Factors Relating Infrastructure Provision by Developer in Formal Housing

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Abstract. In big cities, housing developer has significant role in infrastructure provision. Nevertheless in some cases developers have not fulfilled their role to complete the housing with infrastructures needed. The objective of this study is to explore the characteristics and the related factors of infrastructure provisioning in formal housing developed by developer using the quantitative and association method analysis. Infrastructures are focused on clean water, sewage, drainage, and solid waste system. This study used Parongpong District, West Bandung Regency as case study where the need of infrastructure is not fulfilled. Based on the analysis, can be concluded that there are some variation in infrastructure provisioning and the factor related the condition is the level of income of house owner target.

1. Introduction

Housing needs is increasing every year. Especially in urban areas, the needs is increasing along the population and urbanization growth. The rapid development of urban areas will give a trickling down effect so that the people needs which can not be accommodated in urban areas will be scattered in the surrounding area, including housing needs. This phenomenon also happened in Bandung, where the rate of population growth in the surrounding area is increasing and activity centers are just beginning to develop. West Bandung Regency became one of the areas that received the impact of Bandung development. It is also confirmed by Vice Regent West Bandung, Yayat Soemitra [1] if the population growth rate of West Bandung regency in 2015 is increased 2.3% and nearly 40% of the population comes from outside the area. As a result, the housing needs is shifting. Meeting its need, housing developer start to develop some new housing include in Parongpong District.

Parongpong is one of the districts in West Bandung Regency which has great appeal to be used as a residential area. In order to the physical environmental conditions that are still relatively cool and sightly, District Parongpong also have a good access to activity center in Bandung. Parongpong has 4,012 hectares area with an average elevation of 700 meters above sea level which consists of 7 village and 30 sub-village. The population in 2014 according to the Central Bureau of Statistic¹ reached 102.876 inhabitants and the population density ranges from 22.79 inhabitants/ha.

¹ The Central Bureau of Statistics is a Non-Government Organization that is directly responsible to the President to take care of the population census
The high of housing needs is seen by developers as a great potential businesses. Housing development began to bloom on low price land, but still have good access to urban areas. Based on the Parongpong Profile in 2009 [2] there were 33 housing scattered throughout the village. In addition, according to the Real Estate Indonesia² for West Java Province [3] over the last two years, there are 9 filing new housing projects located in the Parongpong, including Bumi Asri Cihanjuang, Green Valley Cihanjuang, Charm City View, Setra Regency Townhouses, and etc.

In developing housing, developer often face a number of obstacles that would make them to do some efforts to minimize production costs, such as Woodson [4] stated: 1) Select the site locations that are not easily accessible and far from settlement services. Away from work, so the living cost in this housing could be higher; 2) Choose the site with lower feasibility occupants, such as flooding and landslide-prone; 3) Reduce the quality of housing infrastructure and utilities also settlement services such as roads easily damaged road, limited clean water, improper sanitation, none waste management facilities, and etc; 4) Reduce the quality of construction by using substandard building materials; and 5) Repeal the security rights guarantee where land certificates were never resolved.

According Winarso [5], the developer has financial ability to build their own infrastructure. Winarso also explained that in order to reduce the cost of its production, developers choose the lower price land despite not having access to basic infrastructure services then built housing that will eventually be equipped with required facilities. The quality of infrastructure provided by the developer also generally have better quality than what is supplied by the government. Thus, in the context of the wider region, Firman [6] mentions that this can lead to social segregation in residential areas to the neighborhood settlements surrounding communities.

Housing developer has significant role in housing and infrastructure provision, especially in big cities. Nevertheless in some cases developers have not fulfilled their role. In this case the need of infrastructure of the community cannot be fulfilled. Then the objective of this study is to explore the condition of infrastructure in formal housing developed by developer and the factors influencing the condition.

2. Methods
The methods described in this section include methods in data collection and analysis.

2.1. Data Collection
The type of data required in the study are primary and secondary data. Primary data is data obtained from observations directly related to the object of research studies that set. Primary data was collected through observation, interviews, and questionnaires to developers and other stakeholders. Based on the steps being taken in research, data collection is done starting from literature, institutional survey, and a survey in the form of direct observation and questionnaires.

Observations are divided into two stages. The first stage is pre survey where observation was conducted to determine the distribution of housing in the district Parongpong which will be the object of research. At this stage of pre-survey, a total number of 55 housing in Sub Parongpong but only 49 housing can be made the object of research to answer hypotheses and research questions have been formulated. The object of research is described in Table 1 and the spatial distribution is showed in Figure 1. Furthermore, at this stage of the survey, observation was conducted to determine a general overview of basic infrastructure that exist in each housing.

| Table 1. List of formal housing developed by developer in Parongpong. Type of housing classification: A = low income housing; B = low-middle income housing; C = middle-high income housing; and D = high income housing. Cluster Bella Cassa, Royal Duta Townhouse, Sariwangi Regency II, Setra Regency Townhouse, The Green Garden Massuraya Village, and The Philosopher Village is not observed. |

² REI is the formal housing association in Indonesia
| No | Name Of Housing          | Village     | Year of Construction | Total Unit | Class |
|----|--------------------------|-------------|----------------------|------------|-------|
| 1  | Alam Sariwangi           | Sariwangi   | 2009-2010            | 21-40      | B     |
| 2  | Arthabahana              | Cihanjuang  | before 2000          | 151-200    | B     |
| 3  | Bukit Sariwangi          | Sariwangi   | 2005-2006            | 101-125    | A     |
| 4  | Bukit Taman Asri Residence | Sariwangi | 2010-2011            | 21-40      | B     |
| 5  | Bumi Asri Cihanjuang     | Cihanjuang  | 2010-2011            | 101-125    | B     |
| 6  | Bumi Sariwangi 1         | Sariwangi   | 2000-2004            | 201-500    | C     |
| 7  | Bumi Sariwangi 2         | Sariwangi   | 2005-2006            | 21-40      | A     |
| 8  | Cibaligo Permai          | Cihanjuang  | before 2000          | 151-200    | B     |
| 9  | Cluster Bella Cassa      | Ciwaruga    | 2016                 | Below 21   | B     |
| 10 | Duta Asri Residence      | Cihanjuang  | 2014-2015            | 21-40      | B     |
| 11 | Graha Sariwangi Residence| Sariwangi   | 2009-2010            | 21-40      | B     |
| 12 | Green Hanjuang           | Cihanjuang  | 2010-2011            | 21-40      | B     |
| 13 | Greenland Ciwaruga       | Ciwaruga    | 2012-2013            | 41-60      | B     |
| 14 | Griya Amanda 1           | Sariwangi   | 2005-2006            | 21-40      | A     |
| 15 | Griya Amanda 3           | Ciwaruga    | 2005-2006            | 21-40      | A     |
| 16 | Griya Cihanjuang         | Cihanjuang  | 2012-2013            | 21-40      | A     |
| 17 | Harmony Cihanjuang        | Cihanjuang  | 2012-2013            | 61-80      | C     |
| 18 | Insulinde Indah          | Cihanjuang  | 2000-2004            | 151-200    | A     |
| 19 | Komplek Pasir Kemiri     | Cigugur Girang | 2007-2008     | 61-80      | A     |
| 20 | Kompleks Graha Lista     | Ciwaruga    | 2007-2008            | 21-40      | A     |
| 21 | Kompleks Lembah Sariwangi| Sariwangi   | 2000-2004            | 151-200    | B     |
| 22 | Lembah Hijau Cihanjuang  | Cihanjuang  | 2012-2013            | 61-80      | B     |
| 23 | Lembah Permai Hanjuang   | Cihanjuang  | before 2000          | 126-150    | B     |
| 24 | Maharani Village         | Cigugur Girang | 2014-2015     | 21-40      | B     |
| 25 | Nirwana Regency          | Sariwangi   | 2000-2004            | 81-100     | B     |
| 26 | Parigi Indah Kavling DPRD| Ciwaruga    | 2005-2006            | 151-200    | C     |
| 27 | Perumahan Katumiri       | Cihanjuang  | 2000-2004            | 201-500    | D     |
| 28 | Pondok Bunga Sariwangi 1 | Sariwangi   | 2007-2008            | 41-60      | A     |
| 29 | Pondok Bunga Sariwangi 2 | Sariwangi   | 2007-2008            | 21-40      | A     |
| 30 | Pondok Hijau Indah       | Ciwaruga    | before 2000          | 201-500    | C     |
| 31 | Puncak Sariwangi Asri    | Sariwangi   | 2005-2006            | 21-40      | A     |
| 32 | Puri Budi Asri           | Cihanjuang  | before 2000          | 126-150    | B     |
| 33 | Royal Duta Townhouse     | Ciwaruga    | 2016                 | -          | B     |
| 34 | Royal View Residence     | Ciwaruga    | before 2000          | 41-60      | C     |
| 35 | Sariwangi City View      | Sariwangi   | 2009-2010            | 151-200    | B     |
| 36 | Sariwangi Estate         | Sariwangi   | 2010-2011            | 21-40      | B     |
| No | Name Of Housing                  | Village   | Year of Construction | Total Unit | Class |
|----|---------------------------------|-----------|----------------------|------------|-------|
| 37 | Sariwangi Highland              | Sariwangi | 2014-2015            | below 21   | C     |
| 38 | Sariwangi Regency II            | Sariwangi | 2016                 | -          | B     |
| 39 | Selaras Alam Rumah Inspirasi    | Sariwangi | 2005-2006            | 61-80      | C     |
| 40 | Selaras Cihanjuang              | Cihanjuang| 2012-2013            | 21-40      | B     |
| 41 | Serra Valley                    | Ciharuga  | 2010-2011            | 101-125    | C     |
| 42 | Setiabudi Regensi               | Ciharuga  | before 2000          | 501-1000   | D     |
| 43 | Setra Regency                   | Ciharuga  | 2012-2013            | 21-40      | B     |
| 44 | Setra Regency Townhouse         | Ciharuga  | 2016                 | 21-40      | B     |
| 45 | SSP Sariwangi Cozy Living       | Sariwangi | 2009-2010            | below 21   | B     |
| 46 | SSP Sariwangi Perumahan Berteknologi | Sariwangi | 2009-2010            | 81-100     | C     |
| 47 | Taman Cihanjuang 1              | Cihanjuang| 2000-2004            | 81-100     | B     |
| 48 | Taman Cihanjuang 2              | Cihanjuang| 2014-2015            | 21-40      | B     |
| 49 | The Garden Sariwangi            | Sariwangi | 2007-2008            | 21-40      | A     |
| 50 | The Green Garden Massuraya Village | Cigugur Girang | 2016               | -          | B     |
| 51 | The Green Sariwangi             | Sariwangi | 2007-2008            | 41-60      | A     |
| 52 | The Philosopher Village          | Cigugur Girang | 2016               | -          | B     |
| 53 | The Sariwangi Village           | Sariwangi | 2012-2013            | 41-60      | B     |
| 54 | Trinity                         | Cihideung | before 2000          | 61-80      | D     |
| 55 | Villa Istana Bunga              | Karyawangi| before 2000          | 201-500    | D     |
Figure 1. Distribution of Housing in District Parongpong. This housing which then become the object of study

2.2. Data Analysis
The analytical approach used is a quantitative analysis in which all the criteria and analysis undertaken can be measured, calculated, or operated mathematically. In more detail the method of analysis used are descriptive and association analysis.

Descriptive analysis is used to describe the existing condition of infrastructure in each housing. It will show what and how the infrastructure characteristics provided by developer. Association analysis is used to find out the related factors towards the infrastructure provisioning. Chi square analysis was used to identify the correlation between the condition of the existing infrastructure on housing characteristics and the factors. The correlation will indicate the presence of certain trends in the provision of infrastructure that is owned by the developer. In the study, chi square have been selected for this technique in accordance with the need to calculate the relationship between variables with nominal data types, which will only show the relationship between these variables.

Infrastructure examined in the study are clean water, sewage, drainage, and solid waste system. The factors that are expected have a significant correlation are the number of units, residential area, years of development, and housing classification by the target of market.
3. Result and Discussion
Discussion related research will be outlined according to the targets.

3.1. Basic Characteristics of Infrastructure Provision in Housing

Clean Water
Clean water is one of the top priorities in the provision of infrastructure in a residential neighborhood. Clean water is regarded as a vital necessity that must be met for the people. Before building a house is built, the existence of clean water resource will be confirmed first by the developer.

Based on the observation, all the entire housing have access to clean water, sourced from individual wells, artesian wells, springs, or PDAM provided by the developer. Clean water is supplied as part of housing. Developer also has the propensity to build a clean water network system by relying on ground water through individual wells or artesian wells. This indicates the desire of developers to create housing that is independent and also minimize resident dependence to the central urban network in terms of water supply.

Drainage
Drainage become one infrastructure which is quite important in a residential neighborhood. Drainage serves as a medium flow of runoff rainwater that falls to the ground. A good drainage will reduce the potential for inundation, especially if the housing area is at a location that is relatively low and has a high potential for inundation.

Despite the existence of a network of drainage channels are important, but not all housing have it. Based on observations made there were 88% of housing that has a good network of drainage channels with open drainage design, closed drainage, or a combination of both. A network of drainage channels have a high enough priority may be due to the ease and low cost required in development for the provision carried out simultaneously with the construction of the road network.

Sewerage
Sewerage provides a considerable influence on public sanitation problems in a residential neighborhood. Sewerage has a hierarchy of individual services to the communal. In the individual services, the infrastructure that must be provided is a septic tank while the communal infrastructure services that must be provided is a network of waste water treatment plan (WWTP).

Based on the observations made, it is known that the entire housing has had individual septic tanks and 88% of the housing of which have been equipped with a network of communal WWTP. This indicates that it is basically a network of sewerage infrastructure is definitely a basic infrastructure is provided to each house but the construction was not prioritized because it can be continued or handed over to the resident.

Waste Facility
The waste facility has the lowest priority to be provided than other basic infrastructure. Waste facilities including garbage containers and waste collection services are not regarded as something that is so important to be reserved in advance.

Based on the observations made, 80% of housing has garbage containers that can be used by resident to collect garbage produced every day in each home. 95% of housing has had a collection service for carrying garbage each house into further processing which is managed by the neighborhood association³. This indicates that the low priority the provision of the waste facility because it can not take place independently. There is a close relationship to the urban network. Waste management is continued process that taken a high cost. In the smallest units, waste management is the responsibility of government that is done by neighborhood association. Therefore, the provision of waste facilities can

³ Neighborhood association (RT/RW) is the smallest unit of local government in Indonesia
be ruled out in advance because the operating system can further be delivered or undertaken in cooperation with surrounding territories.

The result of the observation made is showed in Table 2.

Table 2. Characteristic of housing infrastructure provided by developer

| No | Element | Result |
|----|---------|--------|
| 1  | Drainage Provided on the right and left of the road | 51% housing has closed drain  
23% housing has open drain  
14% housing has mixed drain  
12% housing has none |
| 2  | Waste Facilities Every house has individual waste facility, can be trash can or permanent garbage bin | 80% housing has individual trash bin  
20% housing has none |
|    | There is waste collection system | 96% housing has waste collection facility  
4% housing has none |
| 3  | Clean Water There is clean water in each house | 65% housing has individual well  
20% housing get clean water from artesian well  
8% housing get clean water from water springs  
4% housing get clean water from PDAM  
2% housing get clean water from local PDAM |
| 4  | Sewerage Every house has an access to individual or communal septic tank | 100% housing has individual septic tank |

3.2. Factors Related the Infrastructure Provisioning

Provision of basic infrastructure in a residential area is not significantly related by the number of housing units built and the construction of housing. Provision of basic infrastructure is significantly related by the type of housing that reflects the market target of each housing. Each type of infrastructure has a tendency to be provided on the type of housing. There is certain trends in the provision of infrastructure where the higher level of economic goals occupants will be more complete infrastructure components are built. The Table 3, Table 4, Table 5, and Table 6 show the correlation between infrastructure provision with years of construction, the total unit, and housing classification. The correlation of the factors and infrastructure provided is significantly can be seen in individual trash bin provision. With the significance 0.048 is correlated with the year of construction and 0.001 is positive correlated with the classification of housing.

Table 3. Correlation between infrastructure provision and year of construction

| No | Element (N=49) | Calculated $X^2$ | $df$ | Sig. | Table $X^2$ | Result |
|----|---------------|------------------|------|------|-------------|--------|
| 1  | Drainage      | 10.372           | 7    | 0.168| 14.067      | No correlation |
| 2  | Individual Trash Bin | 14.211 | 7    | 0.048| 14.067      | There is correlation |
| 3  | Waste Collection | 4.402         | 7    | 0.732| 14.067      | No correlation |
| 4  | Clean Water   | -               | -    | -    | -           | Provided in all type of housing |
No | Element (N=49) | Calculated $X^2$ | df | Sig. | Table $X^2$ | Result
--- | --- | --- | --- | --- | --- | ---
5 | Septic tank | - | - | - | - | Provided in all type of housing

Table 4. Correlation between infrastructure provision and total unit of housing

No | Element (N=49) | Calculated $X^2$ | df | Sig. | Table $X^2$ | Result
--- | --- | --- | --- | --- | --- | ---
1 | Drainage | 7.898 | 9 | 0.544 | 16.919 | No correlation
2 | Individual Trash Bin | 13.430 | 9 | 0.144 | 16.919 | No correlation
3 | Waste Collection | 5.720 | 9 | 0.768 | 16.919 | No correlation
4 | Clean Water | - | - | - | - | Provided in all type of housing
5 | Septic tank | - | - | - | - | Provided in all type of housing

Table 5. Correlation between infrastructure provision and total housing area

No | Element (N=49) | Calculated $X^2$ | df | Sig. | Table $X^2$ | Result
--- | --- | --- | --- | --- | --- | ---
1 | Drainage | 44.347 | 47 | 0.583 | 67.505 | No correlation
2 | Individual Trash Bin | 49.000 | 47 | 0.393 | 67.505 | No correlation
3 | Waste Collection | 49.000 | 47 | 0.393 | 67.505 | No correlation
4 | Clean Water | - | - | - | - | Provided in all type of housing
5 | Septic tank | - | - | - | - | Provided in all type of housing

Table 6. Correlation between infrastructure provision and classification of housing

No | Element (N=49) | Calculated $X^2$ | df | Sig. | Table $X^2$ | Result
--- | --- | --- | --- | --- | --- | ---
1 | Drainage | 1.546 | 4 | 0.819 | 9.488 | No correlation
2 | Individual Trash Bin | 18.340 | 4 | 0.001 | 9.488 | There is a positive significant correlation
3 | Waste Collection | 7.139 | 4 | 0.129 | 9.488 | No correlation
4 | Clean Water | - | - | - | - | Provided in all type of housing
5 | Septic tank | - | - | - | - | Provided in all type of housing

4. Conclusion

Storm water infrastructure, waste facilities and waste management services, clean water, and septic tanks have been generally available on housing built by developers. Variations encountered is the type of infrastructure provided. Only years of development and target the housing market are correlated with the provision of infrastructure, in this case the waste container. New construction housing and middle-high income housing above generally provide a trash receptacle individually. Condition of infrastructure provisioning in housing built by developers has not shown uniformity and so far there are no regulation related to the provision of infrastructure in built housing developer.
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