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The Expansion and Spatial Pattern of Shopping and Tourism Services Facilities in North Bandung Region, Indonesia

Lia Warlina, Lusia Elsa Dika Damayanty*

Urban and Regional Planning Department, Universitas Komputer Indonesia,
Jalan Dipati Ukur 112-114 Bandung 40163, Jawa Barat, Indonesia
*Corresponding Author: lia.warlina@email.unikom.ac.id

ABSTRACT

This study aims to identify the expansion and spatial patterns of shopping and tourism services facilities and evaluate whether the locations are aligned with the spatial plan map of the North Bandung region. The research was conducted by taking inventory of shopping and tourism services facilities in 2010, 2012, 2014, 2016, and 2018. The locations were plotted into maps to calculate each point's spatial pattern for each period using the nearest neighbor analysis method. The 2018 map was overlaid with a spatial plan map to identify whether the existing location aligns with the regional plan. The first results were the expansion and spatial pattern maps of shopping North Bandung area for 2010, 2012, 2014, 2016, and 2018; that show the broadest expansion of shopping facility in 2018 with a clustered pattern. The second results were expansion, and spatial pattern maps of tourism service facilities in the same period show that since 2014 the expansion started with clustered patterns. The evaluation results show that only convenience stores were located in protected areas, but all tourist service facilities were located in these locations. This finding is essential for local governments in monitoring spatial use.

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1. INTRODUCTION

The North Bandung area is one of Indonesia's strategic areas because it is relatively close to the national capital. North Bandung Region has experienced a change in land use from protected area functions to economically oriented areas. Land-use change in this area is characterized by rapid urban land expansion (Pemerintah Provinsi Jawa Barat, 2016). North Bandung Region is critical because its development has shifted to the upper regions as population growth in the area (Gumilar *et al.*, 2015). The shift in development is similar to the peri-urban phenomenon, shown in population growth, socio-economic activity, and urban area physical expansion across urban administrative boundaries (Budiyantini & Pratiwi, 2016).

The North Bandung area's mobility is very high due to shopping activities and tourist sites. These activities are growing very fast due to various other supporting activities developed in the area (Zwain & Bahauddin, 2021), such as residential houses or villas, resorts, apartments, various tourist attractions, and hotels (Nurdini & Hadianto, 2018); Thus, the built area has reached 70%. This condition reduces the actual conservation function, which causes the critical area to increase (Samodro *et al.*, 2020). Research on the mismatch between the existing land cover and the spatial planning map in the North Bandung Area in 2019 showed that many polygons are not suitable in Bandung Barat and Bandung Regency, and Cimahi City (Kusumawati *et al.*, 2020). Research on public housing facilities is carried out in the Bandung Metropolitan Area to see environmental resilience, not to examine the distribution of housing or its relationship to other facilities (Nurdini & Hadianto, 2018).

Changes in land use to other economically oriented functions occur in many parts of the North Bandung area. Land-use change affects the environment in land quality, erosion, and access to water (Kobayashi *et al.*, 2020). Tourism activities can be a factor of land-use change (Warlina, 2016).

The research area conducted in North Bandung Area was on land-use change, environmental problems, and economic aspects. Therefore, we researched the expansion and spatial pattern of facilities North Bandung Region. Research on the spatial patterns of shopping facilities (Islam, 2018) and tourism services (Rangel et al., 2020) has been carried out in many countries, but the study is only one type of facilities. One of the studies that examined the two types of facilities was in Finland, but the study's scope was on the similarities and differences in the two's characteristics. However, the characteristics of shopping centers and tourism in Finland are uniform and influence each other in their respective management (Rusko, 2014). Therefore, the research gap is that there is no research in how the expansion, distribution patterns of facilities in the North Bandung Region.

So that, research on spatial pattern and expansion of shopping facilities and tourism services needs to be conducted. The findings are beneficial because the facilities' location and land use policies' alignment need to be studied. We inquired about the market, convenience store/ supermarket, warehouses, and shopping centers for shopping facilities and tourism services consisting of travel services, attractions, accommodation, and food & beverage services. The method for assessing spatial patterns of these facilities is the nearest neighbor index. The Geographic Information System (GIS) used to analyze these facilities' area locations aligns with spatial use control guidelines. The research objective is to identify the expansion in the number and spatial pattern of shopping facilities and tourism services in eight years and evaluate whether the facilities' locations are suitable for the North Bandung Region spatial plan.

The main novelties of this research are (a) how the pattern of expansion of shopping facilities and tourism services occurs in an

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area, (b) how is the relationship between the spatial patterns of the locations of shopping facilities and tourist services, and (c) the causes of the types of shopping and tourism services facilities are expanding to areas that are controlled by regional policy.

2. LITERATURE REVIEW

2.1. Expansion of facilities in urban areas

In many countries, the expansion of urban areas is due to increased population and denser urban centers. For example, in Northern Ethiopia, expanding urban areas to the outside has increased from the 1980s to the 2000s, based on per capita land consumption in Mekelle City (Fenta *et al.*, 2017); in Eastern China, the causes of urban expansion were population growth and road construction (Guangjin *et al.*, 2016). In South America from 2001 to 2011, the expansion of developed areas occurred in big cities and small cities, contributing to the decline in tropical forest areas (Andrade-Núñez & Aide, 2018).

The expansion of shopping and tourism service facilities from the city center to the suburbs shows a growing demand for these facilities, which shows the region's growing economy (Saraiva & Pinho, 2017; Savini, Majoor, & Salet, 2015; Tiitu, 2018). Tourism activities are usually related to shopping; therefore, tourist attractions' development fosters shopping facilities and vice versa (Mehta et al., 2014). The development of tourism and shopping activities in an area will change its land use (Lanya *et al.*, 2017 ; Stankov *et al.*, 2016). Therefore , expanding shopping facilities and tourism services that change its land use will impact its spatial pattern.

2.2. Spatial pattern of facilities location

The spatial pattern of city facilities can show how land-use planning controls have been carried out. Unplanned development of facilities or urban growth centers causes urban sprawl (Habibi & Asadi, 2011; Shao *et al.*, 2020). Research on the distribution of shopping facilities is widely carried out in many countries. For example, a study on the density of commercial facilities and road concentration had been conducted in Bologna in Italy (Porta *et al.*, 2009) and Barcelona in Spain (Porta *et al.*, 2012). In Changchun, China, retail store spatial distribution used the nearest neighbor, and the spatial pattern was clustered (Wang *et al.*, 2014). The structural relationships between population, commercial areas, and road networks show by store spatial distribution (Baviera-Puig *et al* 2016 ; Reigadinha *et al.*, 2017 ; Saraiva ،،& Pinho , 2017). So the distribution of shopping facilities is essential to be monitored its development so that it does not damage the area's function in the future

An increase in tourist attraction will lead to regional economic growth, but it can also negatively impact an area (Cianga, 2017; Meyer & Meyer, 2015; Petrevska & Gerasimova, 2012). Research of the distribution of hotels and accommodation as city facilities for tourist services conducted in many countries, for example, in Spain (Rangel *et al.*, 2020), and in the United States how the distribution of hotels with amenities (Terry & Schuett, 2018), and in Romania regarding how accommodation with food companies. The distribution of hotels in Kumasi Metropolis, Ghana, shows star hotels clustered in the center and budget hotels on the city's outskirts (Adam, 2013). Research on the distribution of tourist attractions conducted in China shows that the pattern is clustered and close to the water system (Wang *et al.*, 2020).

The nearest neighbor analysis is usually used to calculate the spatial pattern of facilities distribution. This analysis shows the distribution of various facilities to determine the adequacy of the number of services for the community. For example, the nearest neighbor analysis is used to see the regularity pattern of housing in Aligarh District, Uttar

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Pradesh, India (Khan & Ahmad, 2014). The nearest neighbor analysis is also used to see the distribution pattern of health facilities and outreach services in Riyadh, Saudi Arabia (Mansour, 2016). The spatial pattern of various city facilities is essential for urban spatial planning and the improvement of regional planning (Singgih, 2020).

2.3. Regulatory of shopping and tourism facilities in Indonesia

The regulation about shopping facilities in Indonesia is Law Number 7 of 2014, covering shopping facilities, including markets, convenience stores/ supermarkets, warehouses, and shopping centers (Pemerintah Republik Indonesia, 2014). The regulation relates to tourism service facilities is Law Number 10 of 2009 regarding tourism. Tourism service facilities are travel services, attractions, accommodation services, and food and beverage services (Warlina *et al*., 2021). **Table 1** shows the type of shopping facilities based on Law Number 7 of 2014. **Table 2** shows the description of the type tourism service business on Law Number 10 of 2009 concerning tourism. These two regulations are references in Indonesia in the arrangement of shopping or trade facilities and tourism activities.

3. MATERIAL AND METHODS

3.1. Description of the study area

The research area is the North Bandung Region covering parts of Bandung, part of the Bandung Regency, part of Cimahi City, and part of West Bandung Regency, with an elevation about 750 meters above sea level (masl). The North Bandung Region is a particular zone in West Java Province and is stated as a strategic area (Pemerintah Provinsi Jawa Barat, 2008). North Bandung area consists of 21 districts, 107 sub-districts/ villages with 38 776.23 hectares.

Table 1. Types of shopping facilities description based on law number 7 of 2014 concerning trading (Pemerintah Republik Indonesia, 2014).

No	Type of shopping/ trading facilities	Description based on Law Number 7 of 2014 regarding shopping and its facilities
1	Traditional market, market (*Pasar Rakyat*)	Business places are organized, built, and managed by the regional government, private sector, state-owned enterprises. The place can be in the form of shops, kiosks, booths, and tents owned or managed by small and medium-sized, independent trader communities, cooperatives, and micro, small and medium enterprises through buying and selling goods through bargaining.
2	Shopping center (*Pusat Perbelanjaan)*	Certain areas consisting of one or several buildings erected vertically or horizontally that are sold or leased to business actors or managed independently to carry out trading activities
3	Convenience store/ supermarket (*Toko Swalayan*)	*Toko swalayan* are self-service system stores that sell various goods at retail: minimarkets, supermarkets, department stores, hypermarkets, or wholesalers.
4	Warehouses (*Gudang)*	A closed and open immovable room aims not to be visited by the public but to be explicitly used as a storage area for tradable goods and not for one's own needs.

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Table 2. Types of tourism service facilities description based on law 10 of 2009 concerning tourism (Pemerintah Republik Indonesia, 2009).

No	Type tourism service business	Categories of tourism service business based on Law Number 10 of 2009 regarding Tourism
1	*Travel Service*	Tourism Road Transportation
		Tourism Transportation by Train
		Tourism Transport by River & Lake
		Domestic Tourism Sea Transportation
		Tourism International Sea Transportation
2	*Attractions*	Management of Natural Hot Springs
		Cave Management
		Management of Historical & Archaeological Heritage
		Museum Management
		Management of Cultural Environment
		Management of the Object of Pilgrimage
		Agro Tourism Management
3	*Accommodation services*	Hotel Service Business
		Hotel Condominium Services Business
		Service Apartment Service Business
		Camping Ground Service Business
		Caravans Stopover Services Business
		Villa Service Business
		Hut Tourism Services Business
		Hotel Management Services Business
		Senior / Elderly Travel Residential Services Business
		Home Stay Service Business
		Motel Service Business
4	*Food and Beverage services*	Bistro Service Business
		Restaurant Service Business
		Bar / Drinking House Service Business
		Cafe Service Business
		Food Service Business
		Food Sales Centre Service Business

3.2. Spatial data preparation and analysis

We collected data on shopping facilities from the Department of Industry and Trade of West Java Province, Bandung Regency, Bandung Barat Regency, Bandung, and Cimahi City. For tourism service facilities, we obtained data from regional Tourism Offices.

We created tabular data of shopping facilities and tourism services in the North Bandung Region. The data are in 2010, 2012, 2014, 2016, and 2018: markets, convenience store/supermarkets, warehouses, shopping centers (shopping facilities), and tourism services including travel service, attraction, accommodation services, food, and beverage services.

The locations of shopping and tourism services in the North Bandung Area in 2010, 2012, 2014, 2016, and 2018 are plotted on the map obtained from the base map. Location information is obtained from the address data of each location. In addition, we analyzed the distribution patterns of shopping facilities and tourism services using the nearest neighbor analysis.

3.3. The Nearest Neighbour Index (NNI)

The nearest neighbor index or NNI is calculated by taking the nearest neighbor's average distance in a point pattern and

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dividing it by the average distance (Wilson, 2018). This average distance is measured by seeing the same number of points randomly distributed in the same area. NNI values range from 0 for point patterns clustered to values 1 for spatially random point patterns and about 2.15 for regularly distributed point patterns (Lee et al., 2014). The average nearest neighbor index is calculated based on dividing the observed distances by the expected distances with the same number of features covering the same study area. NNI formula is :

$$NNI = \frac{do}{dE} \quad (1)$$

The term d_0 represents the average distance of observation of each point with its nearest point. The equation is

$$do = \frac{\sum_{i=1}^{n} di}{n} \quad (2)$$

where dE represents the expected average distance between the targeted point in random mode. The equation is

$$dE = \frac{1}{2}\sqrt{\frac{A}{n}} \quad (3)$$

where *n* represents the sample quantity, and *A* represents the area of the research region.

3.4. Location alignment with the guideline for controlling North Bandung Region

We overlaid a map of facilities in 2018 and spatial use map in the North Bandung Region. In the West Java Provincial Regulation Number 2 of 2016 (Pemerintah Provinsi Jawa Barat, 2016) on Guidelines for the Control of the North Bandung Region as a Strategic Area of West Java Province, seven zonings for spatial use is stipulated consisting of zone L (protected) and zone B (cultivation) with different levels of water infiltration rate (**Table 3**).

Shopping and service activities in the North Bandung Region are directed at shopping and service areas, offices, urban settlements, and primary arterial road corridors, all of which are included in the cultivation area (Suryadjaja *et al.*, 2020). The North Bandung Region's cultivation area is divided into five cultivation zones: Zone B-1, Zone B-2, Zone B-3, Zone B-4, and Zone B-5 (**Table 3**).

Table 3. Guideline for controlling North Bandung Region (Pemerintah Provinsi Jawa Barat, 2016)

No	Zoning	Control of North Bandung Region Spatial Use	Water Infiltration Rate
1	Zone L-1	Protected forest areas, conservation forests, Taman Hutan Raya Ir. H. Djuanda, Tangkuban Parahu Nature Reserve, Bosscha Observatory area, Lembang Fault (250 m of buffer), Hazard Prone Area III of Tangkuban Parahu Volcano, River / Lake Border, 50 m radius from the spring, land with a slope more than 40%, production forest, green open space;	High
2	Zone L-2	Additional Protected Zone, covering community forest areas, disaster-prone areas II and I Tangkuban Parahu Volcano, rural areas;	High
3	Zone B-1	The Rural Use Zone is an area with a moderate to low density level;	Low
4	Zone B-2	Urban Use Zone is an area with a moderate to high-density area;	Low
5	Zone B-3	Rural Limited Use Zone is an area with a moderate to low density level;	Moderate
6	Zone B-4	Urban Limited Use Zone is an area with a moderate to high-density area;	Moderate
7	Zone B-5	Very Limited Urban Use Zone is an area with a moderate to high-density area.	High

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4. RESULTS AND DISCUSSION

4.1. Expansion and Spatial Pattern of Shopping and Tourism Services Facilities

4.1.1. Expansion and Spatial Pattern of Shopping Facilities in North Bandung Area

The distribution of shopping facilities in North Bandung from 2012 to 2018 is shown in **Figure 1**. The spatial pattern of all types of shopping facilities every two years of observation is clustered (**Table 4**). The spatial pattern used the nearest neighbor analysis method, with the nearest neighbor index (NNI) in the range of 0.119 to 0.682.

The nearest neighbor index for the market from 2010 to 2018 ranges from 0.48 to 0.495, indicating the market's spatial pattern is clustered. This situation aligns with Rangpur City Corporation Bangladesh's research results for market distribution with an NNI value of 0.3, which means a clustered pattern (Islam, 2018).

The NNI of convenience stores/ supermarkets from 2010 to 2018 is 0.33 to 0.43, meaning it is more clustered. While, the NNI of the shopping center ranges from 0.119 to 0.503, which means that the spatial pattern is clustered. A similar condition in retail store spatial distribution in Changchun, the index showed that specialty stores had a centralized pattern (Wang *et al.*, 2014).

The warehouse is not a shopping facility but a trading facility. Because it is included in the classification based on Law No. 7 of 2014 concerning trade, the warehouse is one of the types of facilities observed. The nearest neighbor's highest index value is for the warehouse is 0.682, which means that the spatial pattern is clustered, which tends to be random.

Figure 1 shows that convenience stores/ supermarkets expanded from the south to the north and the eastern part of the North Bandung area with the broadest expansion in 2018. As a result of inventory, the number of convenience stores/ supermarkets was 37 units in 2010 and 288 units in 2018. The significant increase in the number of minimarkets due to population growth leads to expansion of the built area for settlements and their supporting facilities. In addition, population growth in an area causes an increase in housing needs, resulting in the growth of utilities (energy, water, etc), and shopping facilities (Porta *et al.*, 2009; Saraiva & Pinho, 2017; Lasanas *et al.*, 2021; Antonio *et al.*, 2021).

The number of additional traditional markets is relatively small compared to convenience stores/ supermarkets due to the market's less popular than convenience stores/ supermarkets. Meanwhile, the number of warehouses from 2010 to 2018 remains only six units. In line with the increase in the market, the increase in shopping centers was relatively small. In 2010, there were three shopping centers, and in 2018 increase to seven units.

4.1.2. Expansion and spatial pattern of tourism services in North Bandung area

The map of the spatial distribution of tourism service location points from 2010 to 2018 in the North Bandung area is presented in **Figure 2**. In 2010 the distribution points led to the center, then in the following years, the points for the location of tourism services increase and dispersed into all directions. In 2018 these location points were scattered to the north and west of the area.

The distribution pattern with the nearest neighbors analysis for tourism services from 2010 to 2018 is presented in **Table 5**. The NNI of each category of tourism services for every two years ranges from 0.1 to 0.7. Each category of tourism services as a location point is categorized as a clustered spatial pattern.

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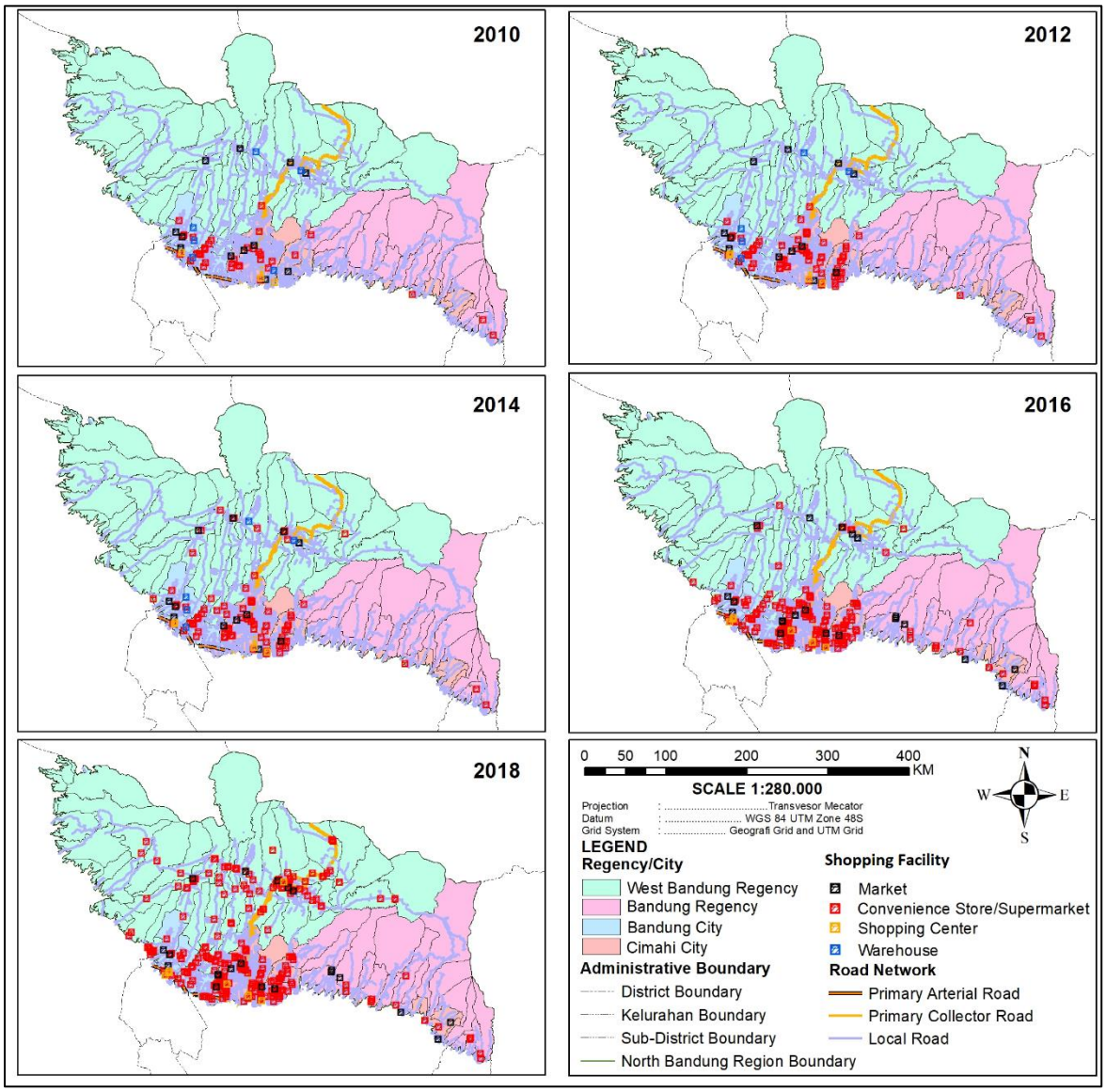

Figure 1. Shopping facility spatial distribution map in North Bandung region, 2010-2018.

Table 4. The spatial pattern of shopping facilities in the North Bandung Area (2012-2018).

Shopping facilities	Spatial Pattern of Shopping Facilities									
	2010		2012		2014		2016		2018	
	NNI	Pattern	NNI	Pattern	NNI	Pattern	NNI	Pattern	NNI	Pattern
Markets	0.480	Clustered	0.480	Clustered	0.480	Clustered	0.495	Clustered	0.495	Clustered
Convenience Stores/ Supermarkets	0.430	Clustered	0.327	Clustered	0.466	Clustered	0.338	Clustered	0.386	Clustered
Warehouses	0.682	Clustered tend to random	0.682	Clustered tend to random	0.682	Clustered tend to random	0.682	Clustered tend to random	0.682	Clustered tend to random
Shopping Centers	0.483	Clustered	0.119	Clustered	0.119	Clustered	0.185	Clustered	0.503	Clustered

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The North Bandung area is famous for its natural tourism, such as ecotourism and agritourism, which has led to the emergence of minimarkets or convenience stores. This condition is different from the urban environment. The distribution of retail and food business locations in a dense urban environment in Cambridge, Somerville, and Massachusetts shows a clustering pattern (Sevtsuk, 2014).

All types of tourism services in the North Bandung Area from 2010 to 2018 increased in number with a relatively similar increase pattern. However, the expansion of shopping facilities that expanded in 2018, the expansion of tourism service facilities have started to occur from 2014.

4.2 Evaluation of the location of the shopping facility and tourism service aligns with spatial plan of north bandung region

The overlay of shopping and tourism services facilities map with spatial plan map is shown in **Figure 3**. **Table 6** shows the location of shopping and tourism service facility points in 2018, located in protected zones (Zone-L) or cultivation zones (Zone-B) based on the guideline for controlling the North Bandung Region as a strategic area.

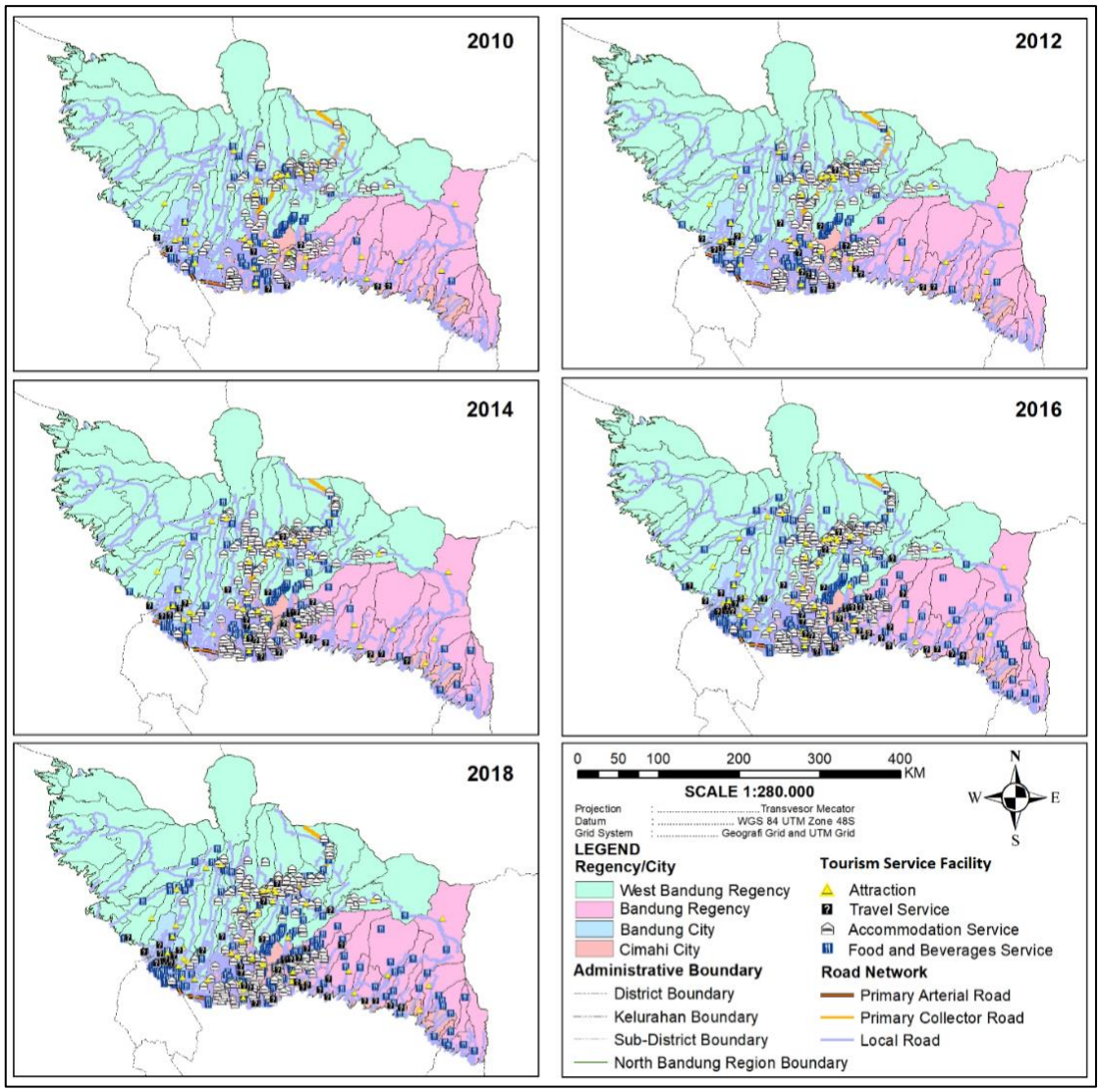

Figure 2. Tourism service spatial distribution map in north bandung region, 2010-2018

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Table 5. The spatial pattern of tourism service locations in the North Bandung Area.

Tourism services	Spatial Pattern of Tourism Service Locations									
	The Year 2010		The Year 2012		The Year 2014		The Year 2016		The Year 2018	
	NNI	Pattern	NNI	Pattern	NNI	Pattern	NNI	Pattern	NNI	Pattern
Travel Services	0.464	Clustered	0.491	Clustered	0.441	Clustered	0.543	Clustered	0.505	Clustered
Attractions	0.745	Clustered	0.770	Clustered	0.763	Clustered	0.787	Clustered	0.744	Clustered
Accommodation Services	0.361	Clustered	0.469	Clustered	0.373	Clustered	0.397	Clustered	0.409	Clustered
Food and Beverage Services	0.447	Clustered	0.119	Clustered	0.441	Clustered	0.517	Clustered	0.467	Clustered

Zone L-1 is a protected area with a prohibition for development except for activities that support regional, particular interests, or strategic functions. Zone L-2 is a protected area but is allowed for housing construction with certain conditions (Pemerintah Provinsi Jawa Barat, 2016).

From **Table 6**, there are 14 convenience stores/supermarkets, three travel services, five attractions, 20 accommodation services, and 42 F&B services located in Zone L-1. **Table 6** also shows three markets, 61 convenience stores/supermarkets, three travel services, six attractions, 44 accommodation services, and 28 food and beverage services in Zone L-2. Construction of housing areas in protected areas cannot be avoided, and zone L-2 is still permitted. When a residential area is built, it is usually followed by a growth in shopping facilities to meet the housing area's needs.

The development in a protected area or conservation area can be considered conflicts of interest between conservation and economic growth worldwide in developing and developed countries (Vedeld *et al.*, 2016). The various objectives of developing protected areas can be for settlement, agriculture, and tourism (Lombard, 2016; Sani & Pongsibanne, 2016; Wigle, 2010). The development will shift urban areas to the outskirts, which occurs in the region due to high population growth, infrastructure development, and public facilities (Savini *et al.*, 2015). The expansion of urban areas can change the land use of the area. Sometimes these land-use changes do not comply with the established spatial planning.

The number of tourism service units is relatively large (**Table 6**) in Zone L-1 and L-2 or protected areas due to the multiplying natural tourism sector. The availability of conservation areas and agricultural land is decreasing due to rapid development and population growth (Al-Najar et al., 2019). Nevertheless, the land is an essential factor in increasing agricultural sector development (Maryati et al., 2018). To control conservation area must harmonize with environmental issues and social equality comprehensively between local and central government di Mexico City (Wigle, 2010; Kurniati et al., 2021).

The local government must provide funds for controlling the North Bandung Area's spatial use, as has been done in Brazil. Maintaining an area to remain a protected area requires a relatively large amount of funds (Silva et al., 2021).

The expansion from built-up areas to protected areas has occurred globally. In China, there has been an expansion of built-up areas into protected areas. There has been a policy to control protected areas, but there are obstacles due to the lack of integration between central and regional institutions (Güneralp et al., 2015). Well-planned regional development will not conflict with conservation objectives because local communities and settlements are part of the

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protected area (Fuente *et al.*, 2020). The involvement of many parties and institutions is essential for controlling expansion into protected areas.

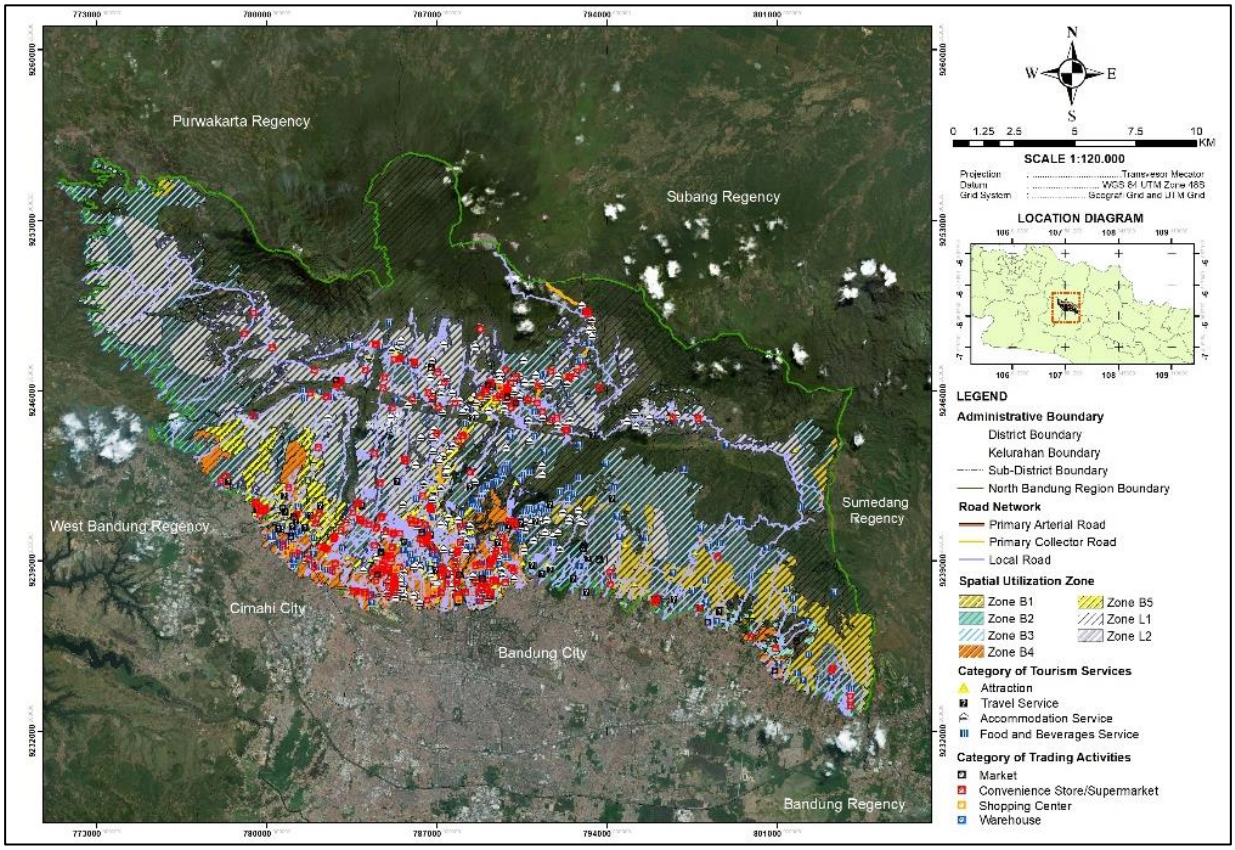

Figure 3. The overlay of shopping and tourism services facilities map with spatial plan map

Table 6. Location of shopping and tourism service facility points in 2018 in protected zones (Zone-L) or cultivation zones (Zone-B).

Shopping facilities and Tourism Services	Number of location points (units) in							Total
	Zone L-1	Zone L-2	Zone B-1	Zone B-2	Zone B-3	Zone B-4	Zone B-5	
Markets	-	3	-	1	5	8	4	21
Convenience Stores/Supermarket	**14**	**61**	1	1	35	98	78	288
Warehouses	-	-	-	-	-	3	3	6
Shopping Centers	-	-	-	-	-	6	1	7
Travel Services	**3**	**3**	2	-	15	7	13	43
Attractions	**5**	**6**	4	-	4	10	22	51
Accommodation Services	**20**	**44**	2	-	58	89	40	253
Food and Beverage Services	**42**	**28**	13	-	80	155	71	389

5. CONCLUSION

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The expansion of shopping facilities and tourist services facilities in the North Bandung area is rather different. The expansion of tourist service facilities began in 2014, while the broadest expansion of shopping facilities occurred in 2018. This can be concluded that the expansion of tourist service facilities triggered the expansion of shopping facilities. Meanwhile, the spatial pattern for each type of shopping facilities and tourism services for eight years is clustered. In 2018, there were shopping and tourism service facilities located in protected areas. Shopping facilities located in protected areas were only convenience stores (*mini markets*), but all tourist service facilities were in these areas. This condition can indicate that the growth of tourist service facilities triggers the existence of convenience stores.

6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Furthermore, the authors confirmed that the paper was free of plagiarism.

7. ACKNOWLEDGEMENTS

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