

## Vertical space utilization in sasangu urban area of South Korea

<sup>1</sup> Pathmasiri EHG, <sup>2</sup> Shin Min A, <sup>3</sup> Bandara TWMTW

<sup>1</sup> Department of Geography, Sangmyung University, South Korea

<sup>2</sup> Department of Korean Language, Dongseo University, South Korea

<sup>3</sup> Department of Geography, University of Peradeniya, Sri Lanka

### Abstract

Traditionally space and place considered as two ends of a continuum generalized location/space at one end and particularistic place at the other. However, in recent years, geographers have attempted at putting place and space together. The study attempts to explain the dialectic interrelationship between urban place and space based on place theory.

**Keywords:** Location, Place, Place theory, space, urban planning,

### 1. Introduction

Space and place are fundamental concepts in geography and to the extent that geographers have defined geography as 'science of place' as well as 'spatial science'. Space is regarded largely as a dimension within which matter is located or a grid within substantive items are contained (Agnew, et.al, 2011) [2]. However, the place is more than location; it has more elements except location; namely locale and sense of place (Agnew, 1987) [1].

On the other hand, space and place are interrelated concepts. There are several ideas about the relationship between the place and space. One common idea is that space comes first as a natural fact and place comes then as a social product (Harrison and Dourish, (1996) [9]. Sack (1997) [20] also defines space as a property of natural world and place as a social product. The relationship is referring as the layer cake model (Kling, et.al, 2000) [13].

Some researchers describe 'space' as the geometrical arrangements that might structure, constrain, and enable certain form of movement and interactions and 'place' as the ways in which settings acquire recognizable and persistent social meaning in the course of interaction. The key idea is that space is the opportunity and place is the (understood) reality (Dourish, 2006) [6]. From that point of view, catch/use or not the opportunity (in other words exploit or not space) is depending on the social practices/technology of the society. In this sense, if space (horizontal or vertical) is used for social practices by using technology, it becomes a resource and if does not use it is just a property of the natural world. On the other hand, some socio-economic, political and cultural rules of place restrict the use of space. For example, in Kandy city of Sri Lanka, it is prohibited to exploit the vertical space more than 12 meters by artificial structures/buildings (UDA, 2002) [23]. Therefore, some say that place and space are dialectically interrelated (Lefebvre, 1991) [15].

Places are invariably parts of spaces and spaces provide the resources and the frames of reference in which places are made. According to place theory location, locale and sense of place are interwoven main elements of any kind of place (Agnew, 1987) [1]. Further, places are woven together through

space by movement and the network ties that produce places as changing constellations of human commitments, capacities, and strategies (Agnew, et.al, 2011) [2].

Limitation of physical and human resources would lead to socio, economic, cultural and political problems in the place (Pathmasiri, et.al 2016a) [18] and would lead to devaluate the power (socio-economic, political and cultural) of the place in the network of places. Therefore, social structures of the places force its institutions to plan, innovate and to use new technologies for solving the problems.

Lack of land resources, lack of facilities, deforestation, pollution, environmental degradation, etc are some of the main problems of urban areas of the world. However, the strategies used for solving these kinds of problems differ among places. Decentralized its urban function to rural areas, neglecting environment pollution, and degradation, extracting vertical space instead of horizontal space are some of the strategies used to solve the urban land resource related problems. Urban function decentralization and urbanization on ecologically sensitive lands such as forest and water leads to devaluate the power of place. On the other hand, vertical space utilization for the urban function is an effective but very high-cost effort.

Busan metropolitan city, the second largest city of South Korea is expanding horizontally (increased the urban land area) as well as vertically (increased the vertical floor space area by establishing malty store buildings). The city is doing leading roles in logistic functions (as the gateway to the northeastern area in Asia), economic, information, financial functions (as one of the capital regions of the country), tourism functions and the central management functions in the southeastern economic region of South Korea (Shin, 2003) [22]. Hence, the understanding of the physical expansion of a city is essential for planning and managing the growth of the city.

### 2. Objectives

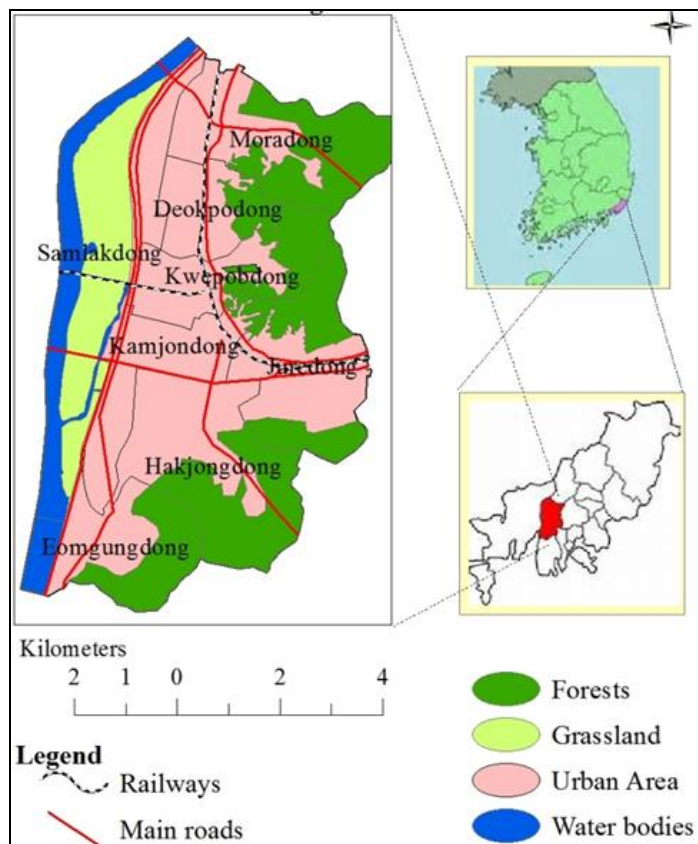
The main objective of the study is explaining the dialectic interrelationship between place and space and the second objective is identifying the trends, patterns in vertical and

horizontal space utilization for the urban functions of Sasangu urban area of Busan metropolitan city.

**3. Methodology**

To achieve the objectives of the study a case study was

conducted in Sasang Administrative District (SAD), one of the 16<sup>th</sup> of administrative subdivisions of Busan metropolitan city (Figure 2).



**Fig 1:** Location and main landuse types of sasangu urban area

Row data related to the buildings and population of SAD that collected by the SAD urban council used for the study. Total number of buildings in SAD (in 1995 was 17,363; in 2005 was 20,310; and in 2016 was 25,203) was used for the study. SPSS 19, excel and ArcGIS 10.1 software were used for analyzing and presenting the data and information.

**4. Result and discution**

Sasang administrative district (SAD) is located on Nanjong valley and the east bank of Nakdong River. Geographically

the study area is located in between latitudes of 35.2096<sup>0</sup>N - 35.1331<sup>0</sup>N and longitudes of 128.9683<sup>0</sup>E - 129.0313<sup>0</sup>E and SAD is a part of Busan industrial and financial city of South Korea. Total land area of SAD is about 55km<sup>2</sup> and about 54.8% of the total area was urbanized. Forests, grassland/flood plain, and water bodies cover about 23.8%, 10.7% and 10.9% in respectively (Table 1). Grassland area also includes to the urban area for management purposes. Hence, the urban area is about 65%.

**Table 1:** Landuse pattern of Sasangu administrative district 2016

Sub division	Urban area (ha)	Forests (ha)	Water bodies (ha)	Grass Land (ha)	Total (ha)
Kamjondong	348	130	0	0	478
Kwebobdong	345	144	0	0	489
Deokpodong	216	131	0	0	347
Moradong	501	259	0	0	760
Samlakdong	144	0	590	524	1258
Eomkungdong	438	85	8	66	597
Juredong	476	227	0	0	703
Hakjongdong	548	341	0	0	889
Total	3016	1317	598	590	5521
%	54.6	23.8	10.9	10.7	100

Source: calculated based on Esri ArcGIS 10.1 online map of SAD

According to Sasang urban council data, during last two decades, total population of SAD has gradually decreased from 295,666 in 1995 to 277,558 in 2005 and to 236,014 in 2016. Hence, during the period depopulated the area at a rate of -0.96% per year and population density for the urban area has decreased from 8,250 in 1995 to 6,585 in 2016. Most populated subdivisions of SAD in 2016 are Jeredong (56,558) and Moradong (43,165). However, figures of population density are higher than the average at Deokpodong (12,538), Juredong (11,932), Moradong (8,582) and Eomkungdong (7,735).

Development/urbanization process of SAD cannot be understood without paying attention to the historical development of Busan city as well as the historical events of South Korea (Pathmasiri, et. al, 2016b) [19]. The area has evolved as a peripheral part of Busan city. Since 1995, SAD is also administrated as a part of Busan metropolitan area. Therefore, spatial patterns of space utilization for the urban functions of SAD is directly interrelated to Busan metropolitan area development and management policies and plans.

Spatial planning's of independence South Korea such as 'Five Year Development Plans' that implemented from 1972 to 1997 and 'Ten Year Comprehensive National Territorial Plans' that are implemented since 1972 are directly affected on the urbanization and development of SAD. After 2000, South Korea is practicing the 'No Development without Plan' policy for avoiding unplan development related urban problems (Kim, 2012) [11].

Present landuse pattern of SAD is based on the 'Policy of Production Increase per Labor' under the 'Busan Master Plan 2011' to increase the residential landuse (Lee, et al., 2013) [8]. Reorganizing the urban spatial structure and preparing comfortable living environment are two of main objectives of the plan (Shin, 2003) [22]. Under the plan Busan city has developed by dividing three regions; eastern part as international and tourist function providing region, central part as trade and financial function providing region, and western part (include Sasangu) as productive and logistics function providing region. In addition to that, urban spatial structure has organized into two main centers (Kwangbogdong and Seomyeon), six secondary centers (Godeok, Hadan, Sasan, Gupo, Dongnae, and Haeundae), and two zone centers (Gijang and Guseo). The study area has organized and developed as an industrial function and metropolitan services providing secondary center of Bussan metropolitan city after 2001. These policies had lead to develope the area as productive and logistic facilities providing area and create a liveable environment by maintaining the Green Belt in Busan metropolitan city. Increases in vertical space utilization for constructing indoor places is the main mechanism that used for achieving the objectives of such plan and policies.

Due to the urbanization, land area under urban functions is increased while agriculture, forest, and water bodies are decreased in Busan metropolitan city (Park, et.al, 2008) [17]. During 1985 to 2005 period, the urban region of Busan city has horizontally expanded at a rate of 5km<sup>2</sup> per year and

urbanized area (out of the total land area) of Busan metropolitan district was increased from 20.6% to 24.2%. The main reasons for the expansion were administration district reforming, adding peripheral areas (such as SAD) to the city and large-scale development projects such as New Port area, reclamation in Dadaepo, a new town in Haendae, urbanization on forest area, etc. By converting Agricultural, forest and water body areas into the urban area, Busan urban area has expanded and changed dramatically. Further, 45.63% of agricultural land that converted into urban land during 1985-2005 has used for 1<sup>st</sup> and 2<sup>nd</sup> kind neighborhood living facilities, 18.49% of urban land that converted from forest used for apartments and 31.84% of urban land that converted from water bodies used for factories (Park, et.al, 2008) [17].

According to Sasangu urban council data, Sasangu urban area also has increased from 3,584 ha in 2008 to 3,606ha in 2016. During the period, about 22 ha of forest edge area has been cleared for urbanization. However, on the other hand during the period urban green land (including road said, riparian, private and government land vegetation) area has been increased from 274.67ha to 286.17ha.

The total ground area covered by buildings of SAD was 238.7ha in 1995 and it was increased up to 407.9ha in 2016 (Table 2). During last two decades, land area covered by buildings had been increased at a rate of 8.06ha per year but the contribution varies among subdivisions of SAD. The annual expansion rate of building covered area at Kamjongdong, Hakjongdong, Juredong, and Eomkundong are higher than 1ha in compare to the other sub regions.

**Table 2:** Spatial variation and trends of land area covered by buildings of SAD

Sub-division	1995 (ha)	2005 (ha)	2016 (ha)	Expansion rate (ha/year)
Kamjongdong	42.7	63.4	77.7	1.67
Kwebobdong	22.7	36.5	42.2	0.93
Dokpodong	27.9	31.8	40.1	0.58
Moradong	28.5	29.8	39.3	0.51
Samlakdong	22.2	28.4	35.5	0.63
Eomkungdong	15.2	23.8	37.1	1.05
Juredong	38.0	50.6	61.9	1.14
Hakjangdong	41.6	52.1	74.1	1.55
Total	238.7	316.3	407.9	8.06

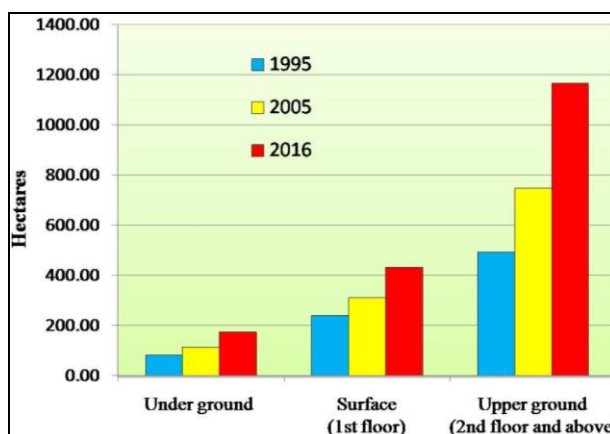
As indicates in Table 3, total no of buildings of SAD at the middle of 2016 was 20,310 and out of the amount 10,349 were individual houses, 3,330 were factories, 1,894 were first kind neighborhood living buildings and 1,850 were second kind neighborhood living buildings. Further, a large propotion of building constructed land area in 2016 is covered by factories (40.4%), individual houses (17.2%), apartment houses (14.5%), 1-kind neighborhood living facility (6.4%), and warehouse facility (4.7%). Land area under factories and apartment houses has increased at higher rates (4.7ha/year and 1.9ha/year in respectively) within last two decades in compare to other facilities providing buildings.

**Table 3:** Types of buildings of SAD, land area covered by the buildings, and annual expansion rate

Type of buildings	Total buildings	Basement area - hectares (2016)	% of total basement area (2016)	1995-2016 expansion rate (ha/year)
1-class neighborhood living	1894	26.2	6.4	0.2
2 kind Neighborhood living	1850	3.5	0.9	0.5
Accommodation	234	3.5	0.9	0.1
Animals and plants associated	20	0.4	0.1	0.0
Apartment house	845	59	14.5	1.6
Automobile-related facilities	251	10.1	2.5	0.2
Broadcasting and communications	1	0.2	0.1	0.0
Business facilities	132	5.5	1.3	0.1
Calibration and military	70	1.3	0.3	0.0
Cemetery facilities	3	0.1	0.0	0.0
Culture and assembly facility	13	0.6	0.1	0.0
Dangerous goods storage and processing facilities	132	2.6	0.6	0.1
Education and welfare	6	1.1	0.3	0.0
Education Facilities	172	13.4	3.3	0.3
Entertainment	15	0.4	0.1	0.0
Factory	3330	164.8	40.4	3.9
Individual house	10349	70.3	17.2	0.2
Manure and waste treatment	35	1.7	0.4	0.0
Medical Facilities	40	2.5	0.6	0.0
Neighborhood Facilities	19	0.2	0.1	0.0
Orders' Facilities	74	1.6	0.4	0.0
Religious Institutions	63	1.8	0.4	0.0
Sales and marketing facilities	87	16.1	3.9	0.4
Sport Facilities	21	1.2	0.3	0.0
Transportation Facilities	10	0.3	0.1	0.1
Warehouse facility	644	19.4	4.7	0.2
Total	20310	408	100	8.1

SAD indoor space expansion is happened not only in horizontally but also in vertically (Figure 2). Total indoor floor area (basement floor area, under ground floor area and upper ground floor area) utilization for urban function in the study area is larger than 4 times of the ground area utilization. In 1995, the total floor area of SAD buildings was

812.31ha and out of them 10.06% has extracted from the underground and 60.56% has extracted from the upper ground (except basement floor). In 2016, total floor area had reached to 1707.1ha and out of them, 9.67% had extracted from the underground and 66.43% from the upper ground 2<sup>nd</sup> floor and higher floors.



**Fig 2:** Changes of land area covered by the buildings in SAD and extracted floor space area from underground and upper ground by the buildings (1995-2016)

The average number of stories of a building for the study area has increased from 2.22 floors to 2.53 floors since 1995 to

2016. However, the rate is higher than the average (of 2016) at Eomkungdong (2.99), Kwebobdong (2.87), Juredong

(2.73), and Moradong (2.71). Nevertheless, as indicates in Figure 3, the numbers of stories of buildings ranged 4 (underground floors) to 25 (upper ground floors) in 1995 and

the range had increased up to 7 (underground floors) to 29 (upper ground floors) in 2016.

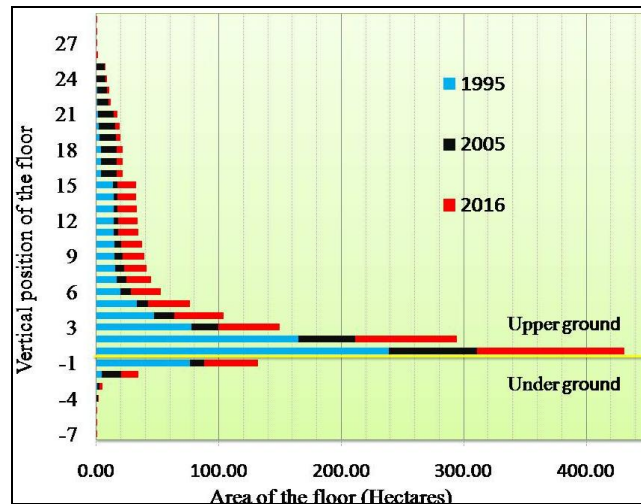


Fig 3: Expansion of total floor area of each floor level of SAD buildings from 1995 to 2016

Further, about 23.9% of total indoor floor area of total buildings in 2016 has extracted from the ground floor (1<sup>st</sup> floor) and about 61.6% from 1<sup>st</sup> to 6<sup>th</sup> floors. In addition to that, a little attention has been paid for extracting the vertical floor space by constructing multi-storied building that has

more than 16<sup>th</sup> stories before 1995 in compare to 1996-2005. The trend has changed again after 2005 and has been paid attention to build 15 or less stories buildings to extract the vertical space for place constructing.

Table 4: Vertically extracted space area of SAD buildings categories and their annual expansion rate

Types	VESA (ha) in 2016	% VESA of the category	% of VESA of SAD (2016)	1995-2016 expansion rate (ha/year)
1-class neighborhood living	56.5	69.7	4.3	0.64
2 kind Neighborhood living	57.2	70.1	4.4	1.12
Accommodation	17.6	84.5	1.4	0.43
Animals and plants associated	0.5	55.4	0.0	0.00
Apartment house	759.9	92.3	58.5	22.6
Automobile-related facilities	11.9	55.7	0.9	0.19
Broadcasting and communications	0.7	76.2	0.1	0.00
Business facilities	28	84.8	2.2	0.89
Calibration and military facilities	1.0	45.7	0.1	0.00
Cemetery facilities	0.2	73.6	0.0	0.01
Culture and assembly facility	2.4	82.6	0.2	0.10
Dangerous goods storage and processing facilities	1.5	38.2	0.1	0.03
Education and welfare	4.7	81.8	0.4	0.06
Education Facilities	56.1	82.0	4.3	2.00
Entertainment	1.0	73.4	0.1	0.01
Factory	134.1	47.0	10.3	3.55
Individual houses	70.2	52.1	5.4	0.17
Manure and waste treatment	0.7	29.9	0.1	0.01
Medical Facilities	14.7	86.1	1.1	0.25
Neighborhood Facilities	0.6	74.1	0.0	0.00
Orders' Facilities	4.3	74.0	0.3	0.1
Recycling facilities	0.1	57.3	0.0	0.00
Religious Institutions	5.5	77.2	0.4	0.07
Sales and marketing facilities	48.5	76.6	3.7	1.83
Sport Facilities	3.2	73.8	0.2	0.10
Transportation facilities	2.5	54.0	0.2	0.12
Warehouse facility	15.4	46.4	1.2	0.24
Total	1299	76.1	100	34.5

The total land area covered by the housing and logistic facilities providing buildings is about 40% of the total ground area covered by the buildings (Table 2). In contrary, the total indoor floor area used for housing and logistic facilities is about 65.1% of total indoor floor area of SAD (49.5% as apartment houses, 8% as individual houses, 6.3 % as first and second kind’s neighborhood living facilities providing buildings, 1.3% other accommodation facilities). The indoor floor area used for factories, education institutes and sales and marketing centers are 17.7%, 4% and 3.8% in respectively.

On the other hand, as indicates in Table 4, vertically extracted space areas (VESA) of apartment houses, medical, accommodation, business, cultural, and educational facilities

providing buildings are larger as much as 4 times of land areas covered by the buildings (the horizontally extracted space area). Further, about 74% of VESA is used as domestic and housing places. VESA expanding rate for SAD is about 34.5ha/year. The rate for apartment houses (22.6ha/year), factories (3.55ha/year), education institutes (2ha/year), sales and marketing institutes (1.83ha/year), second kind neighborhood living places (1.12ha/year) are higher than other places.

The buildings and urban green lands (includes roadside, riparian, private and government land vegetation) covered land areas of SAD are about 11% and 8% of total urban area and rest of land is used for other urban functions (Table 5).

**Table 5:** Contribution of VESA to SAD 2016

Region	Urban land area (ha)			VESA (ha)	Total Place area (ha)	% of urban land area
	Ground floor area	Urban green land	Other land use			
Kamjondong	78	66	204	110	458	132
Kwebobdong	42	63	240	149	494	144
Dokpodong	40	3	173	103	319	148
Moradong	39	9	453	151	652	130
Samlakdong	36	63	569	49	717	107
Eomkungdong	37	6	461	132	636	131
Juredong	62	25	389	429	905	191
Hakjangdong	74	51	423	176	724	132
Total	408	286	2912	1299	4905	136
%	11	8	89	36		

Average VESA for the subdivisions is about 3 times larger than the ground area that covered by the buildings of SAD. However, there is a spatial variation too. The rate is higher than the average at Juredong (6.9 times), Moradong (3.8 times), Kwebobdong (3.5 times), and Eomkungdong (3.6 times). About 1299ha has been extracted by constructing multi-storied buildings in SAD and it has led to expand the total area that used/ can be used for urban functions (VESA and total urban land area) up to 4883ha in 2016. It is about 136% in relation to the total available urban land area of SAD and the figure is higher at Juredong (191%), Dokpodong (148%), and Kwebobdong (144%). Due to the expansion of VESA,

- the indoor floor space per person has increased from 27.53m<sup>2</sup> in 1995 to 43.53m<sup>2</sup> in 2005 and to 76.30m<sup>2</sup> in 2016
- infrastructural and other urban facilities of the city has able to be increased,
- The green belt of Busan has able to be maintained with minimum damage.
- the urban green land area has been slightly increased,
- The socio-economic, political and cultural values of Busan metropolitan city has increased as a financial, logistic, industrial city of South Korea.

**5. Conclusion**

According to the above information, it is clear that absolute and relative location of SAD influences on its social-economic, political and cultural structures and modernization

of the place. On the other hand, SAD creates demand for space, whatever it is horizontal or vertical, to defuse its social structures, systems, institutes, and practices. Then socio-economic, political and cultural rules force the society to innovate new methods/technologies and invest for extracting space to create places. Therefore, vertical space utilization is part of the place process of the place and hence it is clear that there is a dialectic interrelationship between place and space.

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