Housing profile: Analysing human settlement in fisheries village coastal area, North Jakarta

Kartika Putri1, Adenira Hargianintya1, Hayati S Hasibuan1* and Denny M Sundara1

1School of Environmental Science, Universitas Indonesia, Jakarta, 10430, Indonesia

*hayati.hasibuan@ui.ac.id

Abstract. Urban development is currently one of the main focuses of sustainable development, especially in SDGs point number 11. Coastal areas are potential areas for growth, both from an environmental, social, and economic perspective. However, this area is vulnerable to the threat of natural disasters, which impact communities' vulnerability, especially for their settlements. The coastal area settlements' condition still uses conventional materials, which tend to be not environmentally friendly. The research focuses on identifying and analysing fishery village areas, particularly human settlements and environmental problems. So that at the end of the study, we can find problems that hinder sustainable development and are useful as a database for the development of sustainable settlement designs in the future. The method used is mixed between quantitative and qualitative, with direct observation and secondary data analysis and considering several aspects such as socio-economic aspects, the environment as a whole, and physical elements of the building (material, architectural elements, zoning). The results showed that the area's existing design is directly proportional to the socio-economic level of the community and its socio-culture, as well as a problem point in the development of sustainable coastal settlements.

1. Introduction

Based on the Sustainable Development Goals (SDGs), one goal is to create resilient, safe, and inclusive settlements and cities. One of the indicators supports developing countries to build challenging buildings using local materials [1]. The problems currently faced in growing urban areas are uncontrolled population growth and urbanisation, so infrastructure development cannot be optimised [2]. This is because the population growth rate with infrastructure fulfilment is not balanced so that it harms social, economic, and environmental aspects [3], [4].

When associated with the concept of a sustainable city, which is a city that can achieve a dynamic balance between environmental, social, and economic aspects [5], as well as sustainable architecture, which is a concept that reflects the context of the environment, culture, technology, and architectural history, there is a similarity in one indicator, namely the use of materials—building as a form of efficiency [6]. Coastal areas were chosen as areas to be developed because they have environmental features such as natural resources, energy sources, and ecosystem services, as well as various socio-economic features that have the potential to be developed further [7]. However, coastal development needs special attention because it is vulnerable to natural disasters [8], such as rising sea levels and land subsidence. Land subsidence is a serious disaster that occurs mostly on the coast of North Jakarta. One of the causes is due to building loads [9]. This is evidenced by the beach houses that still use concrete,
zinc, and bricks, not by Indonesia’s geographical conditions. Apart from land subsidence, another problem is tidal flooding caused by rainfall, tidal effects, and land subsidence [10].

The settlement is defined as part of the residential area that consists of more than one house unit. It has the infrastructure, public facility, and supporting features in urban and rural regions. When viewed from the economic conditions, there are what are called cities and informal settlements. An informal settlement dominates coastal areas. Casual city (including informal settlement) is defined as a multi-dimension phenomenon involving land tenure, law and regulation, environmental quality, and population processes.

In comparison, informal settlements have several infrastructure problems, such as access to drinking water, basic sewer systems, electricity, etc. Meanwhile, housing has low structural quality, high density, and weak ownership [11]. This day, the coastal area's notion as a multipurpose urban space that focuses on residential functions that interact closely with its inhabitants has begun to shift the previous paradigm that was oriented towards industrial parts. Hence, coastal areas' regeneration must simultaneously promote economic, social, and physical development [12].

From the description above, we can see that the development of material-based urban areas, especially in coastal areas, is critical in sustainable development. The problems faced on the coast are also an opportunity to develop sustainable residential areas; One way is to create residential-based house designs with sustainable materials that respond to coastal problems. However, before planning and designing, it is necessary to identify and analyse existing coastal areas' living conditions, including the building’s environmental, social, economic, and physical characteristics. This paper examines facts and issues regarding the development of coastal settlements, particularly in the Housing Profile and settlements in coastal areas. This research can identify sustainable development problems on the seaside and be useful as a coastal development database, precisely residential spaces.

2. Method
This research method includes an explanation of location research, data collection, and analysis. The research and period location is selected based on several natural phenomena and diversity of socio-economics conditions that affect the human settlement. Data collection and data analysis were carried out by paying attention to health conditions and protocols because this research was conducted during the COVID-19 pandemic.

2.1. Case study location and period
The research location was conducted in North Jakarta, specifically in the Muara Angke fishing settlement area. This area is one of the cities that has experienced significant land subsidence annually. This phenomenon will have environmental impacts such as tidal flooding, damage to infrastructure, a decrease in the community's quality of life, and soon-affecting all Jakarta areas. It is because Angke is known as the centre of marine activities and products in Jakarta. Administratively, this area consists of 5 RWs, namely RW 01, RW 011, RW 20, RW 21, and RW 22. The specific location of the research was conducted in RW 22, which is located on the coastline. This area was chosen because it is situated between two ecosystems (sea and land) so that the threat to sea level rise, flooding, and land subsidence is relatively higher. Besides, this area can see the diversity of social and economic conditions of the community. The location selection in RW 22 was specific because the settlement conditions there were almost unfit for habitation, and many settlements used permanent and conventional building materials (dominated by plywood, concrete, brick).
2.2. Data collection and analysis
This research uses a combination of quantitative and qualitative methods. Quantitative methods used to collect data in the form of a time series regarding the area and existing buildings, natural conditions, and population demographics, aiming to see the fishing village's physical site. Meanwhile, we use qualitative methods to collect data on phenomena, especially social phenomena, at the research location. The results of the data are in the form of primary and secondary data. The data includes several aspects, such as environmental, socio-economic, and building aspects, including facades, zoning, and materials. Data collection was carried out through field observations using in-depth surveys. This in-depth survey includes documentation in photos and videos, manual sketches, and in-depth interviews with informants to validate findings during the study and add specific data. Apart from field observations, secondary data processing was also carried out from previous research, then added by interviews to obtain data about disasters in coastal areas. After the data is collected, the data is analysed to get conclusions to answer the research objectives. The analytical method used is descriptive analysis and spatial analysis. We use the descriptive study to describe field data and comprehensively reduce irrelevant data to investigate, determine the common thread of findings, and conclude previous data reduction results.

3. Results and discussion
3.1. Environmental condition
North Jakarta is part of the DKI Jakarta Province and closes to the coastal area. Therefore, this area becomes the estuary of 13 rivers in the Jakarta area. Moreover, North Jakarta is a city with serious land subsidence problems, reaching 2.5 m over ten years. As a result, the land surface was only 5 cm apart from sea level at the highest tide at one time. If this is allowed to continue, it negatively impacts humans and the environment, such as tidal flooding.
Figure 2. Zoning area on Pluit sub-district, North Jakarta (Google Earth, with modification, 2019).

Muara Angke (specifically at Fisheries Village Coastal Area) in the Pluit sub-district is an area close to the sea, which experiences severe environmental impacts. It has relatively high mobility and density because it is close to the Ports of Muara Angke and Kaliadem. The infrastructure in this area is related to the sea. An example is the existence of a fish market and facilities for drying fish. Besides, this area is also densely populated, and in the COVID-19 pandemic situation (at the time of this research), health protocols were not implemented correctly and adequately.

3.2. Socio-Economic Condition
Fisheries Village Coastal Area has diversity in socio-economic aspects like religion, livelihood, education level, occupation, and regional ethnicity. The woman has dominated the society at the non-productive range (0-4 years) and productive range (30-34 years). The education level of the residents of the fishing village is a high school graduate. However, the fisherman is not the dominant profession in the region. Almost half of the population are traders and employees. The findings in the location field, most of the residents in this area are not of Jakarta's native ethnicity but are considered 'indigenous' because they have lived long enough in Muara Angke.

Apart from being employees and fishermen, the residents' livelihoods repair the ship and peel some shell. These livelihoods are supported by its natural resources, namely shellfish (mostly green clams) and fish. Based on data from the Central Bureau of Statistics, they divide income levels into four groups: low, middle, high, very high. Almost half of the people in Fisheries Village have income around Rp 1,500,000 until Rp 2,500,000, which are lower than the Provincial Minimum Wage of DKI Jakarta in 2019 (Rp 3,900,000).

3.3. Characteristic of House in Fisheries Village
Semi-permanent public facilities and semi-permanent settlements dominate the buildings in the Muara Angke area. However, the buildings' conditions are inclined to be unfit for habitation because many of them are no longer intact (collapsed buildings), or the building-forming elements also use makeshift materials. Also, with a large amount of rubbish, including construction waste materials, this area tends to be uncomfortable to live.
Figure 3. Public Facilities on Fisheries Village Coastal Area (Author’s property, 2020).

The materials used for buildings in this area are mostly stone, brick, concrete, and sand. In the field, many unused buildings will leave dormant so that the remains of building materials accumulate and have the potential to become trash. Some non-permanent structures like small buildings (warung) and as a base for drying fish are made from non-conventional materials (wood, bamboo). Field survey results found that the average residential house has a building area around 10 m² – 75 m². Some of them are low-level houses or houses with partition. The house's orientation faces the street with 1.5 meter wide, but some of them face other homes with a distance of around 80 cm -1 meters. Based on residents' statements, they built their houses on top of the floor from shellfish waste and sedimentation. Besides, if high tide happens, there will be tidal flooding.

Figure 4. (a), (b), (c) Human settlement condition (Author’s property, 2020).
In Figure 4a, it can be seen that residential houses do not have clear zoning between residential areas and garbage storage areas. The house's front is filled with piles of garbage and can mix into the dwelling and the sewer. As a result, at certain times, this area experiences flooding, as shown in Figure 4b. At the same time, Figure 4c shows the interior of the house in this area. It appears that there is a combination of space functions between the dining room and the kitchen. Interior building materials are dominated by non-permanent materials such as plywood and zinc, and the conditions tend to be unfit for habitation.

Figure 5. Distance between houses (Author’s property, 2020).

The distance between houses, which is quite tight, can be caused by the concept of togetherness that is still adhered to by residents of the fishing village. This is evidenced by the many gathering and chatting activities, even during the COVID-19 pandemic. So that the distance between houses can help them to communicate between neighbours; however, this concept will create a loss of individual and social privacy for each individual. Coupled with the reasonably distinctive personal characteristics (as evidenced by a large amount of waste and the placement of natural resources placed carelessly), it gives the impression of being crowded and unorganised in this area.

Figure 6. Diagram between distance and voice (Author’s property, 2020).
The narrow distance between the houses will make the voices produced by the residents of the home clear. In Figure 8, the only vacant land available in the area is the road in front of each site. The road will become a public area for residents; therefore, the sound produced (whether from humans or other elements) will mix and have the potential to cause disturbing noise.

From the aspect of the physical building itself, the research results show that the houses' area in the fishing village area tends to be unfit for habitation, with $10 \text{ m}^2 - 75 \text{ m}^2$, roughly equivalent to the size of 1 room occupied by more than two people. The zoning between private and semi-private spaces will be irregular, and the circulation between areas in the home will not be good.

Facades and building materials also affect the physical appearance of residential areas. Most semi-permanent buildings are made of non-conventional materials such as bamboo, zinc, plywood, and wood. In contrast, permanent structures are made of heavy conventional materials such as stone, concrete, and brick. The outer facade for semi-permanent buildings is a linear arrangement that tends to be random and forms an opening pattern that indirectly forms air circulation, light, and human movement. Because of this, most semi-permanent buildings do not have elements such as doors and windows. This can have both positive and negative impacts. The positive impact is circulation, especially air and light, which can enter the house. However, due to environmental conditions that are quite humid (because it is close to the sea) and hot, and the behaviour of the people who do not care for the environment will indirectly affect residents' health and environmental sustainability.

From the findings above, each aspect of the data studied, such as house characteristics, natural conditions, and socio-economic conditions, has one thing in common: it harms the lives of the people who live in this area. Land subsidence that occurs, if allowed to continue, is predicted to cause Jakarta to sink in 2050 [13]. Socio-economic conditions that make this region vulnerable and find many obstacles to development. Existing residential houses manifest the negative impact of socio-economic phenomena and have a chain effect on natural conditions.

4. Conclusion
This research was conducted to describe residential areas' characteristics in the coastal area of the fisheries village of North Jakarta. The aspects seen in the analysis are the building's physical aspects, such as the facade, the distance between the houses, and the area of the house plan. Meanwhile, the environmental aspect sees land subsidence as a negative phenomenon for the environment. The socio-economic part highlights the economic level, age, livelihoods, and educational level of the population. Building materials are also one of the main highlights of this paper. Referring to the theory previously...
mentioned, the coastal areas in the research location, especially in the socio-economic aspects and settlement conditions, are under the theory regarding the description of cities and informal settlements. The phenomenon of land subsidence that occurs is also following the theory regarding the prediction of land subsidence in North Jakarta from year to year. So, we conclude that the design of the existing area is directly proportional to the community's socio-economic level and its socio-culture and a problem point in the development of sustainable coastal settlements based on residential building materials. Besides, this study's results prove that the theory regarding the concept of cities and informal settlements and the prediction of land subsidence is by the facts in the field.

Acknowledgements
This research is funded by the Grant of Indexed Humaniora International Social Indexed Publications (PUTI) Universitas Indonesia 2020 with contract number: NKB-2584/UN2.RST/HKP.05.00/2020. We also thank our family, friends, colleague, and the others who have supported this research.

References
[1] United Nations Sustainable Development Online: https://www.un.org/sustainabledevelopment/cities/
[2] WCED 1987 Our Common Future
[3] M Wolfram, N Frantzeskaki, and S Maschmeyer 2016 Cities, systems, and sustainability: status and perspectives of research on urban transformations Curr. Opin. Environ. Sustain 22 18 – 25
[4] S Maranghi, M L Parisi, A Facchini, A Rubino, O Kordas, and R Basosi 2020 Integrating urban metabolism and life cycle assessment to analyse urban sustainability Ecol. Indic 112
[5] A Y Al-Zoabi and O M Jarrar 2016 A sustainable city paradigm: criteria and indicators of efficiency Sustain. City XI 143–159
[6] H Niroumand, M F M Zain, and M Jamil 2013 A guideline for assessing of critical parameters on Earth architecture and Earth buildings as a sustainable architecture in various countries Renew. Sustain. Energy Rev 28 130–165
[7] E Loizou, F Chatzitheodoridis, K Polymeros, A Michailidis, and K Mattas 2014 Sustainable development of rural coastal areas: Impacts of a new fisheries policy Land use policy 38 41–47
[8] K H Ekosafitri, E Rustiadi, and F Yulianda 2017 Pengembangan Wilayah Pesisir Pantai Utara Jawa Tengah Berdasarkan Infrastruktur Daerah: Studi Kasus Kabupaten Jepara J. Reg. Rural Dev. Plan 1 145–157
[9] H Z Abidin, H Andreas, I Gumaril, Y Fukuda, Y E Pohan, and T Deguchi 2011 Land subsidence of Jakarta (Indonesia) and its relation with urban development Nat. Hazards 59 1753–1771
[10] I Rudiarto, W Handayani, and J S Setyono 2018 A regional perspective on urbanisation and climate-related disasters in the northern coastal region of central Java, Indonesia Land 7
[11] J Montoya, I Cartes, and A Zumelzu 2020 Indicators for evaluating sustainability in Bogota's informal settlements: Definition and validation Sustain. Cities Soc 53
[12] D H Kwon and S H Lee 2014 The Characteristics of Coastal Settlements -Focused on the Fishery Ports (Songjeong, Gudeokpo, Gongsu) in Busan J. Korea Acad. Coop. Soc 15 1770–1777
[13] D F Hiroshi Takagi, Takahito Mikami, Miguel Esteban 2016 Projection of coastal floods in 2050 Jakarta Urban Climate Projection of coastal floods in 2050 Jakarta Urban Climate 17 135 - 145