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Spatial Configuration of Muncar-Banyuwangi Fishing Village Based on Space Syntax (Case Study: Sampangan Hamlet)

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Abstract**—***Sampangan Hamlet is established as a slum area after the Minneapolitan program development in Muncar- Banyuwangi. This condition raises concerns that the spatial configuration formed after the development of the area does not support the clarity of the spatial structure, especially in the path of movement in this fishing village. This study aims to identify and describe the spatial configuration of Muncar Fishing Village. The research method used is in the form of spatial analysis with space syntax and GIS to uncover the spatial configuration. The research results show that settlement patterns in Sampangan are divided into three according to the location of the settlement areas, namely: perpendicular- parallel to the coastline, grid, and linear and spinal combined patterns. The highest scores for connectivity, integration and choice are in the main access that connects settlements with various social infrastructures, while the highest depth scores are found in residential areas that are far from the beach and far from main road access, but overall intelligibility/spatial clarity in Sampangan has included the high/strong category with a value of R^2 = 0.695 so that the spatial structure of settlements is easy to understand and can support the lives of the surrounding community.*

Keywords**—** *Spatial Configuration, Space Syntax, Fishing Village, Muncar-Banyuwangi*

I. INTRODUCTION

The dependence between humans and the environment in the form of the sea can be seen from the presence of settlements in coastal areas. Coastal settlements are usually inhabited by fishing communities (people whose lives depend on marine and fisheries functions), forming a coastal settlement commonly known as a fishing village. A fishing village as a settlement certainly experiences development from time to time, and this development can create environmental changes that affect the physical and non-physical space of the village which can affect its spatial configuration [1].

Spatial configuration in the context of settlements is a way that can be done to see the character/pattern/shape of settlements that not only understand settlements as physical spaces but also see the interactions between spaces and the people in them [2,3,4,5]. On the other hand, a spatial configuration can see the interconnections between spaces that form the organization or structure of space and the circulation of movement and human interaction within [6]. Furthermore, Farouk & Youssef in their study explained that spatial configuration is not only about spatial relationships/patterns but looking at the way spaces are connected to others as seen from the movement/patterns of movement in space [7].

Spatial configuration can be explained as a spatial description of settlements which can be analyzed using the space syntax approach. Space syntax is a method of translating spatial configurations through spatial relationship patterns so that everyone can read and understand them [8]. Kustianingrum in her research emphasizes that space syntax is used as a technique for depicting space, quantification, and interpretation of spatial configurations both in buildings and settlements diagrammatically [9]. Thus, the spatial configuration of a settlement can be translated using space syntax.

Sampangan Hamlet is a fishing settlement area located on the Muncar East Coast, Banyuwangi Regency, East Java. In 2012, Sampangan was designated as one of the Muncar areas which were developed into a Minneapolitan area, especially in the capture fisheries sector following Banyuwangi Regency Regional Regulation No. 08 of 2012. The existence of development of the Minneapolitan area in Sampangan can be seen physically in the presence of beach reclamation. The reclamation area on Muncar Beach is used as the location for the Beach Fishery Port (PPP) and Fish Auction Place (TPI) which are directly connected to the Sampangan Hamlet area. Unfortunately, in 2021 Sampangan will be included as a slum area on the Muncar East Coast according to the Banyuwangi No. 188/22/KEP/429.011/2021. This condition raises a suspicion that the spatial configuration formed after the development of the area does not support the clarity of the spatial structure of settlements, especially the clarity of the structure of the road network as a pathway for community movement.

The designation of Sampangan Hamlet as one of the slum areas in Pesisir Muncar after the development of the Minneapolitan area raises a prejudice that the spatial configuration that is formed does not support the clarity of spatial structure, especially in the road network for human movement. The purpose of this study is to find out and describe the spatial configuration of the Muncar Fisherman Village Banyuwangi. Furthermore, the urgency of the research is the importance of uncovering the spatial configuration of the Muncar Fishing Village precisely at the study locus of Sampangan Hamlet, so that environmental development phenomena that affect movement patterns and forms of settlements can be understood and can be used as a reference in planning future area development. Then, the absence of research that explains the spatial configuration of settlements

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in Sampangan Hamlet is the impetus for the author to raise this topic.

II. METHODS AND MATERIALS

This research covered the entire area of Sampangan Muncar Hamlet, including the Head of Hamlets (RW) 1, 2, and 3 as well as the reclamation area, which was then divided into 13 regional zones according to the Neighbourhood boundaries (RT). This study uses spatial analysis methods using space syntax and GIS to determine and describe the spatial configuration in Sampangan Muncar. The data collection method used is in the form of primary and secondary surveys, with data sources derived from observations, key persons, and satellite imagery maps in revealing the spatial configuration in Sampangan.

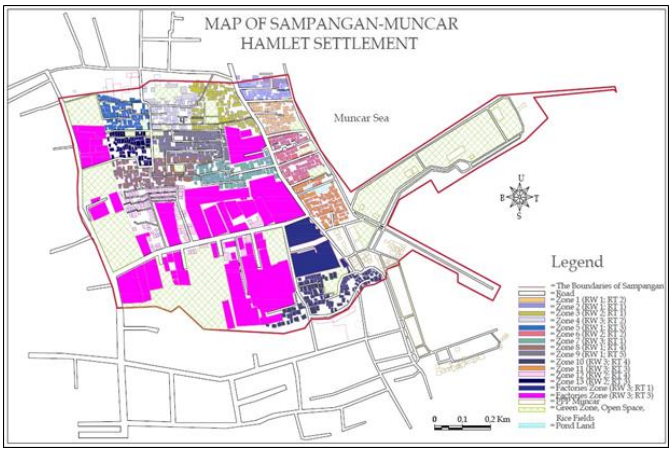

Fig. 1. Map of Sampangan Hamlet in Muncar Fishing Village

A. Waterfront Settlement Space Configuration Based on Movement Patterns

The road network and land use are morphological elements and part of the spatial configuration, which play a role in forming patterns of movement in the space of an area [10]. Cakaric explains that in waterfront settlements, a configuration is described through the relationship between water network patterns, movement patterns, and land use [11]. Therefore, the form of cities and coastal settlements is influenced by the phenomenon of the presence of water. Besides that, circulation or accessibility as a path of movement in settlements along the water forms a pattern that follows the shape/topography of the waters [12].

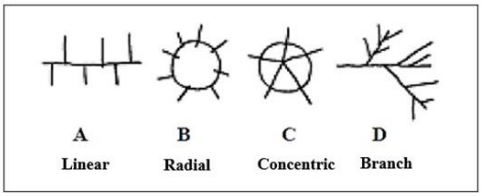

Fig. 2. Circulation Patterns of Coastal Settlements

In general, the pattern/type of road network in settlements is divided into 6 types, namely: grid, radial, ring-radial, spinal, hexagonal, and delta [13]. However, this condition is different from settlements that are directly connected to the waters. According to Rahman's study, the network/circulation pattern in settlements along the waters is divided into four patterns: linear, radial, concentric, and branch patterns [12]. These four patterns can be seen in Figure 2.

The relationship between fishing communities and the physical environment in the form of beaches causes coastal settlements to be divided into four main patterns. These four patterns are influenced by the existence of main access (roads for movement), the coastline, and land use for settlements [4].

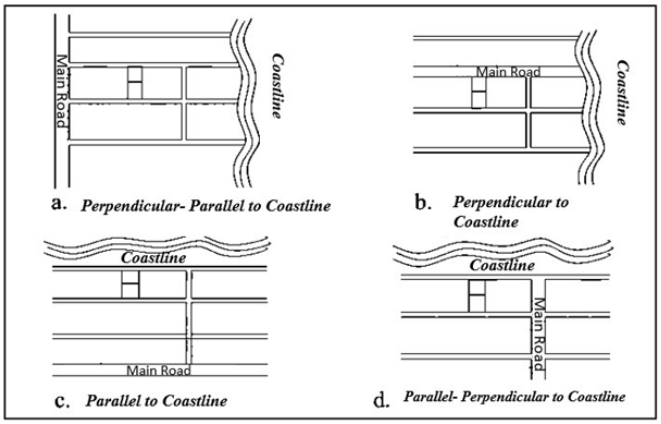

Fig. 3. Patterns of Fishing Village Settlements

B. Space Syntax in Spatial Configuration Analysis

Space syntax is a technique for studying architectural and urban phenomena directly which identifies the spatial relational scheme that composes its characteristic form [2]. In space syntax analysis, continuous space is transformed into a set of connected discrete units [3]. Furthermore, analysis of space syntax patterns and intensity of human movement can be read based on spatial configuration. Based on these conditions, the method approach using space syntax is a quantitative approach that studies the physical characteristics of settlements to explain precisely the hidden characteristics of the spatial pattern configuration [9].

TABLE I. Indicator Dimension of Space Syntax.

No	Indicator Dimension of Space syntax	Definition
1	*Connectivity*	A dimension value that measures local properties by calculating the number of spaces that are directly connected in a space configuration [14]
2	*Mean Depth*	The dimension value of the shortest distance between space elements [18, 19].
3	*Integration*	Dimension values measure global properties in the form of the relative position of each space to other spaces in the spatial configuration [17].
4	*Choice*	The probability value that falls on each shortest path that connects each road segment [18, 19]
5	*Intelligibility*	The value of the correlation level between local scale measurements (connectivity) and global/integrity scale measurements, indicates a network location that is well-connected and well-integrated [19, 14]

In the analysis of space syntax, in looking at the configuration of space based on movement or accessibility in

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the modeling area space or the type of map that is suitable for use in the form of an axial map (axial line) [3,14]. The axial map or axial line is the longest geometric line/longest visual line that can be drawn through a point in a spatial configuration [18]. There are several main indicator dimensions in space syntax, namely: connectivity, mean depth, integrity, choice, and intelligence with additional indicators in the form of choice [8,15,14].

The space syntax application used in this study is DepthmapX version 0.8 assisted by a GIS application (mapping) in uncovering space syntax. In this study, this application was used to find the spatial configuration indicator dimension values that had been set at the beginning, namely: connectivity, integration, depth, choice, and spatial intelligence/clarity, so that the values for each dimension were obtained. In general, the value of each dimension of this configuration indicator is used to answer questions about spatial configuration by describing it [20,21,18]. The parameter values for each variable in the DepthmapX 0.8 application are also shown in a color scale according to Figure 4.

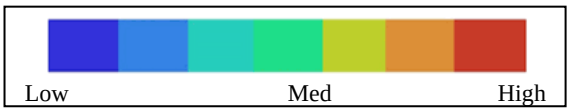

Fig. 4. Color Scale Parameter of DepthmapX

III. Results and Discussion

A. *Settlement Pattern in Sampangan Hamlet Based on Space Syntax*

Fig. 5. Perpendicular-Parallel to the Sea Line Pattern in Muncar Beach Settlements

Settlements that are right by the sea have a main circulation pattern in the form of a “Perpendicular-Parallel to the Coastline Pattern” (see Figure 5). This condition can be seen from the existence of the main access (main road) parallel to the coastline and forming environmental access perpendicular to Muncar Beach. This area includes Z1, Z2, Z3, and Z4, which in residential neighborhood access roads (narrow alleys) face perpendicular to the coastline, while the building layout is oriented towards neighborhood roads. If related to the socio-economic conditions of the Sampangan people, this is appropriate because the people who live in the area right on the edge of Muncar Beach are mostly fishermen, who depend directly on marine products. Therefore, with the form of a circulation pattern where the access road is directly connected to the sea, it will make it easier for local people to catch fish.

Settlements located farther from the waterfront, which includes Z5, Z6, Z8, Z9, Z10, Z11, Z12, and Z13, have a “mixed circulation pattern”, in which settlements close to the main access tend to form a “grid pattern” circulation. Then settlements adjacent to neighborhood/alley access roads tend to have a "linear and spinal combined walking pattern". The mixed pattern in the road network which is located farther from the Muncar waterfront is caused by organic or natural (unplanned) settlement development. This condition was triggered by the natural wealth of Muncar's sea which caused many migrants to come and live in Muncar to fulfill food and clothing needs, thus creating organic settlement development.

Fig. 6. Mixed Patterns of Settlements Further Away from the Muncar Beach

B. *Connectivity Dimension of Sampangan Hamlet based on Space Syntax*

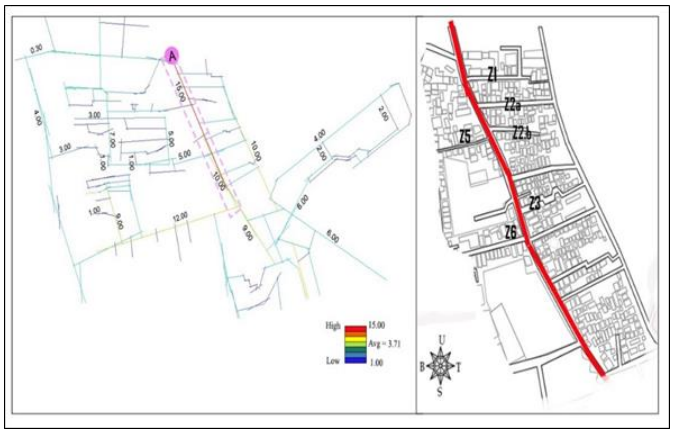

Fig. 7. Connectivity in Sampangan Hamlet

Based on the results of the connectivity analysis in Figure 6, the highest connectivity value is found in road corridor A (Z1, Z2, Z3, Z5, and Z6) which is depicted on a red scale with a value of 15.00. This high road connectivity indicates that the number of road spaces that are directly connected to road corridor A is 15 road corridors, of which road section A is the

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main access that can be used to reach local road access/small alleys around it. Thus, the potential for movement in this road space is greater, accessibility is high, and opportunities for social interaction are also high.

C. *Mean Depth Dimension of Sampangan Hamlet based on Space Syntax*

The area labeled B (area Z13) is the road space with the highest mean depth value of 9.538, this means that this area is quite difficult to reach from the main access because it is located on a neighborhood road or narrow alleys. In the area labeled B1 which is part of the beach reclamation, you can also see a red road with a value of 9.37, this condition is because the area is quite far from the main road access and is located right on the beach far from residents' houses. This condition certainly affects the range of human movement in that space, which means it can affect accessibility, level of social interaction, safety, and comfort of the environment.

Fig. 8. Mean Depth in Sampangan Hamlet

D. *Integration Dimension of Sampangan Hamlet based on Space Syntax*

Fig. 9. Integration in Sampangan Hamlet

The results of the integration analysis in Figure 8 shows that the area labeled A has a bright red color, which means it has the highest integration value, namely 1.56-1.64. This value indicates that road corridor A (main access connecting Z1, Z2, Z3, Z4, Z5, Z6, and Z7) is the most accessible road (high accessibility) compared to other road spaces. Therefore, street space A has the highest movement potential in the Sampangan Hamlet area, thus creating the potential for social interaction and high intensity of meetings between residents. This condition is supported by the fact that road corridor C is access that connects Muncar Harbor (C1), the factory area (C2), and densely populated settlements on the shores of Muncar Beach (C3).

E. *Choice Dimension of Sampangan Hamlet based on Space Syntax*

The highest choice dimension values are shown in road corridor A (Z1, Z2, Z3, Z5, and Z6) which are depicted in bright red with a value of 12,748. Corridor road A has the highest choice value indicating that the road is chosen by many users so that people's preferences for movement via road A are high. This condition should support the existence of social infrastructure throughout the area, encouraging social interaction and ease of accessibility. The fact is that along corridor A, precisely at Z1, Z2.c, and Z2.a, there are educational, shopping, and religious facilities that support the preferences of people's movements in this area.

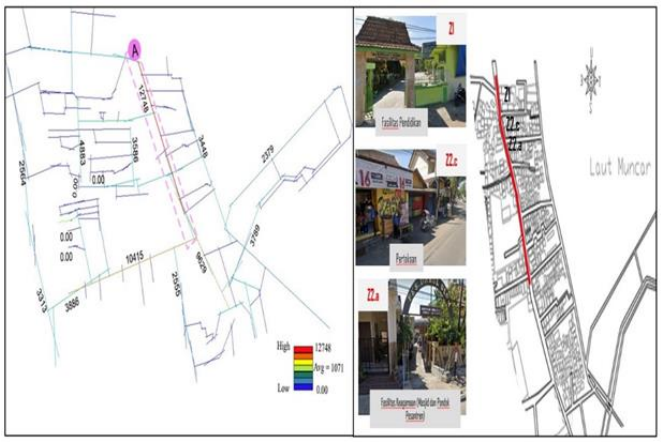

Fig. 10. Choice in Sampangan Hamlet

F. *Intelligibility Dimension of Sampangan Hamlet based on Space Syntax*

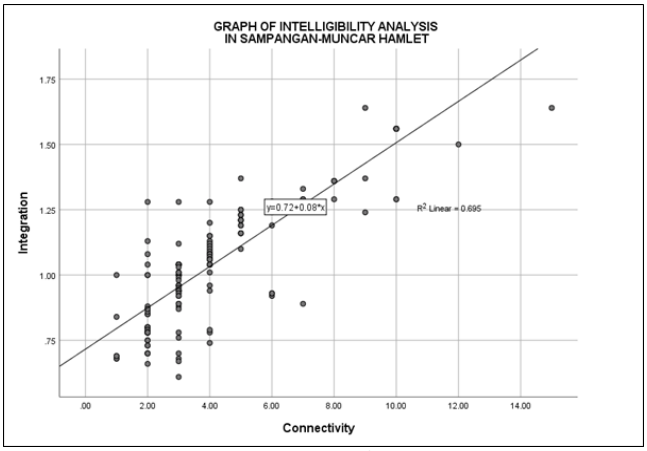

Fig. 11. Intelligibility Graph of Sampangan Hamlet

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The intelligibility dimension is the highest measurement of spatial configuration in space syntax as indicated by the R2 value of the correlation between connectivity and integration. The R squared value in Sampangan Hamlet is 0.695 which means that the level of spatial clarity in this area is in the strong/high category. This condition means that the network of roads/spaces for movement as a whole has a clear spatial structure so that users of the space/community of Dusun Sampangan can easily understand the spatial structure of their residence. Thus, the spatial configuration of Sampangan Hamlet can support the socio-economic conditions of the community with a clear spatial structure. In clarifying the value of intelligence can be seen in Figure 11.

IV. CONCLUSION

The establishment of Sampangan as a slum area in the Muncar coastal settlement after the development of the Minneapolitan area raises an assumption that the current spatial configuration does not support the clarity of spatial structure, especially in the movement paths in this fishing village. The results of this study indicate that the settlement pattern in Sampangan Hamlet, based on the location of the settlement as seen from the pattern of movement paths, consists of three types, namely: (1) a pattern perpendicular-parallell to the sea line in settlements that are right on the beach, (2) a grid pattern on settlements that are far from the waterfront but close to the main access, (3) a combined linear and spinal road pattern in settlements that are far from the beach but close to environmental road access (alley roads), then the value of integration, connectivity, the highest choice is in the area which is directly connected to the main road access on the waterfront (connecting Z1, Z2, Z3, Z4, Z5 and Z6) as a connecting route between settlements and social infrastructure facilities, while the high spatial depth dimension is in areas far from access the main road so that it can affect the level of accessibility and safety and comfort of the environment, on the intelligence/clearness of space on Du sun Sampangan is classified as high with a value of R2 = 0.695, this causes the community to easily understand the spatial structure of their residence, so that they can support the socio-economic conditions of the local community.

REFERENCES

[1] R. Muhammad, S. Bambang, and S. Agung Budi, "Discovering the themes of space in Penyengat Island," *Indian J. Sci. Technol.*, vol. 11, no. 30, pp. 1–11, 2018, doi: 10.17485/ijst/2018/v11i30/130250.
[2] B. Hillier and J. Hanson, *The social logic of space.* 1984.
[3] S. Bafna, "Space syntax: A brief introduction to its logic and analytical techniques," *Environ. Behav.*, vol. 35, no. 1, pp. 17–29, 2003, doi: 10.1177/0013916502238863.
[4] E. T. S. Darjosanjoto, "The Spatial Morphology of Traditional Coastal Settlements in Eastern Java, Indonesia," University of Manchester, 2002.
[5] W. C. Yudhanta, "Pengaruh Konfigurasi Dan Visibilitas Ruang Pada Aksesibilitas, Studi Kasus pada Kawasan XT Square Yogyakarta," *J. Arsit. KOMPOSISI*, vol. 12, no. 1, p. 67, 2018, doi: 10.24002/jars.v12i1.1647.
[6] U. N. Amalia, B. J. B. Gultom, and Affrilyno, "KONFIGURASI RUANG KAWASAN PASAR," *JMARS J. Mosaik Arsit.*, vol. 10, no. 2, 2022, doi: 10.26418/jmars.v10i2.57037.
[7] H. Farouk and M. Youssef, "Movement patterns analysis in the spatial configuration based on the notion of space syntax," *J. Eng. Appl. Sci.*, vol. 67, no. 2, pp. 353–372, 2020.
[8] B. Hillier, *Space is the machine*, vol. 18, no. 3. 2007.
[9] D. Kustianingrum, "Tatanan Spasial Permukiman Tak Terencana Kampung Babakan Ciamis Kota Bandung," *J. Itenas*, vol. 14, no. Desember, 2010.
[10] Tamin, *Perencanaan dan Pemodelan Transportasi*. Bandung: ITB, 2000.
[11] J. Cakaric, "Water phenomenon: Urban morphology transformation," *Facta Univ. - Ser. Archit. Civ. Eng.*, vol. 8, no. 4, pp. 375–388, 2010, doi: 10.2298/fuace1004375c.
[12] H. Rahman, "Pola Penataan Zona Massa Dan Ruang Terbuka Pada Perumahan Waterfront (Studi Kasus : Perumahan Pantai Indah Kapuk)," *Dimens. (Jurnal Tek. Arsitektur)*, vol. 34, no. 2, pp. 115–121, 2006, [Online]. Available: http://puslit2.petra.ac.id/ejournal/index.php/ars/article/view/16543.
[13] E. K. Morlok, *Pengantar teknik dan perencanaan transportasi (Introduction to transportation engineering and planning)*. Jakarta: Penerbit Erlangga, 1991.
[14] B. Hillier, A. Penn, J. Hanson, T. Grajewski, and J. Xu, "Natural Movement: or, configuration and attraction in urban pedestrian movement," *Environment and Planning B: Planning and Design*, vol. 20, no. 5. pp. 29–60, 1993, doi: 10.5694/j.1326-5377.1963.tb26584.x.
[15] Al-Sayed, K. A. Turner, B. Hillier, S. Iida, and A. Penn, *Space syntax methodology Bartlett School of Architecture*. UCL: London, UK, 2014.
[16] S. Soltani, N. Gu, J. J. Ochoa, and A. Sivam, "The role of spatial configuration in moderating the relationship between social sustainability and urban density," *Cities*, vol. 121, no. August 2021, p. 103519, 2022, doi: 10.1016/j.cities.2021.103519.
[17] B. Hillier and J. Hanson, "The Reasoning Art: or, The Need for an Analytical Theory of Architecture," in *Space Syntax First International Symposium*, 1997, p. 6.
[18] J. P. Siregar, *Metodologi dasar space syntax dalam analisis konfigurasi ruang*. 2014.
[19] F. Ulvianti and A. Anindita, "Integrasi dan Konektivitas Ruang Terbuka Publik di Kampung Kota (Analisis Space Syntax di Kawasan Pasar Simpang Dago)," in *Prosiding Temu Ilmiah IPLBI 2018*, 2018, pp. D020–D026, doi: 10.32315/ti.7.d020.
[20] J. Parlindungan, "Korelasi Antara Konfigurasi Ruang Publik Dengan Interaksi Sosial: Pendekatan Space Syntax Dengan Studi Kasus Pada Kawasan Perumahan di Kota Malang," *J. Tata Kota dan Drh.*, vol. 13, no. 1, pp. 15–22, 2021.
[21] R. Adriyanto, I. Aliyah, and G. Yudana, *SPACE SYNTAX: Kesesuaian Lokasi Ritel Modern Berdasarkan Analisis Space Syntax*. 2020.