; Figure 7.3 shows a kitchen sewer pipe that appears to flow directly into an open field behind the house, without a closed sewer system or permanent gutter; Figure 7.4 shows a kitchen washing area where wastewater is not drained into a special channel but flows freely around the floor and walls. Accumulated dirty water causes moisture, structural damage, and health risks for residents.



**Figure 7.** Typology of Communal WWDP Conditions in Slum Environments Tammua Urban Village

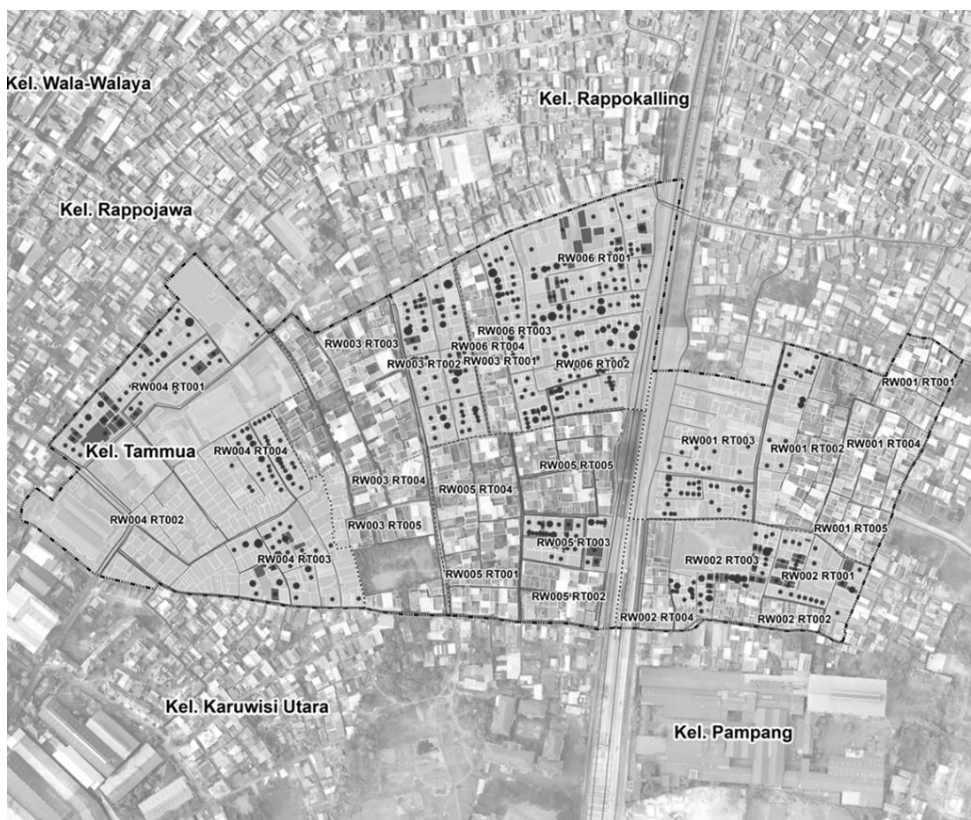
These inadequate sanitation conditions highlight the complex challenges of wastewater management in the Tammua slum. The limited and poorly functioning communal WWDP system, combined with high reliance on unhygienic individual sanitation, leads to environmental pollution and public health risks. Technical issues such as flooding caused by inadequate systems have also reduced residents' trust in communal facilities, hindering integrated sanitation management efforts.

### Vulnerable Groups Mapping

The distribution of vulnerable groups in various RTs in six Tammua RWs is presented in the following map. Vulnerable groups in this context refer to residents with specific socio-economic limitations and/or physical-psychological limitations, which make

them more susceptible to the lack of access to basic services, infrastructure, and the risk of environmental disasters. To provide a more systematic understanding of the distribution of problems related to access to basic infrastructure in Tammua Urban Village, an analysis was carried out on two main aspects: access to drinking water and access to sanitation. These two aspects are analyzed in relation to the level of social vulnerability of the population. This analysis aims to identify areas that experience overlaps between low access to basic infrastructure and high levels of social vulnerability. To simplify the presentation, the research data is presented in the form of a matrix. Table 4 contains five main components: the name of the region (RW/RT), the status of drinking water access, the category of vulnerable groups, the status of sanitation access, and qualitative interpretation based on the results of map observation. Based on a survey conducted in Tammua, it is known that around 51 percent of women live in slums. 940 children, 365 elderly people, and 12 people with disabilities.

Figure 8 is the spatial distribution of these vulnerable groups in the slum delineation.



**Figure 8.** Distribution of Tammua Vurnerable Groups

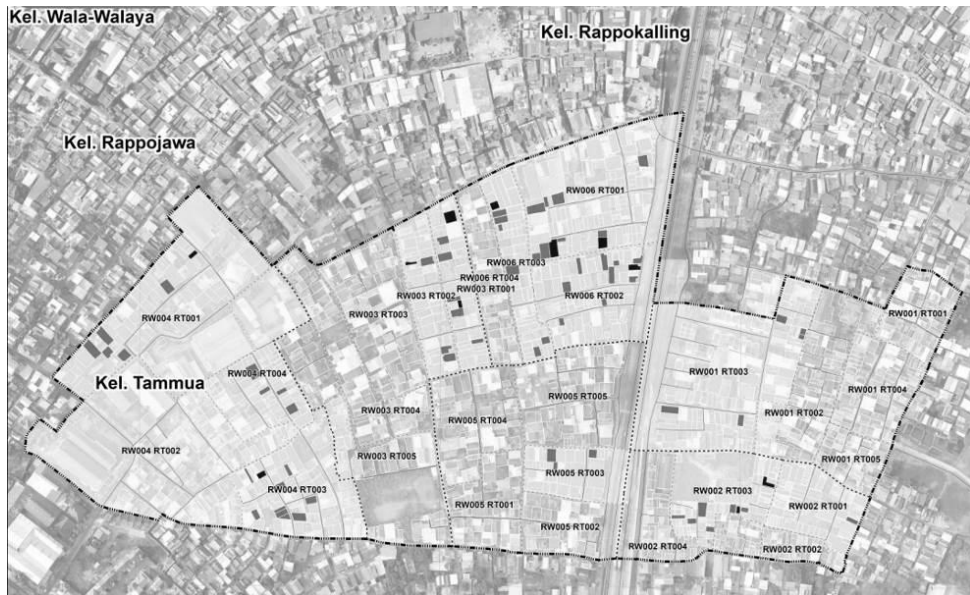
Figure 8 shows many high-level vulnerable groups evenly distributed across almost all RWs, marked with red dots. The highest concentrations were seen in: RW

004 (northwest), especially RT 002 and RT 003, RW 001 and RW 002 (east), especially in RT 001 and RT 002, some solid points also appeared in RW 006 and RW 005. The problem of access to drinking water and vulnerable groups is unevenly distributed but concentrated in zones that are also categorized as slums, as found in the previous images. The absence of PDAM connections even though the pipeline network is mapped indicates non-technical obstacles, such as limited connection costs, inconsistencies in land ownership documents, or informal house locations. Thus, access to drinking water is still inequality. To further clarify the distribution of drinking water access spaces, especially for vulnerable groups, is presented in Table 6 below.

**Table 6.** Access to Drinking Water and Sanitation in Tammua Urban Village

| <b>RW/RT Region</b> | <b>Access to Drinking Water</b> | <b>Vulnerable Groups (Score 1-9)</b> | <b>Sanitation Access (Latrines)</b> | <b>Vulnerability</b>                                           |
|---------------------|---------------------------------|--------------------------------------|-------------------------------------|----------------------------------------------------------------|
| RW 001              | Limited, uneven in RT 001-003   | High in RT 001 and RT 004            | Many lack latrines in RT 003-RT 004 | High density, inadequate water and sanitation infrastructure   |
| RW 002              | Mostly inaccessible             | High in RT 001 & RT 002              | No latrines in RT 002-003           | Very limited water and sanitation infrastructure               |
| RW 003              | Mostly no access                | Medium-high vulnerability            | Public toilets used                 | Collective sanitation, dense and vulnerable settlement         |
| RW 004              | Many areas without access       | High in RT 002 and RT 003            | Most lack latrines                  | Dense activity zones with minimal infrastructure access        |
| RW 005              | Mixed PDAM and non-PDAM access  | High in RT 003                       | Low sanitation, some no latrines    | Uneven infrastructure distribution, concentrated vulnerability |
| RW 006              | Limited in RT 003 & RT 004      | Moderate to high risk                | Generally use latrines, uneven      | Varied sanitation access in diverse settlement patterns        |

Almost all RWs demonstrate a spatial correlation between vulnerability levels and limited access to drinking water and sanitation. This indicates that vulnerable groups not only face socioeconomic pressures but are also exposed to environmental health risks due to inadequate basic infrastructure. The RWs with the most critical conditions are RW 002 and RW 004, attributed to a combination of low water access, lack of latrines, and a high concentration of vulnerable groups. While the use of public toilets remains prevalent in some areas, it does not align with the principles of proper sanitation in the long term, particularly for vulnerable groups with limited purchasing power and housing space.



**Figure 9.** Map of the Distribution of Vulnerable Groups in the Tammua Urban Village

The results of mapping the distribution of vulnerable groups show that 51% of women live in slum areas, 940 children use the road as a play area, and 365 elderly women reside in slum areas. In addition, the elderly continue to actively participate in exercise programs at the Elderly *Posyandu* located on the north side of the Tammua Urban Village head office. Meanwhile, the group of people with disabilities consists of 12 individuals. Based on primary data obtained through interviews with collective members of the Community Self-Reliance Agency, who act as supporters, and a study of secondary data from the results of field FGDs conducted by the KOTAKU-DFAT program in Tammua in 2021, accessibility—both physical and non-physical—is identified according to the general profile of vulnerable groups.

### Photo Story Cycle of Vulnerable Groups

The phase of applying the GESI concept was also identified based on observations in the field, it was found that the samples taken during the design implementation of the slum settlements in Tammua Urban Village were through photo story. This phase is almost the same as behavioral mapping activities by observing the behavior of vulnerable groups. One of the samples that became the unit of observation was elderly women. The portrait of the woman who is the unit of observation is the 78 years old elderly who has a disability and lives in an uninhabitable house in the Tammua slum settlement. His profession is as a plastic scavenger to make ends meet. Currently, she lives in her own house because her husband is gone. His income as a scavenger is uncertain, only around Rp. 200,000 per month. According to observations, access to clean water sources and MCK activities are obtained by staying at a neighbor's house.

## Identification of GESI of Vulnerable Groups

Interviews with key figures and representatives of vulnerable groups in Tammua identified various groups such as laid-off factory workers, the elderly, people with disabilities, elderly women, female heads of households, and individuals with autism. These groups face limited access to health, economic, physical, and social facilities, as well as barriers in community participation, income control, and benefits received. For example, laid-off workers have access to health services but limited social and economic participation; the elderly and disabled have access to basic facilities but limited business capital; elderly women rely on scavenging activities with mobile sanitation access; and individuals with autism have very limited social and educational access and depend entirely on family.

Data show that vulnerable groups face multidimensional barriers—physical, social, and economic—in accessing basic services and participating in social life. The main barriers include economic constraints, physical access limitations, and social participation restrictions. Although some facilities are accessible, basic needs and social support remain inadequately met. Based on Table 7, vulnerable groups exhibit varied access, such as informal workers who have health service access but financial limitations, and the elderly and disabled who face physical barriers to accessing residential facilities.

This GESI analysis is crucial as a foundation for social inclusion policies emphasizing accessibility, protection, and empowerment of marginalized groups, beyond just physical infrastructure development.

**Table 7.** GESI Analysis Diagram of Vulnerable Groups in Tammua Slums

|                             | <b>Barrier Type</b>                        | <b>GESI Access</b>                                                                       | <b>GESI Participation</b>                                   | <b>GESI Control</b>                                                                 | <b>GESI Benefits</b>                                                                                            | <b>Environmental Barriers</b>                                                                                   |
|-----------------------------|--------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Factory Workers on Furlough | Access to healthcare facilities            | Health facilities are available in the form of health centers and have KIS service cards | Never participated since suffering from illness             | Source of income from wives who sell at home and school children's motorcycle taxis | Boarding lives in a resident's house there is no rent fee benchmark. Getting health care support from neighbors | Economic barriers: difficulties in medical expenses                                                             |
| Elderly & Disabled          | Have PDAM and sanitation, access to stalls | Have PDAL and sanitation, access to stalls                                               | Attend the meeting if there is an invitation from RW or BKM | Source of income from wives who sell at home and school children motorcycle taxis   | Boarding lives in a resident's house there is no rent fee benchmark. Getting health care support from neighbors | Boarding lives in a resident's house there is no rent fee benchmark. Getting health care support from neighbors |
| Elderly Female              | Physical access and resources              | Access to toilets, access to waste collection locations                                  | Attend meetings if invited                                  | Earning a living from scavenging                                                    | Utilizing Public Toilets in RW Houses, Toilets in Neighbor's                                                    | There is a toilet in the neighbor's house with slippery floor conditions                                        |



|       | <b>Barrier Type</b>                                                          | <b>GESI Access</b>                                                                                                                                             | <b>GESI Participation</b>                                                                                                                 | <b>GESI Control</b>                    | <b>GESI Benefits</b>                                                 | <b>Environmental Barriers</b>                           |
|-------|------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|----------------------------------------------------------------------|---------------------------------------------------------|
|       |                                                                              | (collecting used and dry waste)                                                                                                                                |                                                                                                                                           |                                        | Houses (Moving Around)                                               |                                                         |
| Woman | Safe access to motorcycle taxi bases, access to garbage scavenging locations | Access to roads, access to Central Market, Access to Garbage Bank/Garbage Bin, Access to motorcycle taxi base & pete-pete waiting area (public transportation) | Active as a member of the Women's Empowerment Institute and the Taklim Council. Actively taking a role in BKM meetings and village events | Earning a living on his own since 2009 | Access to finance has been a member of KSM Revolving Fund since 2009 | There is no pedestrian path to the motorcycle taxi base |

This study highlights critical issues in Tammua informal settlement, marked by high density, irregular buildings, and 273 units below technical standards. Limited access to water and sanitation affects 82 households, with many relying on dug wells. RW 002 and RW 004 show the highest vulnerability due to infrastructure gaps and concentrations of vulnerable groups. Despite using a GESI-based participatory APKM framework, vulnerable groups' participation remains low due to barriers. The study emphasizes integrating spatial justice and inclusive design in informal settlements. A core matrix summarizes key physical, infrastructure, social, and GESI findings in Tammua.

The results indicate that RW 002 and RW 004 are the most vulnerable areas in the Tammua informal settlement, due to limited access to basic infrastructure like drinking water and sanitation combined with a high concentration of vulnerable groups (Table 8). Although the GESI-based participatory approach using the APKM (Actors, Participation, Control, and Benefit) framework shows promise for fostering inclusivity, the actual involvement of vulnerable groups remains suboptimal. Furthermore, spatial inequality persists, as the spatial design does not fully adapt to the needs of women, children, the elderly, and people with disabilities, preventing comprehensive achievement of spatial equity.

The overlap of infrastructure gaps and vulnerable groups in RW 002/RW 004 aligns with Rigon et al. (2020), who argue that spatial exclusion in informal settlements exacerbates gendered and disability-based inequalities (Rigon, 2022). Limited access to water and sanitation for women and the elderly, and disability groups reflect broader systematic failures in participatory planning (Satterthwaite & Mitlin, 2013).

**Table 8.** Integration of GESI in Architectural, Basic and Social Infrastructure Aspects in the Tammua Informal Settlement

| Aspects                         | Key Findings                                                                                           | Affected GESI Dimensions                                                                  |
|---------------------------------|--------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| Slum morphology typology        | Slum divided by administrative RT boundaries and separated road patterns due to toll road              | Spatial fragmentation caused by infrastructure                                            |
| Building layout & morphology    | 188 irregular units, most not facing main roads.                                                       | Limited mobility and public space access for woman, elderly, and people with disabilities |
| Occupancy density               | Very high (711.11 units/hectare), with no open buffer spaces                                           | Restricted movement, increased safety risks, and low privacy for vulnerable groups        |
| Access to drinking water        | 82 households lack clean water access: 801 served.                                                     | Difficulty accessing clean water for elderly woman and informal workers                   |
| Sanitation (MCK and Drainage)   | Use of dug wells, inadequate public toilets, 7,359 damaged drainages mixed with waste.                 | High disease risk; Women and children struggle to access safe sanitation                  |
| Sewage system                   | 3 communal WWDP partially active, drains forcibly opened due to flooding into homes                    | Difficulty accessing healthy sanitation, especially for renters                           |
| Social vulnerability mapping    | 1.317 vulnerable groups; 940 children, 365 elderly women, 12 with disabilities                         | Special needs unmet in design and policy                                                  |
| Participatory Innovation (APKM) | Participation via FGDs, community mapping, photo-stories; not fully inclusive of all vulnerable groups | Unequal opportunity and control over design process; partial involvement                  |
| Functional spatial balance      | Suboptimal zoning; settlement overlaps roads, industrial zones, and toll underpasses                   | Women and elderly face services access difficulties due to inefficient zoning             |

## CONCLUSION

The research in the Tammua slum area reveals several important empirical findings regarding building density and settlement layout, basic infrastructure disparities, and GESI-based participation. The slum area has a very high building density (approximately 711 units per hectare), with an organic and unstructured settlement pattern. Most buildings do not meet technical standards, and their orientation does not follow the road network, resulting in narrow and limited public spaces that hinder circulation and accessibility, especially for vulnerable groups. Physical infrastructure such as neighborhood road networks, drainage systems, and access to clean water and sanitation show significant quality disparities between settlement blocks. Damaged and clogged drainage, along with inadequate sanitation, worsens the settlement's environmental conditions and increases public health vulnerabilities. Although there are community participation mechanisms in the planning and arrangement of informal

settlements, the involvement of vulnerable groups in decision-making and implementation processes remains limited due to physical and social barriers, meaning that the principles of social inclusion and spatial justice have not yet been fully realized.

The findings reinforce the concept that unplanned and densely populated informal settlement layouts contribute to social marginalization and unequal access to space and basic services. Housing policies and settlement planning need to systematically integrate GESI principles in the design and management of informal settlements to create inclusive, safe, and livable spaces for all residents, especially vulnerable groups. Informal settlement architectural practices should prioritize participatory approaches that empower local communities, focusing on the reconstruction of public spaces, improvement of basic infrastructure quality, and strengthening the adaptive capacity of the settlement environment.

This study focuses on the local context of the Tammua informal settlement using qualitative methods limited to a number of informants, so caution is needed in generalizing the results. The long-term dynamics of participatory architecture interventions based on GESI also require further exploration.

Further research combining quantitative and qualitative approaches with a broader geographical scope is needed. Informal settlement architectural interventions must integrate improvements in physical spatial planning, optimization of basic infrastructure, as well as strengthening inclusive participation and social empowerment. Multi-stakeholder collaboration and active community involvement are essential for the sustainability and effectiveness of slum settlement improvement programs.

## ACKNOWLEDGMENT

This research was conducted as part of the 2022/2023 Muhammadiyah Research Grant development scheme. The authors express their sincere gratitude to the Research and Development Council for Higher Education (Diklitbang), Muhammadiyah Central Executive, for providing financial support and guidance throughout the research process. Special thanks are also extended to the Institute for Research and Community Service (LP2M) of Universitas Muhammadiyah Makassar for their invaluable facilitation and assistance during the implementation of this study. The authors would also like to acknowledge the Collective Leadership of the Community Self-Reliance Agency (Badan Keswadayaan Masyarakat) of Tammua Urban Village for their active participation and support throughout the fieldwork process.

## REFERENCES

- Adiputra, M. S., Rustiadi, E., & Pravitasari, A. E. (2022). Pola Sebaran Permukiman Kumuh di Kabupaten Tangerang dan Keragaman Spasial Faktor yang Mempengaruhinya. *Journal of Regional and Rural Development Planning*, 6(2), 146–164. <https://doi.org/10.29244/jp2wd.2022.6.2.146-164>
- Aditya, T. (2010). Usability Issues in Applying Participatory Mapping for Neighborhood Infrastructure Planning. *Transactions in Gis*, 14(s1), 119–147. <https://doi.org/10.1111/j.1467-9671.2010.01206.x>
- Amalia, A. A. (2018). KARAKTERISTIK HUNIAN PERMUKIMAN KUMUH KAMPUNG SAPIRIA KELURAHAN LEMBO KOTA MAKASSAR. <https://doi.org/10.24252/nature.v5i1a2>
- Amalia, A. A., & Fuadillah, S. (2024). Analisis Tingkat Keteraturan Bangunan Hunian Kelurahan Kampung Buyang Kota Makassar. *Journal of Green Complex Engineering*, 1(2), 79–88. <https://doi.org/10.59810/greenplexresearch.v1i2.93>
- Amalia, A. A., & Ikaputra, I. (2024). Tinjauan Literatur: Informalitas Permukiman Informal Perkotaan. *Jurnal Linears*, 7(1), Article 1. <https://doi.org/10.26618/j-linears.v7i1.14344>
- Arif, M. M., Ahsan, M., Devisch, O., & Schoonjans, Y. (2022). Integrated Approach to Explore Multidimensional Urban Morphology of Informal Settlements: The Case Studies of Lahore, Pakistan. *Sustainability*, 14(13), 7788. <https://doi.org/10.3390/su14137788>
- Budiyanto, H. (2011). Pendampingan dalam proses perencanaan partisipatif program penataan lingkungan permukiman berbasis komunitas. *Local Wisdom-Jurnal Ilmiah Online*, III, 34–40.
- Cervero, R., & Kockelman, K. (1997). Travel demand and the 3Ds: Density, diversity, and design. *Transportation Research Part D: Transport and Environment*, 2(3), 199–219. [https://doi.org/10.1016/S1361-9209\(97\)00009-6](https://doi.org/10.1016/S1361-9209(97)00009-6)
- Chidya, R., Holm, R. H., Tembo, M., Cole, B., Workneh, P. S., & Kanyama, J. (2016). Testing Methods for New Pit Latrine Designs in Rural and Peri-Urban Areas of Malawi Where Conventional Testing Is Difficult to Employ. *Environmental Science Water Research & Technology*, 2(4), 726–732. <https://doi.org/10.1039/c5ew00246j>
- Chigbu, U. E., & Onyebueke, V. U. (2021). The COVID-19 pandemic in informal settlements: (Re)considering urban planning interventions. *Town Planning Review*, 92(1), 115–121. <https://doi.org/10.3828/tpr.2020.74>
- Chigudu, A. (2021). Planning and Design as Defining Parameters for Urban Resilience: The Case of Zimbabwe BT - Resilience and Sustainability in Urban Africa: Context, Facets and Alternatives in Zimbabwe (I. Chirisa & A. Chigudu, Eds.; pp. 55–68). Springer Singapore. [https://doi.org/10.1007/978-981-16-3288-4\\_4](https://doi.org/10.1007/978-981-16-3288-4_4)
- Djodding, I. M. (2020). PARTISIPASI MASYARAKAT DALAM PENATAAN PERMUKIMAN KUMUH DI KELURAHAN BONTODURI KECAMATAN TAMALATE KOTA MAKASSAR.

- Douglas, G. C. C. (2016). The formalities of informal improvement: Technical and scholarly knowledge at work in do-it-yourself urban design. *Journal of Urbanism*, 9(2), 117–134. <https://doi.org/10.1080/17549175.2015.1029508>
- Gouverneur, D. (2014). *Planning and Design for Future Informal Settlements*. Routledge. <https://doi.org/10.4324/9781315765938>
- Hamdan, A. D., & Sumartinah, H. R. (2021). Aplikasi Participatory Design pada Rancangan Permukiman Sepanjang Rel Stasiun Sidotopo. *Jurnal Sains Dan Seni ITS*, 9(2), 58–63. <https://doi.org/10.12962/j23373520.v9i2.57161>
- Harisun, E., Conoras, M. A. M., & Darwis, M. (2019). IDENTIFIKASI DAN PENANGANAN KAWASAN KUMUH PADA KELURAHAN MAKASSAR TIMUR. *TECHNO: JURNAL PENELITIAN*, 8(1), 259. <https://doi.org/10.33387/tk.v8i1.979>
- Iannillo, A., & Fasolino, I. (2021). Land-use mix and urban sustainability: Benefits and indicators analysis. *Sustainability (Switzerland)*, 13(23). <https://doi.org/10.3390/su132313460>
- Idris, M. Y. (2019). *Arahan pengembangan kawasan permukiman berkelanjutan di Kawasan Pesisir Kota Makassar [Thesis, IPB (Bogor Agricultural University)]*. <http://repository.ipb.ac.id/handle/123456789/120428>
- International Development Partners Group. (2017). *A Common Framework for Gender Equality & Social Inclusion*. GESI Working Group Gender Equality and Social Inclusion Working Group, International Development Partners Group, Nepal.
- Kim, J., Hagen, E., Muindi, Z., Mbonglou, G., & Laituri, M. (2022). An examination of water, sanitation, and hygiene (WASH) accessibility and opportunity in urban informal settlements during the COVID-19 pandemic: Evidence from Nairobi, Kenya. *Science of the Total Environment*, 823, 153398. <https://doi.org/10.1016/j.scitotenv.2022.153398>
- Walsh, E.A., 2018. White fragility as an obstacle to anti-racist resilience planning: Opportunities for equity-conscious partnerships. *Journal of Urban Management*, 7(3), pp.181-189. <https://doi.org/10.1016/j.jum.2020.12.002>
- Mitlin, D., & Weldeghebrael, E. H. (2025). The contribution of urban reform coalitions to inclusive and equitable cities. *ENVIRONMENT*, 37(1).
- Nelly, S. (2021). Gender Equality and Social Inclusion (GESI) in Village Development. 10(2).
- Prasetyo, I., Suryawan, M. B., & Indah, I. L. (2021). Rancang Bangun Sistem Penguncian dan Pendeteksi Kebakaran Dini Pada Ruang dengan Kendali Android Menggunakan Arduino. In *CAHAYATECH* (Vol. 9, Issue 2). Cahaya Surya. <https://doi.org/10.47047/ct.v9i2.112>
- Rigon, A. (2022). (PDF) Diversity, justice and slum upgrading: An intersectional approach to urban development. *Habitat International*, 130 (2022) 102691. <https://doi.org/10.1016/j.habitatint.2022.102691>
- Robertson, T., & Simonsen, J. (2012). Challenges and Opportunities in Contemporary Participatory Design. *Design Issues*, 28(3), 3–9. [https://doi.org/10.1162/desi\\_a\\_00157](https://doi.org/10.1162/desi_a_00157)

- Simonsen, J. and Robertson, T. eds., 2013. Routledge international handbook of participatory design (Vol. 711). New York: Routledge. <http://www.routledge.com/books/details/9780415694407/>
- Roy, A. (2009a). Why India cannot plan its cities: Informality, insurgence and the idiom of urbanization. *Planning Theory*, 8(1), 76–87. <https://doi.org/10.1177/1473095208099299>
- Roy, A. (2009b). Why India cannot plan its cities: Informality, insurgence and the idiom of urbanization. *Planning Theory*, 8(1), 76–87. <https://doi.org/10.1177/1473095208099299>
- Rudianto, I., Syafri, S., & Rasyidi, E. S. (2024). Analisis Kawasan Permukiman Kumuh DAS Jeneberang Kota Makassar. *Urban and Regional Studies Journal*, 7(1), Article 1. <https://doi.org/10.35965/ursj.v7i1.5502>
- Rumata, N. A., Ilma, N., Janna, N. M., & Nurdin, L. (2023). KAJIAN TINGKAT KEKUMUHAN KAWASAN PERMUKIMAN DI KAWASAN BONTORANNU KOTA MAKASSAR. *Journal of Green Complex Engineering*, 1(1), 11–19. <https://doi.org/10.59810/greenplexresearch.v1i1.39>
- Sanoff, H. (2010). Multiple views in Participatory Design. *Focus*, VII(2), 11–21.
- Satterthwaite, D., & Mitlin, D. (2013). *Reducing Urban Poverty in the Global South*. Routledge. <https://doi.org/10.4324/9780203104330>
- Sawira, S., & Rahman, T. (2018). An observation on the quality of interfaces in order to understand the complexity and coherence of informal settlement: A study on Tamansari Kampung in Bandung. *IOP Conference Series: Earth and Environmental Science*, 158(1). <https://doi.org/10.1088/1755-1315/158/1/012002>
- Shatkin, G. (2004). Planning to Forget: Informal Settlements as “Forgotten Places” in Globalising Metro Manila. In *Urban Studies* (Vol. 41, Issue 12, pp. 2469–2484). SAGE Publications. <https://doi.org/10.1080/00420980412331297636>
- Soliman, A. M., & Soliman, Y. A. (2022). Exposing urban sustainability transitions: Urban expansion in Alexandria , Egypt. *International Journal of Urban Sustainable Development*, 14(1), 33–55. <https://doi.org/10.1080/19463138.2022.2056894>
- Sucahyo, H., & Pradoto, W. (2020). Pengaruh Regenerasi Kota Terhadap Kualitas Lingkungan Permukiman Industri Kecil Batik Studi Kasus: Kawasan Pabean, Kota Pekalongan. *Jurnal Planologi*, 17(2), 134. <https://doi.org/10.30659/jpsa.v17i2.7951>
- Turner, J. C. (1967). Barriers and Channels for Housing Development in Modernizing Countries. *Journal of the American Institute of Planners*, 33(3), 167–181. <https://doi.org/10.1080/01944366708977912>
- UNDP Indonesia. (2025). Indikator SDG — Indikator SDG. <https://unstats.un.org/sdgs/metadata/>
- Vainio, T. (2016). Motivations, Results and the Role of Technology in Participatory Design Research During 2000’s – A Review in the Field of Architecture and Urban Planning. *Architecture and Urban Planning*, 11(1), 14–18. <https://doi.org/10.1515/aup-2016-0002>
- Victor, C., Vega Ocasio, D., Cumbe, Z. A., Garn, J. V., Hubbard, S., Mangamela, M., McGunegill, S., Nalá, R., Snyder, J. S., Levy, K., & Freeman, M. C. (2022).

Spatial heterogeneity of neighborhood-level water and sanitation access in informal urban settlements: A cross-sectional case study in Beira, Mozambique. *PLOS Water*, 1(6), e0000022. <https://doi.org/10.1371/journal.pwat.0000022>

Yeboah, V., Asibey, M. O., & Abdulai, A.-S. J. (2021). Slum upgrading approaches from a social diversity perspective in the global south: Lessons from the Brazil, Kenya and Thailand cases. *Cities*, 113, 103164. <https://doi.org/10.1016/j.cities.2021.103164>

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