1441

SPATIAL STUDY OF SOCIAL FACILITIES PLACEMENT IN DENSE SETTLEMENT USING SPACE SYNTAX ANALYSIS CASE STUDY: BANJAR BUALU, BENOA VILLAGE, BALI

by
Putu Gede Wahyu Satya Nugraha
Department of Engineering and Planning, Warmadewa University
Email: putugedewahyu@gmail.com

Article Info	ABSTRACT
	Banjar Bualu area is one of the densely populated residential areas in Benoa Village, Bali. The high population must be balanced with the number of social facilities to meet the needs for social, cultural, and economic activities of the community. But in reality, there is still a lack of social facilities built to accommodate the social activities of the local community. Social facilities play a role in providing space for socializing and interaction, so their location must be easily accessible from residential areas. This study aims to provide recommendations for the location of social facilities in the Banjar Bualu residential area, Benoa Village. The method used is a qualitative method with an exploratory approach through space syntax analysis with DepthmapX software, to see integration, connectivity, and also the potentials of space that can be used as social facilities. The method of data collection was carried out by non-participant observation and secondary data related to maps of the road network and buildings from settlements in the Banjar Bualu area. *This is an open access article under the CC BY-SA license.*

Corresponding Author:
Putu Gede Wahyu Satya Nugraha,
Department of Engineering and Planning,
Warmadewa University,
Jl. Terompong No.24, Sumerta Kelod, Kec. Denpasar Tim., Kota Denpasar, Bali 80239, Indonesia
Email: putugedewahyu@gmail.com

1. INTRODUCTION

In 2020 Benoa Village has a population of 41,722 people with a population density of 1,474 thousand people per km2. Along with the increasingly dense settlements in the Benoa Village area marked by an increase in population and activities, it has an impact on the emergence and development of many settlements, especially in the downtown area. Indirectly there has been migration due to the development of life in Benoa Village. Most outsiders choose to live in housing, of course, the land is also purchased and developed by investors, as a means of settlement due to the arrival of outsiders [1]. Limited land resulted in reduced land for social facilities to accommodate community activities. Social facilities have a significant role in residential areas, where they become community meetings and gathering spaces. Social facilities are used to hold social activities, such as community meetings, performances, health programs, and other social activities [2].

The Benoa Village area has an area of 28.28 km2 with 3 traditional villages and 16 Banjar Dinas. Banjar Bualu is one of the official banjars with an area of 20.2 hectares and a population of 2,277 people (BPS Badung, 2021). Banjar is a community that is smaller than the Traditional Village and is part of the Traditional Village and is the community of social life. Banjar Bualu location is close to the ITDC Nusa Dua tourism area, so many hotels and resorts are crowded with tourists. This has an impact on increasing population migration from outside the city and province who settled in the Banjar Bualu area. Even so, there are still no integrated social facilities to accommodate community social activities which are centered in the Banjar Bualu area. These social facilities must be placed in an easily accessible area to accommodate social interaction for all communities in scattered settlements. In a previous study, the relationship between community facilities to support social activities, especially parks and green spaces,

....

has value as a space to influence social interaction by having a function as a recreation room and a space to carry out outdoor activities [3].

Space syntax is best described as a research program that investigates the relationship between human societies and space from the perspective of a general theory of the structure of inhabited space in all its diverse forms: buildings, settlements, cities, or even landscapes. The point of departure for space syntax is that human societies use space as a key and necessary resource in organizing themselves. In doing so, the space of inhabitation has configured a term that space syntax recognizes as an act of turning the continuous space into a connected set of discrete units [4]. Space syntax can be used to see the connectivity or interrelationships between spaces and the spatial integration of the road network in settlements. The connectivity and integration of the space can then be linked to potential destinations for placing social facilities. Good connectivity and integration of space syntax can mean that an area is an area that has good accessibility and is easy to reach most. The high accessibility of the area can be considered the right area to place social facilities because it is an area that is a potential attraction and destination [3]. This study aims to determine the potential for placing social facilities that can be easily reached by the community in settlements to strengthen social interaction in the Banjar Bualu area, Benoa Village-Bali using space syntax analysis.

Connectivity dan integration: Analisis space syntax

People use the street as a space that involves action and reaction; space for a movement to find a place; space for a meeting to interact with others; space for a recreation activity; space for people to appreciate and remembers their history. Thus, the street is an important public space for human lifestyle in cities and towns. A street connects people from one point to a destination in any activity [5]. Thus, the street is an important public space for human lifestyle in cities and towns. A street connects people from one point to a destination in any activity. It is also identified as a space between blocks and as the edge of block in cities and towns. Studies related to space syntax represent streets as straight lines connecting nodes such as junctions to form a street network. Thus, a reflection of people's moving through the street network for their wayfinding to the destination is influenced by its connectivity [6]. Connectivity generally measures the configuration of space only in spaces that are directly connected in a configuration [7]. Connectivity measures how many roads are connected to the observed path. Connectivity is used to determine the level of interaction between each room and the spaces near the space. The main function of the connectivity value is to measure the level of intelligibility. Calculate the connectivity value by adding up all the rooms that are directly connected to the observation room. Integration is measuring the configuration from each space of origin to other spaces in a system. In general, it calculates how close the observation space is to all other spaces and can be viewed as a measure of relative asymmetry [7]. Integration measures how integrated a road (or center) to the Integration network can be considered to represent the potential of a destination. The more space that is connected to the observation room, the higher the integration value [3]. Connectivity and good integration of the syntax space can mean that an area is an area that has good accessibility and is easy to reach the most. The high accessibility of the area can be considered the right area to place social facilities because it is an area that is a potential attraction and destination. Intelligibility is the highest measurement stage in the syntax space. The intelligibility value shows the level of correlation between local scale measurements (connectivity) and global scale measurements (integrity). Thus, intelligibility is a measurement of the structure of a spatial configuration. In contrast to connectivity and integrity, the results of the intelligibility measurement will become properties in the room configuration system, while the results of connectivity and integrity measurements will become properties in each room [3].

Social Facilities

Kuswartojo (2010) explained that large-scale (mass) housing is not only a matter of area and the number of people accommodated, but more important terms of meeting service needs. In addition, the ease and efficiency of providing facilities [8]. The facilities in question are social facilities in housing. Budihardjo (1998) describes housing facilities as facilities and infrastructure for the housing environment. The housing facilities and infrastructure in question include:

- Social services, such as schools, clinics, health centers, and hospitals, are generally provided by the government.
- Social facilities, such as places of worship, funerals, conference halls, sports fields, playgrounds, open spaces, shops, markets, and street stalls [9].

Chitrakar (2016) revealed that when public space does not exist in an urban environment it will have a significant impact, such as residents finding it difficult to find a place to meet and interact with others [10]. The challenge in increasing social interaction in public spaces is how to encourage citizens to interact continuously in their environment [11]. The challenge to encourage these residents is not only based on the quality of social facilities but also on the location of their placement in residential areas. In previous studies, social facilities in housing

....

development have an important role as a space for gathering and fostering social relations among residents. Good accessibility is one of the factors that influence the use of social space and facilitates social interaction in it [2].

Social welfare in the housing environment can be seen from the level of interest and willingness of the residents of housing to take advantage of these facilities. If any of them are looking for facilities outside of housing even though the facilities have the same function, it can be concluded that the available facilities cannot answer their needs [12].

Accessibility based on Penchansky and Thomas (1981) can also be explained in terms of affordability, acceptability, availability, and adequacy [13]. According to Black (1981), accessibility is a measure of the convenience or ease of land use locations interacting with one another and the ease or difficulty of these locations being reached through the transportation network system. Based on some of the literature found, it is concluded that accessibility can be defined as the ease of accessing destinations that can provide comfort for activities. The accessibility of social facilities in a residential environment explains the ease of getting social facility services in a residential environment which can service be measured by social facilities, from the distance and the intensity of use of social facilities [14].

2. RESEARCH METHOD

The method used for this research is experimental quantitative [15]. Banjar Bualu area is used as a case study in this study to find the potential for placing social facilities in dense settlements in Nusa Dua, Benoa Village, and Bali by using spatial configuration testing. By connecting connectivity and integration to the existing circulation patterns in the settlement. This experimental research was conducted using simulation, the researcher made a plan proposal by going through a simulation study and testing the problem-solving plan model [16]. This simulation research uses existing data in the research case. Interventions are only carried out within the boundaries of the case being studied and then simulated.

2.1 Data Collection Method

The purposive sampling method was used in this study, where the selected area is considered one of the densest settlements in the Banjar Bualu area and does not yet have adequate social facilities. The purposive sampling technique, also called judgment sampling, is a deliberate choice determined by the researcher for certain considerations because of the qualities possessed so that later it will be more representative [17]. Data were collected through primary data and secondary data. Primary data is carried out through field observations to determine the physical shape of the road and the observation area. While secondary data is data regarding research related to space syntax. The secondary data used were taken from the South Kuta District Map and google earth satellite imagery.

2.2 Data Analysis Method

Axial analysis of the space syntax is used to see the connectivity or interrelationships between spaces and the spatial integration of the road network in the settlement and then linked to the potential destinations for placing social facilities. The space syntax simulation was carried out using the DepthmapsX (Multi-Platform Spatial Network Analysis Software) software from UCL. This analysis technique simulates the spatial configuration based on observations of natural steps from various forms of grid layout of the existing road network in the area. These steps arise due to various factors, one of which is attraction. This attraction is then seen as something that determines the movement of pedestrians [18]. The potential attraction of the space will be used to place social facilities which basically can be easily reached by the community in the settlement.

3. RESULTS AND ANALYSIS

3.1 Connectivity, integration dan intelligibility: Analisis space syntax

At this stage, we will discuss the analysis of the spatial configuration in the case study using space syntax related to connectivity, integration, and intelligence. Connectivity measurements are carried out to find the level of interaction between each room and adjacent rooms. The calculation of the connectivity value for each room is done by adding up all the rooms that are directly connected to the observation room. Connectivity in this analysis results is considered as a potential destination that is sub-section or local. Meanwhile, for potential destinations that are global, the region is represented by the results of the integration analysis. Image 1 below is the result of the connectivity analysis of the space syntax.

1444

International Journal of Social Science (IJSS)
Vol.2 Issue.2 August 2022, pp: 1441-**1448**
ISSN: 2798-3463 (Printed) | 2798-4079 (Online)

Figure 1. Banjar Bualu Connectivity analysis

It can be seen in figure 1, the minimum connectivity is 4 in dark blue and the maximum value is 121 in red. Meanwhile, the average value is 36.8403. The highest value is located on Siligita Street, but in this context, it is not the target of the analysis results because it is outside a residential area or has public access.

Table 1. Street Connectivity Analysis

Attribute	Minimum	Average	Maximum
Connectivity	4	36,8403	121

Analysis of the road used to place social facilities must be in a residential area. Several locations have the potential because they have a high value, which can be seen in table 2. Of the three locations, the first Siligita Shortcut Road has the highest score of 76 which is located in a residential area with close access to the main Siligita road. Second, Gang Sunyi is located in a dense residential area but has narrow access of about 2m wide which can only be passed by motorbikes with a score of 69. Lastly, Jalan Flamboyan XV with a score of 63, the drawback is that there is no parking space for vehicles. Thus, the South Siligita Short Road can be considered the right location for the placement of social facilities that are sub-section or local because it has the most connections to the surrounding roads.

Table 2. Street Connectivity Results

1	Pintas Siligita Selatan Street	**76**
2	Sunyi Alley	**69**
3	Flamboyan XV Street	**63**

3.2 Integration
Integrity is one of the measurements in space syntax because, with this measurement method, an analysis of the configuration of space as a system can be carried out. The calculation of this integration also involves spaces that cannot be observed from the observation room, where the assessment of the integrity of space will involve all other spaces in a spatial configuration [19].

1445

....

Figure 2. Banjar Bualu Integration analysis

The results of the analysis of the integration of space syntax in the Banjar Bualu area show that the minimum value is 0.902501 in dark blue and the maximum value is 2.3102 in red. Meanwhile, the average value is 1.5571. The highest value is located on the main road of Siligita, but in this context, it is not the target of the analysis results because it is outside a residential area or has public access, or is directly connected to other areas.

Table 3. Street Integration Analysis

Attribute	Minimum	Average	Maximum
Integration	0,902501	1,5571	2,3102

The analysis of the road used to place social facilities must be in a residential area so that the road that has the highest value is on Kuruksetra Street with a value of 1.969238. This road can be considered the right location for the placement of social facilities that are global or major in the entire Banjar Bualu area because it has the highest destination potential in the entire region. This is associated with the theory of natural movement [20], the distribution of this integrity value can produce a hypothesis about the tendency of pedestrians or outdoor activities to occur in spaces with high integrity values. In addition, there is another road that has a fairly high integration value and is located in the middle of a settlement, namely Sale Alley with a value of 1.728833.

3.3 Intelligibility

Intelligibility is a hypothesis on the ease of observers (space users) in understanding the spatial structure in a spatial configuration. A high intelligibility value indicates that connectivity at a local scale reflects the ease of access to other spaces [21], whereas a low value reflects that the structure of space (global) cannot be understood from the existence of space as a whole partial (local) so that observers tend to get lost easily.

....

1446

International Journal of Social Science (IJSS)
Vol.2 Issue.2 August 2022, pp: 1441-1448
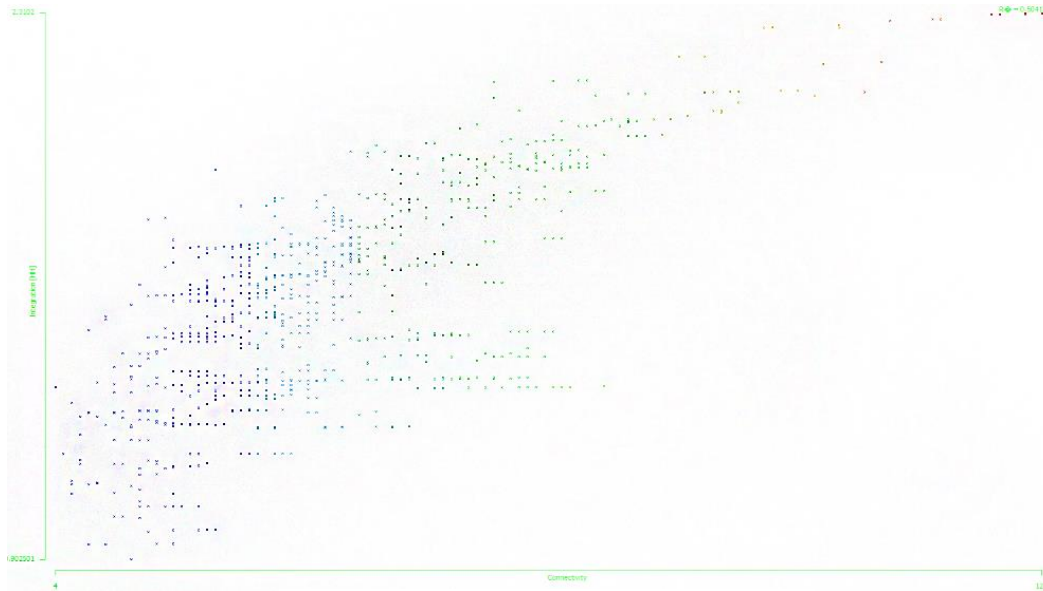**ISSN: 2798-3463 (Printed) | 2798-4079 (Online)**

Figure 3. Intelligibility analysis scatter map

In this spatial configuration, the distribution of connectivity and integrity values results in low intelligibility (R = 0.504138). It can be observed in the axial map connectivity that the highest value is on a different road with axial map integrity, which means that the central area has very good proximity to other spaces but this central area is not fully capable of acting as a gathering room. Thus, it can be assumed that the space tends to be divided into several parts according to the location of the main gathering room. Therefore, the type of placement of social facilities that can be applied can be divided or not centralized at one point.

4. CONCLUSION

By using space syntax, this research can determine the potential for placing social facilities in Banjar Bualu, Benoa Village, and Bali with connectivity, integration, and intelligibility approaches. The placement of social facilities obtained can be in the form of social facilities that are local and global to the region. Local social facilities can be placed around Pintas Siligita Selatan Street or Flamboyan XV Street, while global social facilities can be placed around Kuruksetra Street with the alternative at Sale Alley. Intelligibility shows a low value so basically, the placement of social facilities is very good for other spaces, but this global social facility is not fully capable of acting as a gathering room, so social facilities are needed that are divided or not centered at one point. This supports the need for local social facilities or sub-sections.

REFERENCES

[1] F.I Gede Agus*, et al.*, " Migrasi dan Perubahan Sosial di Nusa Dua 1970-2013,"*Jurnal Humanis, Fakultas Ilmu Budaya Unud,"* vol. 19, pp. 433-440, May 2017.
[2] Yuliastuti, N., Sukmawati, A. M., & Purwoningsih, P, "Utilization of Social Facilities to Reinforce Social Interaction in Formal Housing," *Archnet-IJAR: International Journal of Architectural Research*, Vol.12(1), pp.134–151, 2018.
[3] Ramadhan. T.,Ramadhan.G.,Wijaya.K & Permana. Y.P, "Kajian Spasial Penempatan Fasilitas Sosial Di Permukiman Padat Kota Bandung Menggunakan Analisis Space Syntax Studi Kasus: Wilayah Kelurahan Burangrang, Kecamatan Lengkong, Kota Bandung," *Arcade Jurnal Arsitektur,* Vol. 2(2),pp. 66-72, July 2018.
[4] Bafna.S, "Space syntax: A brief introduction to its logic and analytical techniques," Vol. 35(1),pp. 17-29, 2003.
[5] Jiang B., & Claramunt. C, "Topological analysis of urban street networks," *Environment and Planning B: Planning and design*, Vol.*31*(1),pp. 151-162, 2004.
[6] Mohamad, W. W., & Said, I,. "A review of variables of urban street connectivity for spatial connection," In *IOP Conference Series: Earth and Environmental Science* ,Vol. 18, No. 1, p. 012173, February 2014.
[7] Hillier, B., & Hanson, J. *The Social Logic of Space*. Cambridge University Press, Cambridge, 1984.

....

[8] Kuswartojo, T. "*Mengusik Tata Penyelenggaraan Lingkungan Hidup dan Pemukiman: Mengusik Tata Penyelenggaraan Lingkungan Hidup dan Pemukiman*," Bandung: Kelompok Keahlian Perumahan dan Permukiman ITB, 2010.

[9] Budihardjo, E. "*Kota Yang Berkelanjutan*." Bandung: P.T. ALUMNI, 1998.

[10] Chitrakar, R. "Meaning of public space and sense of community: The case of new neighbourhoods in the Kathmandu Valley." *Journal of Architectural Research: ArchNet IJAR*,Vol. 10(1),pp. 213–227, 2016.

[11] Zhang, W., & Lawson, G. "Meeting and Greeting : activities in Public Outdoor Spaces Outside High-density Urban Residential Communities," *Journal of urban Design International,* Vol.14,pp.207–214, 2009.

[12] Golany, G. *Social Planning, New Town Planning, Principles and Practice*. New York: John Wiley and Sons Inc, 1976.

[13] Ngui, André, N. & Vanasse, A. "Assessing spatial accessibility to mental health facilities in an urban environment." *Spatial and Spatio- temporal Epidemiology 3*, pp.195 – 203, 2012.

[14] Tamin, Ofyar Z. *Perencanaan dan Permodelan Transportasi Edisi Kedua*. Bandung: Penerbit IT, 2000.

[15] Groat, L., & Wang, D. *Architectural Research Methods*. Canada: John Wiley and Sons, Inc, 2002.

[16] Warada, W., & Mutiara, D."Analisis Space Syntax Rumah Susun Berbasis Gang Kampung". *In Simposium Nasional RAPI XII* (pp. A59-63). Solo: FT UMS, 2013.

[17] Etikan, I., Musa, S. A., & Alkassim, R. S. "Comparison of Convenience Sampling and Purposive Sampling." *American Journal of Theoretical and Applied Statistics*, Vol.5(1),pp. 1–4, 2016.

[18] Adiyanto, J. "Kajian Perubahan Ruang Terbuka pada Kawasan Bersejarah dengan Metode Space Syntax (Studi kasus Kawasan Kampung Kapitan Palembang)." *Jurnal Perencanaan Wilayah Dan Kota*,Vol.27(2),pp.103. Available: https://doi.org/10.5614/jrcp.2016.27.2.3

[19] Hillier, B. Space is the machine: *A Configuration Theory of Architecture*. Design Studies (Vol. 18). London: The Press Syndicate of The University of Cambridge, 2007. Available: https://doi.org/10.1016/S0142-694X(97)89854-7.

[20] Hillier, B., Penn, A., Hanson, J., Grajewski, T., & Xu, J. "Natural Movement: or, Configuration and Attraction in Urban Pedestrian Movement." *Environment and Planning B: Planning and Design*,Vol 20,pp. 29–66, 1993.

[21] Hillier, B., Burdett, R., Peponis, J., & Penn, A. *Creating Life: Or, Does Architecture Determine Anything? London WCIH OQB*, Great Britain: Bartlett School of Architecture and Planning University College London, 1987.

....

THIS PAGE HAS INTENTIONALLY BEEN LEFT BLANK