The land-use of Bandung, its density, overcrowded area and public facility toward a compact city

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Abstract. The concept of a compact city has been introduced since 1973. It is a utopian vision largely driven by a desire to see more efficient uses of resources. In 1980s, the reconfiguration of the physical urban form of metropolitan areas was increasingly debated by both theorists and practitioners. Recently, the concept of a compact city has been more focused on developed countries in which the population tends to decrease. However, in Asia, except Japan which contains many dense cities, it has become a concept which promotes relatively high residential density with mixed land uses, though rather only in population and density. This paper addresses the land-use of Bandung that having the density over 14,000 people/km², which has been so much potential toward a compact city. Somehow, unpreparedness of urban planning and regulation, the city seemed overwrought to serve its inhabitants. This condition is shown from the demographic condition, especially population density in Bandung based on its sub areas of the city (SWK). The stack of public facilities in a certain district has led the concentration of density and activity, which finally raising the slum and overcrowded settlement. Finally, this paper explores the implications of land use management and describes challenges faced and possible approaches, especially in land-use management strategies to be implemented in Bandung.

1. Introduction
The number of urban areas, especially in developing countries in the coming years has been predicted to be more widespread. One of the most serious problems in the 21st century is no other than the global population growth, and consequent urban expansion, particularly in developing countries. Based on Demographia (2015), 57% population live in Asia continent, which most of them are developing country. The concern of the urban form, infrastructure as well as the density is considered as an important factor in understanding how cities function. Density then becomes one of the demography problems, which related to urban spaces has risen, such as overcrowded settlements, mostly inhabited by squatters, spread throughout the downtown area. The unpreparedness of spatial planning and law enforcement to keep implementation on track seems to become a big problem for many urban spatial planners in some cities in Indonesia. Urban environmental problems tend to increase exponentially. The idea of the compact city which requires the population density and optimal land use, it seems only managed in developed countries, mainly because of the number of inhabitants slowly decreasing. In contrast, in developing countries, there are many dense cities that promote a high population with their inhabitants living in the mixed land uses area, but somehow the compact city becomes just a term to describe an amount of density, rather than a well-managed city.

There is the issue of how best to design and implement compact city, these are mostly formulated for existing cities, each with its specific context, a locality needs to adapt its compact city strategies to
fit its particular circumstances. In other words, no single comprehensive compact city model is applicable to all cities. The implication of compact city in a developing country somehow is interesting to discuss here. Thus, the challenge of compact city concept in developing country, such as in Indonesia is interesting to explore, in what extent this concept can be applied to cities in developing countries. Bandung then, has been chosen as a area study, as the capital city of West Java Province which is the most densed province in Indonesia.

2. High density vs Compact city

2.1. High Density in Developing Country
Density, as employed in land use planning and related applications, appears to be a simple concept. However, amounts of density are often misinterpreted and distorted due to the numerous technical complexities involved in coming up with them. Therefore, it is significant that the scales of geographical references be explicitly limited in density calculations, otherwise the comparison of density measures will be unmanageable. Nevertheless, there is no standard measure of density; there are only measures that are more widely used than others[1].

Densities in developing country cities are much higher than in developed countries, especially in the core city. Many explanations have been given: [2]

a. Higher rates of population and urban growth
b. Lower incomes have meant much smaller dwelling sizes and tiny lots,
c. In terms of the ‘modern’ sector in developing countries, housing preferences have favored high-rise apartments rather than single family housing.
d. The prevalence of mixed-use structures and neighborhoods has resulted in residential densities becoming higher the closer they are to the city centre.
e. Lax planning regulations, and either the absence or the inadequacy of building codes, have led to uncontrolled increases in densities
f. There remains considerable scope for further increases in densities in low income settlements

Figure 1 shows the continent with the largest urban area population in the world is Asia, which has a population of more than 500,000 people. The next table 1 describes the top 10 cities in Southeast Asia based on population density.
Table 1. Largest Urban Areas in Southeast Asia, based on population density

|   | Metro | Population | Density | Area |
|---|-------|------------|---------|------|
| 1 | Manila [3] | 11,855,975 | 638.55 | 18,567 |
| 2 | Bandung + Cimahi [4] | 3,017,681 | 208.03 | 14,506 |
| 3 | Jabodetabek (metro) [5] | 17,220,076 | 1345.82 | 12,795 |
| 4 | Yogyakarta [6] | 394,012 | 32.5 | 11,812 |
| 5 | Surakarta [5] | 520,061 | 44.03 | 11,812 |
| 6 | Yangon | 5,998,000 | 598.75 | 10,018 |
| 7 | Surabaya [5] | 3,314,700 | 374.78 | 8,844 |
| 8 | Singapore [7] | 5,535,000 | 719.1 | 7,697 |
| 9 | Kuala Lumpur [8] | 1,627,172 | 243 | 6,696 |
| 10 | Bangkok [9] | 8,280,925 | 1,568.74 | 5,279 |

As the 4th most populous country in the world, Indonesia still dealing with uneven population distribution, there are 12 cities with high populations, from a total of 510 cities spread throughout 34 provinces. These cities have population densities of more than 10,000/km², and all of them are located on Java Island. The urban form characteristic exhibits the overcrowded neighborhoods with relatively low FAR but contrary high dwelling units. Most informal developments have a similar density measurement profile. Moreover, consider its high population, it does not give each person a sizeable amount of personal living space.

Thus, the density here, except in Singapore hardly to say that cities with urban form characteristics above are the result of some prescient ground design. Rather, their compactness has emerged spontaneously, if not chaotically.

2.2. Compact city in Developing Country

Discusses how the application of compact city in the developing country, is inseparable from term of ‘‘What is sustainable urban form?’’ Furthermore, the term sustainability is currently quite vague and has not been defined clearly. However, the following is likely to be the common discussion dimension in recent years; that has three aspects [10].

a. To keep a stable economic growth with restructuring the productive system for saving resources and energy, (Economic sustainability)
b. To maintain safe and comfortable living environment through zero emission, (Environmental Sustainability)
c. To secure social equity in distribution of wealth and social services (Social Sustainability)

Anyhow, to achieve the terms of ‘‘sustainability’’ as mentioned above, it seems the road is still long and left a lot of homework to be completed. The very basic problems in the highly dense city in developing country are often described mostly in living environment are not in good condition. The traffic congestion, noise and air pollution are something that is constantly faced every day. The over-crowed settlement which then an embryo of slum and squatter settlement with poor sanitary condition due to lack of tap water and sewerage. These settlements are common to find in the cluster of commercial area.

Focus on compact city implementation then is the intensification of the use of space in the city. This proposal is sharpening the distinction between density and intensity of development, for they are not the same thing. Density is a quantitative measure of number within a prescribed area, whereas intensity reflects a more subjective measure of built-up-ness or urbanity. Density itself is of little importance unless it is related to built form. Compact is meaningless unless it is related to some facts and figures [11]. With higher residential densities and centralization, and they write that ‘planners
should aim for compactness and integration of land uses, for some degree of “self-containment”. Furthermore, Newman and Kenworthy also demand more intensive land use, centralized activity and higher densities. [12]

3. Study Case: Bandung, a Capital of Densest Province in Indonesia

Bandung is the second largest metropolitan area in Indonesia, after the capital city of Indonesia, Jakarta. With 2,470,802 citizens recorded inhabited in the land of 167.67 km$^2$ bringing the density of Bandung into 14.736 / km$^2$. The population growth rates in Bandung from 2005 to 2010 are reported 1.15%. Bandung is divided into six development areas, shown at figure 2.

In previous research it is found that there is no correlation between population and overcrowded areas, nor the population density to overcrowded areas [13], the correlation between three of them are shown by figure. 3a, 3b, and 3c.

![Figure 2. Development areas (SWK) in Bandung, 2007](image)

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1 http://bandung.go.id/

2 From 2011 this development area is change into 8 areas, but the supporting data are not compatible enough, so it was decided to take the data in 2007
As shown in the above figure, the most overcrowd area is found in Cibeuying district, meanwhile the highest population is in Tegal Lega district and the most densest area is in Karees district.

From figure 4, it emphasizes the statement that the overcrowded area as an urban slum and squatter does not occur as a result of the density.

3.1. Bandung Land-use

The condition of Bandung density becomes a dilution that restrains from a compact city. Furthermore, this condition will be explained by giving the spread of Bandung Master Plan of land-use (figure 4).

Bandung downtown is located in the intersection of area between Cibeunying, Karees, Tegal Lega and Bojanegara. This area is called high economic productivity of land, which accounted for regional economic growth, and also giving the negative effects of the impact of urban growth.

The elements that affect to urban growth which influence on the percentage of land use is shown in figure 5.
The key points of a compact city as mentioned before are described as:
- promoting the ‘intensification of the use of space in the city’ with higher residential densities and centralization;
- planning for compactness and integration of land uses, for some degree of “self-containment”;
- demanding more intensive land use, centralized activity and higher densities.

Thus, physical elements, such as a group of buildings with their activities and less-movement of an inner city, have a strong influence to induce the success of a compact city.

Based on the land-use percentage in Bandung, the physical elements of the impact of urban growth can be categorized into:
- Service (education, government, health )
- Settlement
- Industry
- Commercial and recreation

The problem then occurs when these physical elements are stacking in a clustering area. As mentioned, it is in the downtown area, which is increasing the movement from one district to other districts.

The main problem of this movement is because of the imbalance of public facilities, especially the quality of education and health facilities.

The top five good schools are stacking in Cibeuying area, from elementary level to high school. This is compounded by the existence of state universities which are also located in Cibeunying.

3.2. Land-use Assessment

Land-use assessment is intended to determine the level of use of the land used by the physical elements (building function) that generates movement in the city.

The selected elements are:
- Schools (divided from elementary to higher education)
- Government
- Health Facilities
- Commercial
- Industry
- Settlement

![Figure 5. Percentage of Land-use](image)
Table 2 Scoring of Land-Use

| no. | Physical Element | Indicator | Element land-use | Tegal Lega | Cibeunying | Karees | Bojanegara | Ujung Berung | Gede Bage |
|-----|------------------|-----------|------------------|-----------|------------|--------|------------|-------------|----------|
| 1   | Favorite         |           | SDN Sabang       | v         |            |        |            |             |          |
|     |                  |           | SDN Merdeka      | v         |            |        |            |             |          |
|     |                  |           | SDN Banjarsari   | v         |            |        |            |             |          |
|     | SCHOOL (top 3 from elementary school to University) | Passing Grade | SMP 2           | v         |            |        |            |             |          |
|     |                  |           | SMP 5           | v         |            |        |            |             |          |
|     |                  |           | SMP7            | v         |            |        |            |             |          |
|     |                  |           | SMAN 3          | v         |            |        |            |             |          |
|     |                  |           | SMAN 5          | v         |            |        |            |             |          |
|     |                  |           | SMAN 8          | v         |            |        |            |             |          |
|     |                  |           | ITB             | v         |            |        |            |             |          |
|     |                  |           | UNPAD           | v         |            |        |            |             |          |
|     |                  |           | UPI             | v         |            |        |            |             |          |
| 2   | GOVERNMENT      | Main office | Cityhall and mayor's office | v |            |        |            |             |          |
|     |                  |           | governor office | v         |            |        |            |             |          |
|     |                  |           | BAPPEDA         | v         |            |        |            |             |          |
| 3   | HEALTH          | Main Hospital | RS. BOROMEUS     | v         |            |        |            |             |          |
|     |                  |           | RS. ADVENT      | v         |            |        |            |             |          |
| 4   | COMMERCIAL      | Biggest Mall | Champelas walk  | v         |            |        |            |             |          |
|     |                  |           | BIP             | v         |            |        |            |             |          |
|     |                  |           | BSM             | v         |            |        |            |             |          |
| 5   | Industry        | trading traffic | Cibaduyut       | v         |            |        |            |             |          |
|     |                  |           | Binong Jati     | v         |            |        |            |             |          |
|     |                  |           | Champelas       | v         |            |        |            |             |          |
| 6   | Settlement      | Higest price | Dago            | v         |            |        |            |             |          |
|     |                  |           | Setiabudhi      | v         |            |        |            |             |          |
|     |                  |           | Batununggal     | v         |            |        |            |             |          |

Diagram of Land-use scoring as shown in figure 6 below:

The diagram beside explain that SWK Cibeunying is the densest land use for educational, governmental, health, commercial, industrial and residential. Previous study about SWK Cibeunying has found that the change of land-use in this SWK has started in 2000. The change of housing function into rental office has changed in 31%, from 60% of total land-use has changed in Cibeunying area. [14]

Figure 6. Stack of Land-use distribution in Bandung
The trend of land-use changing, especially penetrating the land-use of settlement shows there is lack of supervision by the city government to implement the Master Plan 2013. Furthermore, in his article, Tanuwidjaya giving the analysis that “Master Plan 2005 was failed to realise the carrying capacity of Bandung (natural and social). Due to rapid urbanization, the Master Plan 2013 had to increase the population capacity of Bandung from 750’000 persons (“Karsten Plan”) to 3 million persons. Further, the integrated land use and transportation planning approach in Master Plan 2013 were failed to be implemented due to land and development speculation by private sectors. The current commercials are mostly designated mostly in the city centres, while affordable housings are located in the suburban area. The separation actually will decrease accessibility, city vibrant life and livelihood issues. And this would worsen the city traffic jams.’’ [15].

4. Conclusions
The description of statistical data on land use in Bandung and the influence of its physical elements indicate that the compact city cannot be achieved only by relying on the sheer density. The fundamental difference of compact cities in developing countries lies in the management of land use that has not been well managed and proportional; the main problem is the quality and uneven infrastructures.

SWK Cibeunying then, becomes the most vulnerable SWK, and seriously urgent to make intensification land-use in order to avoid a decline in the environmental quality and quality of life of city residents.

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