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Industrial Growth, Housing Gaps: Assessing Flat Needs for Workers (Case of Pringapus, Indonesia)

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Abstract

This study aims to analyze the needs and planning of flats for workers in the industrial area of Pringapus District, Semarang Regency. Along with the development of the industrial sector in this area, the demand for decent housing for workers is increasing, but has not been balanced by the provision of flats that are in accordance with their needs. Based on demographic data and labor density in the area, this study will identify the conditions of housing needs as well as technical, social, and environmental aspects that need to be considered in planning decent and sustainable flats. The main focus of this study is how an effective flat planning model can be applied, taking into account the economic limitations of workers and the need to create a safe and comfortable residential environment. The method used in this study is normative legal research, which includes an analysis of laws and regulations, government policies, and relevant literature on flat planning for workers in industrial areas. The results of this study are expected to provide recommendations for better planning and construction of flats in the

Pringapus industrial area, as well as support government policies in providing affordable and decent housing for workers.

Keywords

Flats, Industrial Workers, Housing Planning, Pringapus District, Industrial Area

A. Introduction

Industrial areas in Indonesia continue to grow rapidly, one of which is the industrial zone located in Pringapus Subdistrict, Semarang Regency. In this area, numerous large and medium-sized industries have developed, attracting thousands of workers from both within and outside the region. According to the Central Bureau of Statistics (BPS) of Semarang Regency, in 2019, the number of workers involved in the industrial sector in Pringapus increased sharply, in line with rapid local economic growth.[1] Data from the Semarang Regency Manpower Office shows that there are more than 8,000 active workers in various industrial sectors in Pringapus Subdistrict. Most of them do not own homes and rely on inadequate boarding houses or rented accommodations with high population density. This situation indicates a gap between industrial growth and the fulfillment of basic needs for workers. It also highlights an increasing demand for supporting facilities, one of which is adequate housing for workers. Many workers coming from outside Semarang Regency are forced to rent houses or live in boarding houses with poor housing quality. A significant number live in rented houses with limited facilities that do not meet health and comfort standards. According to data from the Central Bureau of Statistics of Semarang Regency, this condition has the potential to lower workers' quality of life, which in turn could affect their productivity. This situation has

[1] Destiana, Betha Jaswati Putri. "Analisis Lokasi dan Jenis Hunian Baru di Kawasan Industri Kecamatan Pringapus Melalui Sistem Pengambilan Keputusan Multikriteria." *Geo Spatial Proceeding* (2021).

prompted the Semarang Regency Government to seek solutions to provide decent housing for workers.[2]

One effective solution considered is the construction of simple rental flats (*Rusunawa*). Rusunawa provides vertical housing options with more affordable rental costs while still meeting housing quality standards. In addition, the construction of flats can reduce the impression of slums and overpopulation in uncontrolled residential areas. The development of flats in the Pringapus industrial area also aims to reduce the social and economic burdens caused by the gap between the number of workers and housing availability. By providing decent housing, it is hoped that workers can live comfortably, improve their quality of life, and ultimately increase their productivity at work. In this context, flat planning should not only focus on the physical aspects of the building but also on social and environmental aspects that support residents' comfort. The Semarang Regency Government recognizes the urgency of providing vertical housing amid limited land and high demand for accommodation around industrial areas. Therefore, the construction of flats becomes a strategic solution to address these challenges.

In this context, the most appropriate type of flat to be implemented is the Simple Rental Flats (Rusunawa). Rusunawa are vertical dwellings built by the government and intended for low-income communities (MBR), including laborers and industrial workers. These units are rented at affordable rates and are designed with adequate basic facilities such as clean water, electricity, sanitation, and shared open spaces. The presence of Rusunawa supports the government's social objectives in creating a healthy, decent, and productive living environment for workers.[3] The selection of Rusunawa also aligns with

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[2] Suharno, Suharno, and Rika Irawati. "Sediakan Rumah Bagi Pekerja, Pemkab Semarang Bakal Bangun Rusunawa di Pringapus", *Tribun News Jateng,* August 6, 2017. Retrieved from <https://jateng.tribunnews.com/2017/08/06/sediakan-rumah-bagi-pekerja-pemkab-semarang-bakal-bangun-rusunawa-di-pringapus>.

[3] Mahulae, Boy Pardamean, and S. Sunarti. "Optimalisasi Pengelolaan Rusunawa di Kota Semarang." *Jurnal Pengembangan Kota* 9, no. 2 (2021): 245-258; Octavionesti, Alva Ayu, and Fadjar Hari Mardiansjah. "Penanganan Permukiman Kumuh Melalui Pembangunan Rusunawa: Studi Kasus Rusunawa Kaligawe, Kota Semarang." *Jurnal Riptek* 11, no. 1 (2019): 41-56; Silitonga, Rina Leidyawaty.

applicable regulations, namely Law Number 20 of 2011 on Flats, which stipulates that public flats can be managed as rental units to meet housing needs for low-income communities.[4]

In addition, Ministerial Regulation PUPR No. 14/PRT/M/2017[5] reinforces the position of Rusunawa as a means to

"Intensifikasi Pemungutan Bea Perolehan Hak Atas Tanah dan Bangunan (BPHTB) di Kota Semarang Berdasarkan Perda Kota Semarang Nomor 2 Tahun 2011." *Unnes Law Journal* 1, no. 1 (2012): 1-9.

4 *See* Republic of Indonesia, *Law Number 20 of 2011 on Flats.* See also Tambunan, J. Salamat, and Bambang Heri Supriyanto. "Property Ownership of Housing Units in Flat (SRS) By Law Number 20 of 2011 on Flat." *International Journal of Social Science* 4, no. 2 (2024): 145-154; Pramudya, Putu Kharisa, and I. Made Pria Dharsana. "Legal Protection of Ownership of Flats Units Against Foreign Nationals in Indonesia." *NOTARIIL Jurnal Kenotariatan* 8.1 (2023): 37-43.

5 Ministerial Regulation PUPR No. 14/PRT/M/2017 is an Indonesian government regulation issued by the Ministry of Public Works and Public Housing that sets out the requirements for accessibility in buildings and their surrounding environments. Its primary objective is to ensure that all people—regardless of physical ability—can access, navigate, and use public buildings independently, safely, and comfortably. The regulation emphasizes the concept of *Universal Design*, which promotes inclusivity by ensuring that building facilities are usable by everyone, including persons with disabilities, without the need for adaptation or specialized design. It applies to both new and existing buildings and includes detailed provisions for various accessibility features such as ramps with proper slopes, elevators in buildings with more than five floors, wide and unobstructed circulation paths, accessible sanitary facilities, visual and tactile signage, and level or ramped entrances. It also requires that the external environment—like sidewalks and surrounding infrastructure—be designed to allow easy and safe movement for all users. While the regulation marks a significant step toward inclusive design and aligns with human rights principles and sustainable development goals, it has been criticized for vague language and insufficient technical specifications. For example, certain terms like "comfortable" or "independent" are not clearly defined, and the regulation lacks strong enforcement mechanisms or clarity about responsible oversight bodies. Nevertheless, it reflects Indonesia's growing commitment to promoting equity in the built environment and improving access for persons with disabilities. This regulation replaces the previous 2006 guideline and represents a more progressive and inclusive approach to public infrastructure development. *See* Nara, Hartini, and Siti Nuraini Purnawati. "Pendampingan Orang Tua Anak Berkebutuhan Khusus di Rumah Susun Sederhana Sewa (Rusunawa) Jatinegara Kaum Jakarta Timur." *Kumawula: Jurnal Pengabdian Kepada Masyarakat* 6, no. 1 (2023): 128-136.

fulfill basic needs in urban and industrial areas. Unlike Special Flats (*Rumah Susun Khusus,* Rusus), which are intended for specific groups such as civil servants, military/police personnel, disaster victims, or relocated communities, Rusunawa are designed to reach a broader population not included in these categories, including informal and industrial sector workers. Therefore, the construction of Rusunawa in Pringapus Subdistrict represents a form of local government intervention in providing equitable and inclusive basic social infrastructure. From a legal perspective, this program also refers to Government Regulation No. 12 of 2021 on Housing and Settlements Management, which emphasizes the importance of collaboration between central and local governments in providing housing for low-income communities. This policy provides a clear framework for the Semarang Regency Government to legally, efficiently, and sustainably develop Rusunawa construction strategies. [6]

The construction of Rusunawa in Pringapus is also part of the local government's efforts to address uncontrolled urbanization and the emergence of slum areas. The presence of organized and integrated vertical housing with urban spatial planning will create a more orderly and sustainable industrial area. Therefore, Rusunawa planning must involve all parties, including the government, developers, and worker communities. Through in-depth needs analysis, this Rusunawa project is expected to become a model for worker housing development in other industrial areas in Indonesia. This study also aims to identify potential obstacles in the planning and implementation process and formulate recommendations that can be implemented by the local government and stakeholders. The need for Rusunawa is an important indicator that industrial area development must be accompanied by responsive settlement planning. Workers are not just a source of production, but

[6] Yordan, Billy, and Wiwik Widayati. "Analisis Kebijakan Pengelolaan Rumah Susun di Kota Semarang." *Journal of Politic and Government Studies* 3, no. 3 (2014): 396-410. *See also* Sulistiyani, Ambar Teguh. "Problema dan Kebijakan Perumahan di Perkotaan." *Jurnal Ilmu Sosial dan Ilmu Politik* 5, no. 3 (2002): 327-344; Yuniyanti, Salma Suroyya, and Frency Siska. "Enhancing legal certainty for consumers in apartment unit trade: A comparative analysis of dispute settlement agreements in Indonesia and the Netherlands." *Journal of Law and Legal Reform* 5, no. 1 (2024): 333-360.

also city residents who require decent quality of life. Therefore, worker housing planning should receive equal attention to economic zone development. Additionally, good Rusunawa planning also considers tropical architecture principles, energy efficiency, and environmental sustainability. This is important so that the housing is not only functionally comfortable but also environmentally friendly and cost-efficient for residents.

On the other hand, flat construction must also consider strategic factors such as proximity to industrial centers, easy access to transportation, and availability of other public facilities. A strategic location will make it easier for workers to carry out daily activities, reduce commuting time to workplaces, and lower transportation costs. Facilities such as recreational parks, sports areas, and commercial zones should also be considered to improve residents' quality of life. Furthermore, flat planning must include efficient and functional design. Limited space in flats requires planning to maximize space usage without compromising resident comfort. Good design must consider aspects of natural lighting, adequate ventilation, and room arrangements suitable for industrial workers' lifestyles. Thorough planning will ensure that flats not only serve as residences but also foster a healthy and productive community.

The local government must also ensure that flat construction aligns with existing regulations and policies. In Indonesia, flat construction is regulated under Law Number 20 of 2011 on Flats, which governs the management, construction, and operation of flats. In addition, the government must also consider regional regulations related to zoning and land use for flat construction. The Semarang Regency Government, through Bappeda and the Housing Department, needs to collaborate to formulate policies supporting this Rusunawa development. Involvement of various parties in flat planning and construction is crucial. The government, developers, and the community must work together to ensure that flat construction meets workers' needs. For example, developers need to listen to workers' aspirations and consider their needs regarding unit size, provided facilities, and fair rental systems. Community involvement is also important to create an inclusive environment and support the

sustainability of this project. Flat construction also needs to consider environmental sustainability aspects. In this regard, the use of environmentally friendly materials, energy efficiency, and proper waste management are essential.

Flats built on sustainability principles can help reduce negative environmental impacts and create healthy and comfortable housing for workers. The government and developers need to commit to considering ecological impacts during and after the construction process. As part of a broader development strategy, worker flats in the Pringapus industrial area should also be designed to have long-term economic value. Besides meeting housing needs for workers, these flats can also become investment assets for developers and the local government. This program can also stimulate local economic growth by creating new jobs during construction and maintenance. By considering these various factors, flats in the Pringapus industrial area can become an effective and sustainable worker housing development model. This flat construction is not only intended to provide housing but also to create an ecosystem that supports regional social and economic growth. The success of this flat construction will serve as an example for other regions facing similar problems. The presence of these flats is expected to reduce social inequality arising from difficulties in accessing decent housing. Workers who have previously lived in low-quality rented houses or boarding houses will gain access to better and healthier living spaces. This will undoubtedly improve workers' social welfare and reduce economic inequality in the Pringapus industrial area.

However, a major challenge in flat planning and construction is funding. Rusunawa construction requires significant investment, both from the local government and the private sector. Therefore, the Semarang Regency Government needs to conduct feasibility studies and plan funding sources well, through the Regional Budget (APBD), National Budget (APBN), or collaboration with private developers through Public-Private Partnership (PPP) schemes.

Private sector involvement in this construction can accelerate project realization. From a management perspective, the operational sustainability of flats is also an important factor to consider. Efficient and transparent management systems are essential to ensure that flats

continue to function properly, given that flats are housing used by many residents with various backgrounds. Therefore, the role of flat managers is crucial in maintaining facilities and ensuring residents' comfort and safety. Overall, the construction of flats for workers in the industrial area of Pringapus Subdistrict is a strategic step that can improve workers' quality of life and promote economic development in Semarang Regency. The local government must ensure that all aspects of flat planning, construction, and management are carefully considered so that this project can succeed and provide maximum benefits for all parties. This requires strong collaboration between the government, private sector, and community.

The background of this research is based on the real need for decent, affordable, and strategic housing for workers in the industrial area of Pringapus Subdistrict, Semarang Regency. This area continues to experience rapid industrial growth, causing an influx of workers from various regions. However, the increase in the number of workers is not matched by adequate housing provision. Many workers live in narrow boarding houses or rented accommodations with limited facilities that do not meet decent living standards. This leads to social and health problems and reduces work productivity. Industrial areas in Pringapus such as PT Ungaran Sari Garment and other manufacturing companies have become centers of local economic growth. However, data from the Semarang Regency Bappeda shows that most workers in this sector still do not have permanent and decent housing. This is exacerbated by the limited supply of subsidized housing and high land prices around the industrial area. This condition demands careful, data-based planning for vertical housing such as flats. This approach must consider actual worker needs, purchasing power, distance to workplaces, and land availability. Therefore, with comprehensive needs analysis, Rusunawa construction can be directed into a program that is not only physical but also oriented toward improving community welfare. Problem identification:

1. What is the housing needs condition for workers in the industrial area of Pringapus Subdistrict based on demographic data and labor density?

2. What technical, social, and environmental aspects need to be considered in planning decent and suitable flats for workers in Pringapus Subdistrict?
3. How can an effective and sustainable flat planning model be implemented to meet the housing needs of workers in the Pringapus industrial area?

This research uses normative legal research methods, focusing on analyzing laws and regulations, policies, and legal literature related to flat planning for workers in industrial areas.[7] This study aims to identify and analyze legal aspects related to housing needs for industrial workers and to examine policies and regulations underlying flat provision in Pringapus Subdistrict, Semarang Regency. The approaches used include the statutory approach, which analyzes regulations governing flat provision and industrial areas, such as Law No. 1 of 2011 on Housing and Settlements, as well as relevant Government Regulations and Regional Regulations. Additionally, the conceptual approach is applied to examine theories of decent flat planning for industrial workers and aspects of social justice in fulfilling housing needs. The historical approach is used to understand the development of housing needs for workers in industrial areas and their influence on housing policies in the area.

Legal materials used in this research include primary legal materials, namely regulations such as laws and government regulations governing housing and industrial areas, as well as regional regulations related to spatial planning and flat construction. In addition, secondary legal materials such as scientific journals, articles, and books discussing flat planning and housing policies are also used to provide further insights. Tertiary legal materials, such as legal dictionaries and other references, are used to clarify definitions of legal concepts relevant to this research topic.

The analytical technique used is descriptive-analytical analysis, where researchers will describe the applicable legal conditions and compare them with empirical conditions in the field, particularly regarding housing needs for workers in the Pringapus industrial area.

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[7] Soekanto, Soerjono. *Pengantar Penelitian Hukum.* Jakarta: RajaGrafindo Persada, 2012.

Using this analysis, it is hoped that gaps between existing regulations and their field implementation can be identified, and recommendations regarding policies and flat planning for workers can be provided.[8] This study aims to analyze housing needs for workers in Pringapus based on demographic data and labor density and to examine technical, social, and environmental aspects that need to be considered in planning decent flats. Additionally, this study also aims to formulate an effective and sustainable flat planning model to meet housing needs for workers in the industrial area of Pringapus Subdistrict, Semarang Regency.

B. Housing Needs Condition for Workers in the Industrial Area of Pringapus Subdistrict based on Demographic Data and Labor Density

1. Demographic Data

Pringapus Subdistrict in Semarang Regency has experienced significant industrial growth in recent years. This is indicated by an increase in the number of industrial workers, recorded at 10,298 in 2018 and increasing to 17,342 in 2019. This growth has created a need for adequate housing for workers, most of whom come from outside the region. Although the population density in Pringapus Subdistrict of 643 people per km² is still below the Semarang Regency average of 988 people per km², rapid industrial growth has led to a significant increase in population. This poses challenges in providing decent and affordable housing for workers. The population of Pringapus Subdistrict reaches 54,021 people, with Klepu Village having the highest population at 8,780 people. Most of the population is in the productive age group, between 15 and 64 years old, indicating great potential in the labor sector. However, this increase in the productive-age population also increases the need for adequate housing.[9]

Industrial growth in Pringapus Subdistrict has caused changes in the function of residential houses around the industrial area. Many houses have been converted into boarding houses, shops, or stores to

[8] Muhammad, S. *Metode Penelitian Hukum*. Bandung: Penerbit Citra Aditya Bakti, 20003.

[9] Pradipta, Demas. "Rusunawa Pekerja Industri di Kecamatan Bergas Kabupaten Semarang." *IMAJI* 3, no. 3 (2014): 109-120.

meet workers' needs. This change indicates a shortage of decent and affordable housing for industrial workers. With the increasing number of industrial workers and changes in residential functions, the need for decent and affordable housing has become increasingly urgent. The local government needs to take strategic steps to provide housing suitable for industrial workers' needs, such as constructing simple rental flats (Rusunawa). The Semarang Regency Government has planned to build Rusunawa in Pringapus Subdistrict to meet industrial workers' housing needs. This step is expected to reduce pressure on informal settlements and improve workers' quality of life. Although there are plans for Rusunawa construction, challenges in implementation exist, such as land limitations, funding, and inter-agency coordination. The government needs to overcome these challenges through careful planning and cooperation with relevant parties.

Providing decent housing for industrial workers not only impacts their welfare but also social and economic stability in Pringapus Subdistrict. Adequate housing can increase work productivity and reduce social problems arising from slum settlements. In addition to the government's role, private sector involvement in providing housing for industrial workers is also important. Collaboration between the government and private developers can accelerate the construction of needed housing and ensure project sustainability. The housing need for workers in the industrial area of Pringapus Subdistrict is urgent due to rapid industrial growth and an increasing number of productive-age residents. The government needs to immediately realize Rusunawa construction and encourage private sector involvement in housing provision. These steps will help address housing issues and improve the welfare of industrial workers in Pringapus Subdistrict.

2. Labor Density and Its Impact on Housing Needs

Industrial areas, including those in Pringapus Subdistrict, Semarang Regency, have experienced rapid development in recent years. As a result of rapid industrial growth in the area, housing needs for workers have become an urgent issue. This is mainly driven by the increasing number of workers and job opportunities in the area. Improper planning in housing provision can lead to high population

density, traffic congestion, and decreased quality of life for workers living in the area.[10]

Industrial growth in Pringapus Subdistrict has driven increased urbanization, with many migrants seeking jobs in the industrial sector. This has caused increased demand for housing around the industrial area. However, the availability of decent and affordable housing has not been able to keep pace with the growing number of workers, forcing many of them to live in inadequate places. This condition causes various social and health problems that need to be addressed immediately. Increased housing needs have led to land use changes around the industrial area. Many agricultural lands have been converted into settlements or boarding houses to meet workers' housing needs.

This change impacts not only the environment but also local food security. Therefore, comprehensive spatial planning is needed to maintain a balance between housing needs and environmental sustainability. Rapid settlement growth around the industrial area is not matched by adequate infrastructure and public facility development. Many worker settlements lack access to clean water, sanitation, and public transportation. This condition can lower workers' quality of life and potentially cause public health problems. The government needs to pay attention to basic infrastructure development in new settlement areas. Most workers in the Pringapus industrial area have limited income, making it difficult to access decent and affordable housing. Many of them live in narrow boarding houses with minimal facilities.

3. Affordable Housing Needs

This condition emphasizes the importance of providing housing suitable for workers' financial capabilities, such as simple rental flats (Rusunawa). Rusunawa construction can be a solution to provide decent housing for low-income workers. Providing decent housing for industrial workers requires collaboration between the government and the private sector. The government can provide land and supportive regulations, while the private sector can play a role in housing

[10] Muna, Faizul. *Strategi Penyediaan Tempat Tinggal Bagi Buruh Industri di Kawasan Industri Bergas Kabupaten Semarang*. Diss. Program Pasca Sarjana Universitas Diponegoro, 2009.

construction and management. This partnership can accelerate the provision of needed housing and ensure project sustainability. In addition, community involvement in housing planning and management is important to create a comfortable and harmonious environment.

4. Potential and Challenges in Housing Provision

The lack of decent housing for industrial workers can lead to various social impacts, such as increased crime rates, disease spread, and social conflicts. Dense and disorganized settlements can also disrupt public order and environmental comfort. Therefore, adequate housing provision is not only important for individual welfare but also for overall social stability. To address housing issues in the Pringapus industrial area, sustainable housing development strategies are needed. These strategies include integrative spatial planning, efficient vertical housing construction, and adequate public facility provision. In addition, it is also important to consider environmental and social aspects in every stage of housing development. Thus, housing needs can be met without sacrificing environmental quality and community life. Effective housing provision planning requires accurate data and information on the number of workers, housing needs, and the socioeconomic conditions of the community. This data can be used to determine the location, type, and number of needed housing units. In addition, periodic monitoring and evaluation are also important to adjust planning to the dynamics of industrial area development. The government and related institutions need to enhance their capacity in data collection and analysis to support evidence-based planning.[11]

In addition to housing provision, worker welfare improvement can also be done through education and training. These programs can enhance workers' skills and productivity, giving them opportunities to earn better incomes. With increased income, workers will be better able to access decent housing and improve their quality of life. The government and companies need to collaborate in providing relevant education and training programs for workers. Housing needs for

[11] Suryani, S. *Perencanaan dan Desain Rumah Susun: Teori dan Praktik.* Bandung: Penerbit ITB, 2012.

workers in the industrial area of Pringapus Subdistrict are a complex and urgent issue. Rapid industrial growth has increased housing demand, but provision has not been able to keep up with these needs. The government, private sector, and community need to work together in planning and providing decent, affordable, and sustainable housing. Strategic steps such as Rusunawa construction, integrative spatial planning, and worker capacity enhancement.[12]

C. Technical, Social, and Environmental Aspects to be Considered in Planning Decent and Suitable Flats for Workers in Pringapus Subdistrict

1. *Technical Aspects*

Planning flats for industrial workers in Pringapus Subdistrict, Semarang Regency, requires a multidimensional approach, especially from a technical perspective, to ensure that the flats can truly support workers' living needs decently, safely, and sustainably.[13] Industrial workers generally have intense work rhythms, limited rest time, and high mobility. Therefore, the housing to be occupied must be properly designed—both in terms of geographical location, building structure, and constituent materials.[14]

1) Strategic Location Selection

The location of the flats is the most important factor to consider from a technical perspective. A location close to industrial areas, such as around PT Ungaran Sari Garment or other Pringapus industrial zones, allows workers to travel shorter distances to their workplaces. This directly impacts time efficiency, reduced transportation costs, and increased labor productivity. The presence of flats in a strategic location will encourage the creation of integrated residential-industrial zones, a modern

[12] *See* Ariansyah, Ridho Rifky. "Identifikasi Faktor Penghambat Penyediaan Hunian Pekerja Industri di Kabupaten Tangerang (Studi Kasus: Kawasan Industri & Pergudangan Cikupamas dan Kawasan Industri Millenium)." *Jurnal Muara Sains, Teknologi, Kedokteran dan Ilmu Kesehatan* 6, no. 2 (2022): 201-210.

[13] Hasan, A. *Perencanaan Kota dan Pembangunan Perumahan* (Yogyakarta: Graha Ilmu, 2010.

[14] Indah, Diani. *Implementasi Kebijakan Pengelolaan Rumah Susun Sederhana di Perkotaan*. Jakarta: Uwais Inspirasi Indonesia, 2022.

spatial planning approach already implemented in various advanced industrial cities.

2) Building Design Suitable for Needs
Architectural building design must also be tailored to the basic needs of industrial workers. Buildings must have good air circulation to support residents' health, especially in tropical areas like Semarang Regency. The use of natural lighting not only reduces dependence on electricity but is also psychologically and biologically beneficial. In this regard, tropical architecture principles such as cross ventilation, wide windows, and latticework are very important. Additionally, room layouts must consider minimum space requirements for workers' privacy, especially for those who are married. Housing types can be developed into several variants, such as studio units for single workers and 36 or 45 square meter units for small families, considering vertical land efficiency.
3) Environmentally Friendly Building Materials
Using durable and environmentally friendly materials is not only about long-term cost efficiency but also part of responsibility toward environmental sustainability. Materials such as lightweight bricks, heat-insulated roofs, and low-e (low emissivity) glass can help maintain indoor temperatures, keeping rooms cool during the day without air conditioning and warm at night. Moreover, local materials such as processed teak wood or bamboo can be alternatives with high aesthetic and energy efficiency values. In this context, the green building approach becomes an important reference in flat construction in industrial areas. Flats that not only accommodate housing needs but also reduce carbon footprint and maintain local ecosystem balance are an essential part of sustainable development.
4) Accessibility and Supporting Infrastructure
Another technical aspect is the availability of supporting infrastructure, such as road access, public transportation, clean water connections, electricity, internet networks, and good drainage systems. Good flats must be connected to collector or

arterial roads accessible by public or private vehicles. Thus, despite being close to industries, workers can still reach public service centers such as health clinics, schools, and markets. Vertical accessibility within the flat building must also be carefully considered. For flats with more than four floors, adequate elevators and emergency stairs must be provided. This is crucial for residents' safety and the building's functional suitability.

5) Technical Regulations and Building Standards
In implementation, flat construction in Pringapus Subdistrict must also refer to Ministerial Regulation PUPR No. 14 of 2007 on Technical Requirements for Flats, which regulates minimum building feasibility standards, availability of public facilities, and building resilience against disasters. Additionally, Government Regulation No. 16 of 2021 on Building Construction provides a legal framework regarding licensing systems, building functions, and technical classifications.

2. Social Aspects

Social aspects in flat planning involve understanding the socioeconomic needs and characteristics of workers. Industrial workers in Pringapus generally have limited income, making simple rental flats (Rusunawa) the appropriate choice. Rusunawa construction can help address housing needs for low-income workers. Additionally, it is important to provide public facilities such as community spaces, playgrounds, and sports areas to support social interaction among residents and create a harmonious environment. Social aspects in flat planning are a crucial element that must be holistically designed so that the constructed housing not only meets physical needs but also psychosocial needs of residents. In the context of flats for industrial workers in Pringapus Subdistrict, Semarang Regency, social aspects carry significant weight as they directly relate to the dynamics of workers' lives from various economic, cultural, and social backgrounds.[15]

[15] Effendi, R. *Perencanaan dan Pembangunan Perumahan: Perspektif Sosial dan Hukum*. Jakarta: Kompas, 2005

1. Workers' Socioeconomic Conditions
   Most workers in the Pringapus industrial area come from low to middle-income groups. According to data from the Central Bureau of Statistics (BPS) and the Semarang Regency Manpower Office, the majority of factory workers in this area earn around or slightly above the Regency Minimum Wage (UMK), which in 2023 was around IDR 2.8 million per month. With such limited income, accessing commercial housing such as subsidized housing or private rentals becomes a heavy burden for many workers, especially those with families. Therefore, constructing Simple Rental Flats (Rusunawa) is a realistic and targeted solution to meet the need for decent, financially affordable housing.
2. Importance of Socially Decent Housing
   Decent housing is not only viewed from its physical structure but also from its ability to support social interaction, security, and balance between private and public spaces. In many flat complexes designed without considering social aspects, problems such as crime, conflicts among residents, and low community participation in maintaining the environment often arise. Therefore, Rusunawa planning in Pringapus must be based on socially oriented housing principles, placing residents at the center of planning—people-centered housing.
3. Public and Communal Facilities
   To create a harmonious and inclusive environment, the existence of public facilities is very important. Facilities such as multipurpose rooms, children's playgrounds, prayer rooms or places of worship, and sports areas are not just complements but function as social cohesion binders among residents. Multipurpose rooms, for example, can be used for community activities, resident meetings, skills training, or even productive economic activities such as small bazaars or cooperatives. Without these elements, flats will only become socially barren multi-story buildings.

4. Social Diversity of Residents
   Industrial workers in Pringapus come from various regions and different cultural backgrounds, including migrants from outside Central Java. This requires inclusive social management that respects differences. Rusunawa managers need to implement policies that encourage cultural tolerance, participation in collective activities, and establish resident organizational structures such as RT/RW or resident forums. This will foster a sense of belonging and strengthen the social system within the flat environment.
5. Social and Economic Affordability
   Besides rental prices that must match workers' economic capabilities, it is also important to consider easy access to public facilities outside the Rusunawa environment, such as schools, health facilities, and markets. Affordability does not only mean cheap but also easily accessible and integrated with workers' and their families' daily lives. In other words, the ideal Rusunawa location should not only be close to factories but also connected to basic social facilities that comprehensively support workers' family lives.
6. Role of Government and Social Institutions
   The role of the local government is vital in ensuring that flats are not just a physical project but also a social program. Social assistance, health education, job training for workers' family members, and community empowerment programs can be conducted by the Social Service, Housing Department, and Manpower Office. Additionally, collaboration with NGOs or social foundations focused on decent housing and community development will strengthen the social impact of this project.
7. Need for Structured Social Governance
   In flat management, a clear and participatory social management structure is required. Flat management (managers, security, cleaning staff) must be professional yet close to residents. Information systems, complaint channels, and resident participation in decision-making processes (e.g.,

community meetings) are essential parts of healthy and inclusive social governance.

3. Environmental Aspects

Flat planning in industrial areas such as Pringapus Subdistrict, Semarang Regency, is not only required to meet decent housing needs for industrial workers but must also seriously consider environmental aspects. A healthy, clean, and sustainable environment is a basic right for every citizen, as mandated in Article 28H paragraph (1) of the 1945 Constitution, stating that everyone has the right to a prosperous physical and mental life, a place to live, and a good and healthy environment.

1) Land Use Efficiency
   Flat construction is a solution to land limitations in increasingly crowded industrial areas. However, this efficiency cannot only be measured by the number of units built on an area but must also consider the ratio between built space and open green space (RTH). Ideally, at least 30% of the land area should function as RTH, in accordance with the mandate of Law Number 26 of 2007 on Spatial Planning. RTH functions not only aesthetically but also as an environmental buffer that can absorb water, reduce pollution, and maintain air quality.
2) Solid and Liquid Waste Management
   Increased population density due to flat construction will directly impact the volume of domestic waste, both solid waste (household garbage) and liquid waste (used water from bathing, washing, and toilets). Therefore, waste management systems must be comprehensively designed. For liquid waste, a communal wastewater treatment plant (IPAL Komunal) is essential to prevent contamination of water channels or residents' wells. For garbage, the 3R principles (Reduce, Reuse, Recycle) must be implemented, and clear waste sorting facilities provided.

The integration of these three aspects is very important in sustainable flat planning. A holistic approach considering technical,

social, and environmental needs can produce housing that is not only habitable but also supports residents' welfare and environmental sustainability. Integrated planning can improve workers' quality of life and support economic growth in industrial areas.

D. Effective and Sustainable Flat Planning Models to Meet Housing Needs of Workers in the Pringapus Industrial Area

Effective and sustainable flat planning in industrial areas like Pringapus must respond to the evolving needs of workers as industrial investment increases. The ideal planning model is not merely about providing living spaces but also about creating functional, healthy, inclusive, and integrated living environments. In this context, flats must be designed considering three pillars of sustainability: technical, social, and environmental aspects, to ensure long-term durability and maximum benefits for residents and surrounding communities.

Technically, an effective flat model must use a compact housing approach with optimal vertical land utilization. This concept enables meeting housing needs within land limitations while preserving green open spaces around them. Additionally, buildings must apply modular design principles for more efficient and flexible construction. Modular design allows flat units to be built incrementally according to needs, with significant cost and construction time savings. This design also facilitates future maintenance and renovation processes.

Socially, planning must consider rental affordability for low-income workers, who generally earn below IDR 3 million per month. Simple rental flats (Rusunawa) are the most suitable model in this regard. The presence of Rusunawa significantly improves access to decent housing for industrial worker groups in the industrial area. Additionally, providing social facilities such as multipurpose rooms, parks, and places of worship will support social interaction among residents, create a sense of togetherness, and strengthen social cohesion.

Community-based housing planning needs to be integrated to build active resident participation in managing their housing.[16]

Environmentally, a sustainable flat model must use green architecture principles. This includes utilizing natural lighting, cross ventilation to reduce air conditioning use, using environmentally friendly materials, and efficient waste and rainwater management systems. Implementing green architecture principles not only reduces environmental impact but also improves residents' quality of life and reduces long-term operational costs.[17]

Integrating flats with public transportation and workplaces is an important strategy in sustainable planning. In the book "*Sustainable Urbanism: Urban Design with Nature*" by Douglas Farr (2008), it is stated that a short distance between residence and workplace reduces dependence on motor vehicles, lowers carbon emissions, and improves workers' life balance. Therefore, the ideal flat location should be within a 1–2 km radius of the industrial area or connected via scheduled public transport routes.[18] Furthermore, post-construction management is an equally important part of the planning model. Many flat projects fail in the long term not due to design but due to lack of proper management systems. A professional yet participatory management institution is needed to ensure facility maintenance, environmental management, and

[16] Ajiyunanta, Ardha, Bambang Adji Murtomo, and Dhanoe Iswanto. "Rumah Susun Sewa Buruh Pabrik di Kawasan Industri Kecamatan Pedurungan Kota Semarang." *IMAJI* 1, no. 2 (2012): 177-184.

[17] Subadra Abioso, Wanita, and Gilang Budi Kusnadi. "Green Approach in Designing Rumah Susun Sewa Sederhana (flat rent) in Rancacili Bandung Indonesia." *Journal of Engineering Science and Technology* 16, no. 4 (2021). *See also* Pernama, Angelia, et al. "Green Architecture for Flat: Study Case Bekasi Flat." *Tarumanagara International Conference on the Applications of Social Sciences and Humanities (TICASH 2019)*. Atlantis Press, 2020; Szczepańska, Magdalena, Anna Gałecka-Drozda, and Agnieszka Wilkaniec. "Green Space at New Housing Estates: Flat Price Versus Accessibility to Good Quality Greenery." *Sustainability* 15, no. 13 (2023): 9997; Ragheb, Amany, Hisham El-Shimy, and Ghada Ragheb. "Green architecture: A concept of sustainability." *Procedia-Social and Behavioral Sciences* 216, no. 6 (2016): 2016.

[18] Farr, D. *Sustainable Urbanism: Urban Design with Nature*. Wiley & Sons, 2008.

social supervision. Resident involvement in management will create a sense of ownership and strengthen social sustainability.[19]

Equally important is the regulatory framework and policy support. Flat planning for workers must comply with applicable regulations, such as Ministerial Regulation PUPR No. 14 of 2007 on Technical Requirements for Flats, and national housing policies promoting decent and affordable housing. The local government must also actively participate in land provision, development incentives, and field implementation supervision. Collaboration between government, private sector, and community is the key to the success of this planning model. With this multidimensional approach, flats will not only be a short-term solution to the industrial worker housing crisis but also part of realizing inclusive, sustainable, and humane cities. Pringapus Subdistrict has great potential as a pioneer in sustainable worker flat development, which can be replicated in other industrial areas in Indonesia.

E. Conclusion

The high need for decent housing for workers in Pringapus Subdistrict is a critical issue requiring serious attention. Based on demographic data and labor density, the Pringapus industrial area has significantly increased its workforce, especially with the presence of large industries such as PT Ungaran Sari Garment and other factories. Most workers are migrants from outside the region and do not have permanent residences. The limitation of formal housing causes most of them to rent in inadequate environments or live in rented houses under high-density conditions. Technical, social, and environmental aspects greatly influence the success of planning decent flats for workers. Technically, strategic location selection close to industrial centers, efficient land use, building design adaptive to tropical climates, and

[19] Kusuma, Nevine Rafa, Rossa Turpuk Gabe, and Triatno Yudo Harjoko. "Community Engagement and Children Spatial Needs in Rusun Kemayoran." *Proceeding of the 15th International Conference on QIR (Quality in Research)* Vol. 1411, 2017. *See also* Lau, Mandy. "Community-based housing solutions in Hong Kong: how and why have they emerged?." *International Journal of Housing Policy* 20, no. 2 (2020): 290-301; Chown, Ian. "Houses and flats." In *Metric Handbook*. London: Routledge, 2012, pp. 8-1.

modular construction systems are primary considerations. Socially, rental affordability, availability of public facilities, and community-based approaches are needed to create harmonious social life. Environmentally, green building principles must be well integrated through energy conservation, effective waste management, and provision of green open spaces to maintain urban ecosystem balance.

The effective and sustainable flat planning model in Pringapus Subdistrict must combine principles of inclusivity, efficiency, and sustainability. The concept of simple rental flats (Rusunawa) is the right choice as it can accommodate workers' financial limitations. Planning must be locally needs-based, involving stakeholders—local government, developers, and worker communities. Implementing a Transit-Oriented Development (TOD) based model and environmentally friendly design approaches will support the realization of worker settlements that are decent, affordable, and long-term resilient.

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