



RESEARCH ARTICLE

SOCIAL DETERMINATION OF WASTE GENERATION IN PUBLIC HOUSING

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ABSTRACT

Banyuning Sub-district is a suburb of Singaraja City that potentially experiencing the problem of waste. This fact is supported by the existence of settlements, especially the residential as the largest land use in Banyuning Sub-district. As the largest residential, the number of people living in the area is also great. Large population will be the largest waste contributor in Singaraja City. Through analytic survey method with quantitative analysis techniques, it will show the relationship between the social characteristics of the settlers with waste generated. The relationship shows that the number of family members, income and education levels significantly influence waste generation, and the income level is the biggest influence with regression coefficient 0.634. An interesting finding and has novelty in this article are all independent variables value is positive, except for the education level that is negative. The findings were evidenced by the regression coefficient of education level that is (-) 0.279.

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INTRODUCTION

This study included the scope of the study of settlements geography. Barlow and Newton (1977) defines the settlements geography as a study of the nature and distribution of human habitation, either in the form of individual settlers or settler in large groups. In relation with this research, focused on the study of public housing or residential, especially on household waste problems that exist in the residential. Geography approach used to assess the problem is the ecological approach. This ecological approach is used to analyze the relationship between the characteristics of the settlers to the existence of waste generated. Relationships are understood in this approach is the activity of the settlers will cause great waste generation phenomenon. This phenomenon is due on the one hand the consumption needs of the settlers increasingly, and on the other hand support of the environment as a space where waste collection is very limited. The city is a region experiencing massive population growth. Large urban population growth has consequences for the needs of a large living space (Yunus, 2006).

Population growth, economic development, urbanization and improvement of people's living standards lead to acceleration of household waste generation rate (Minghua et al., 2009). Space as a receptacle that required for citizen to live conventionally divided into public and private settlements. Limitations of city space resulted the orientation in settlements development tend to lead to residential as a solutions to the need of citizen for settlement. Based on Law No. 1 Year 2011 on Housing and Settlement Region, residential is defined as a collection of house as part of the settlement, both urban and rural areas, which is equipped with the infrastructure, facilities, and public utilities as a result of efforts to comply with the house habitable. Residential areas of the city are generally intended for settlar from outside the city (immigrant) or colonization pioneering families. In other words, settlers in the residential is heterogeneous. One of this heterogeneity can be seen in terms of occupation. Mainly they are engaged in industry and services, so the residential that built in the city has an urban nature. On the other hand, residential is one of urban built-up area that have a high pressure on the environmental carrying capacity. Okwesili et al. (2016) argue that the rate of rapid industrialization has proven to be a major problem in environmental health. Residential environmental degradation as one of the ecological problems the city is a manifestation of the pressure of the settlers who exceed the carrying capacity of the environment. Waste is a determinant factor in the ecological problems of the city, especially in the residential

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environmental degradation. For Oyeniyi (2011), waste is capable to different interpretations and meaning. He argued that waste could be any material which has been used and is no longer wanted, for example, because the valuable or useful part of it has been taken out. Waste could also mean an opportunity not taken i.e. when one does not take an advantage of an opportunity when it is available, from these and many more ways through which the term could be understood or used, it is the first sense as any material which has been used and is no longer wanted, because the valuable or useful part of it has been taken out. Residential urbanized settlers is the largest producer of household waste. Household waste known as municipal solid waste (MSW) was trash of urban households consisting of items of everyday such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances and batteries (Environmental Protection Agency, 2011). Municipal or household wastes are often generated from several sources where variable human activities are encountered. Several studies indicate that much of the municipal solid waste from developing countries are generated from households (55–80%), followed by commercial or market areas (10–30%) with varying quantities from streets, industries, institutions among others (Nabegu, 2010; Nagabooshnam, 2011). Parallel with these definition, in Government Regulations No. 81 Year 2012 on the Management of Household Waste explained that household waste is waste from household daily activities. Based on both these definition, the household waste is solid waste that is the result of settlement. Thus, the household waste is the fastest to produced and the longest to decompose. Singaraja city is the capital of Buleleng Regency, Bali Province which has ecological problems, that is also sourced from household waste. The existence of household waste is inseparable from the characteristics of Singaraja City as an education city. Predicate as the education city resulting in a population of Singaraja City experienced a significant increase. Population growth in Singaraja City is dominated migrants with academic background, both as students and as educators and staff employees. Population growth in Singaraja City as a consequence of education city resulted in increased the needs of space to stay. Residential development is one of the space that accommodate the increased demand for living for migrant population in the Singaraja City.

Banyuning Sub-district is a sub-urban area in Singaraja City with an area, population and residential as well as the biggest waste generation rate. Banyuning Sub-district has an area of 5.13 km², or 18.39% of the total area of Singaraja City and a total population of 16 057 people or 16.66% of the total population in Singaraja City in 2014 (Central Bureau of Statistics, 2015). Based on data from Integrated Services Office of Public Housing and Housing List of residential, that of 16 residential contained in Singaraja City and 8 of them scattered in Banyuning sub-district. On the other hand, according to the Department of Hygiene and Stated (2014) that Banyuning Sub-district is an area with potential for the biggest household waste generation, ie 32.51 m³/day from a total of 89.06 m³/day in Singaraja City. This fact reveals that as the region with the highest distribution of residential, Banyuning sub-district is the largest producer of household waste in Singaraja. Residential predominantly urbanized settlers in consumption activity continues to produce output in the form of waste. Waste that has been generated is household waste that is relatively difficult and takes a long time to unravel. On the other hand, the carrying capacity of the residential

environment has limitations in accommodating waste generated. The main limitation of the environmental carrying capacity is limited in the supply of residential land and infrastructure for disposal or waste collection. Waste generation is manifestations of inequality between high waste production and low environmental capacity. Waste generation is the quantity of waste generated by an activity within a certain time, or in other words the amount of waste generated in units of weight (kilograms) gravimetric or volume (liters) volumetric (Tchobanoglous *et al.*, 1993). Unit waste generation is generally expressed as a unit of the scale of quantity per person or per unit building. The scale of quantity, among others, is a unit of waste in: (1) unit weight, ie kilogram per person per day (kg / person / day) and (2) a unit volume, ie liters per person per day (liters / person / day) (Damanhuri and Padmi, 2010). Theoretically waste generation influenced by social characteristics of settlers, including the number of family members, education level and income level. The number of family members is is the total number of household family members who live and eat from one kitchen to the population groups that are already included in the group of labor (Mantra, 2003). The level of education is the stage of formal education or who have completed (Mantra, 2003). The level of income is the amount of real income donated to meet the needs of the household. The quantity of solid waste generation is mostly associated with the economic status of a society (Guerrero *et al.*, 2013). Based on the above description and background, then compiled the following problems: the fact is that there is concentration of large household waste generation, particularly in the most residential of Banyuning Sub-district. In the other fact can be shown that the resulting household waste generation has a tendency to increase. Therefore it is considered essential to analyze the relationship between the social characteristics of the residential settlers with waste generated in Banyuning Sub-district.

MATERIALS AND METHODS

The design in this study using analytic survey research design. The object of this study is the household waste, while the subjects were residential settlers. The design of this analytic survey is not conducted on the entire study population, but just take a sample or a portion of the population that represent characteristics of the population. The sample in this study design is divided into the sample area that consists of 2 residential namely BTN Banyuning Indah and Multi Banyuning Lestari, with the samples of each subject 70 households and 30 households, so the total sample amounted 100 household as a subject. Collecting data in this study are described based on the type and the following data collection techniques. The data in the study consisted of primary data and secondary data. Primary data includes data: (1) social characteristics of the settlers, including the number of family members, education level and income level, and (2) of waste generation collected directly from the original source or object or subject of study. While belonging to the secondary data includes data: (1) the number of residential, and (2) the number of households residential sourced from Banyuning Sub-district office instance. The data collection techniques, both primary data and secondary data in this study were (1) the questionnaire is used to obtain information about the characteristics of the settlers of residential, including the number of family members, education level and income level; (2) observation is used to get the size of waste generation under the provisions of SNI 19-3964 1994; and (3) the

Table 1. Characteristics of Settlers According to Number of Family Members

No	Number of Family (members)	BTN Banyuning Indah		Multi Banyuning Lestari	
		F	%	F	%
1	1	4	5,7	0	0
2	2	18	25,7	16	53,3
3	3	25	35,7	12	40
4	More than 3	23	32,9	2	6,7
	Total	70	100	30	100

Source: Primary Data, 2016

Table 2. Characteristics of Settlers According to Educational Level

No	Education Level	BTN Banyuning Indah		Multi Banyuning Lestari	
		F	%	F	%
1	Primary School Graduates	1	1,4	0	0
2	Junior High School Graduates	0	0	0	0
3	Senior High School Graduates	43	61,4	5	16,7
4	Collage Graduates	26	37,2	25	83,3
	Total	70	100	30	100

Source: Primary Data, 2016

Table 3. Characteristics of Settlers According to Income Level

No	Income Level	BTN Banyuning Indah		Multi Banyuning Lestari	
		F	%	F	%
1	Less than 1 million	1	1,4	0	0
2	1 Million up to 1,5 Million	25	35,8	21	70
3	More than 1,5 - 3 Million	36	51,4	7	23,3
4	More than 3 Million	8	11,4	2	6,7
	Total	70	100	30	100

Source: Primary Data, 2016

Table 4. Characteristics of Household Waste Generation Based On Residential

No	Waste Generation	BTN Banyuning Indah		Multi Banyuning Lestari	
		F	%	F	%
1	Less than 2 Kg	23	32,9	22	73,4
2	2 Kg up to 4 Kg	38	54,2	7	23,3
3	More than 4 Kg	9	12,9	1	3,3
	Total	70	100	30	100

Source: Primary Data, 2016

Table 5. Simple Linear Regression Equations of Settlers Social Characteristics with Waste Generation

No	Settlers Characteristics	Konstanta	Koefisien	T Table	T Count	Sig.
1	Number of Family Members	0,196	0,514	1,984	8,870	0,000
2	Education Level	3,998	-0,673	1,984	-6,918	0,000
3	Income Level	-0,576	0,849	1,984	18,060	0,000

Source: Primary Data Processing

Table 6. Anova Test of Settlers Characteristics to Waste Generation Simultaneous

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	35.671	3	11.890	161.244	.000 ^a
Residual	7.079	96	.074		
Total	42.750	99			

a. Predictors: (Constant), Number of Family Members, Education and Income Level

b. Dependent Variable: Waste Generation

Source: Primary Data Processing

Table 7. The Influence of the settlers Characteristics to Waste Generation

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	.556	.265		2.099	.038		
Number of Family Members	.143	.042	.186	3.457	.001	.593	1.685
Education Level	-.279	.054	-.238	-5.147	.000	.810	1.235
Income Level	.634	.056	.655	11.342	.000	.518	1.931

a. Dependent Variable: Waste Generation

Source: Primary Data Processing

$Y = 0,196 + 0,514 X$	(1) the influence of the number of family members
$Y = 3,998 + (-0,673) X$	(2) the influence of the education level
$Y = -0,576 + 0,849 X$	(3) the influence of the income level

Figure 1. Partial Regression Equations of Settlers Characteristics Influence the Waste Generation

recording of documents to obtain information on the number of residential and residential household. Analysis of the data in this study is quantitative analysis. The quantitative analysis used is descriptive and inferential statistics. Descriptive statistics were used to describe the frequency table data is collected without significance test, whereas inferential statistics used are simple and multiple linear regression simultaneously and partially to test the hypothesis significance level. This analysis is used to determine the direction of the relationship between independent variables and the dependent variable, and to predict the value of the dependent variable when the independent variable values increase or decrease.

RESULTS

Characteristics of these settlers understood as a description of the structure of the population who live in Banyuning Sub-district residential. Social characteristics of the settlers described include number of family members, education level and income level of household in both residential, namely BTN Banyuning Indah and Multi Banyuning Lestari. First, the characteristics of the settlers according to the number of family members. The number of family members who dominate in BTN Banyuning Indah is numbered 3 members to 25 settlers or 35.7%, while the Multi Banyuning Lestari is dominated amounted to 2 members with 16 settlers or by 53.3%. This shows that the number of family members in the residential BTN Banyuning Indah larger than Multi Banyuning Lestari residential as shown in Table 1. Secondly, the characteristics of the settlers by educational level. In Table 2 shows that the lowest level of education settler status as household is a primary school, which only contained 1 settler or 1.4% in the residential BTN Banyuning Indah. Although in both residential settlers are educated graduates higher education, but the percentage is different.

BTN Banyuning Indah residential settlers on a graduated higher education which is 26 settlers or 37.2%, but is dominated settlers who graduated from high school with the number of 43 settlers or 61.4%. While in Multi Banyuning Lestari dominated by settlers with graduate higher education amounted to 25 settlers or 83.3%. Third, the characteristics of the settlers by income level. According to the income level of residents in both residential, it appears that the income level of settlers in residential BTN Banyuning Indah higher than Multi Banyuning Lestari. Household income in BTN Banyuning Indah is dominated at intervals income of more than Rp 1,500,000 to Rp 3,000,000 which accounted for 36 households or 51.4%. While household income in Multi Banyuning Lestari who dominate the interval income is Rp 1,000,000 to Rp 1,500,000, which has 21 households or 70% as shown in Table 3. Description of the characteristics of the household waste is reviewed based on waste generation. Waste generation in both residential exhibit variations. Waste generation that dominates the BTN Banyuning Indah is the interval weight of 2 Kg to

4 Kg of 38 settlers, or by 54.2%. While waste generation that dominates the Multi Banyuning Lestari is less than 2 Kg. This shows that waste generation in BTN Banyuning Indah larger than Multi Banyuning Lestari residential. Characteristics of household waste by waste generation as shown in Table 4. The influence of the characteristics of settlers to the waste generation showed by the analysis of the effect of variable partially (t-test) and simultaneous (f-test). It can be seen from the large value of partial regression coefficient or t-test at each independent variable characteristics of settler as shown in Table 5. In Table 5 shows that the number of family members, education level and income level are partially significant effect on waste generation. It is visible from all three value t is greater than t table. As for each of the linear regression equation settlers characteristics as shown in Figure 1. Simultaneously the influence of the social characteristics of the settlers to the residential waste generated in Banyuning Sub-district described by hypothesis testing through F test as shown in Table 6. In Table 6 shows that the value of 161.244 F count larger than F table 2.70, it can be concluded that the number of family members, education level and income level simultaneously influence waste generation. On the other hand, the value prob. F count (sig.) Value is 0,000 less than the 0.05 level therefore it can be concluded that the characteristics of the settlers together significant effect on waste generation. The influence of the three independent variables can be known from the value of R square. The results of the analysis of the coefficient of determination R-square is equal to 0,829. This value means that 82.9% of waste generation is influenced by the number of family members, education level and income level. While the remaining 17.1% is influenced by other factors not included in the model. Furthermore, to determine the regression equation of the influence of the characteristics of settlers to the waste generation is to use the regression coefficient or t test as shown in Table 7. Table 7 shows the regression coefficients for each variable, the variable of the numbers of family members amount 0.143, educational variables - 0.279 and income variables amount 0.634. The regression equation is $Y = 0,556 + 0,143X_1 + (-0,279) X_2 + 0,634X_3$. There are 3 interpretation of multiple linear regression model. First, the regression coefficient of the number of family members is positive means as the number of family members rises, then the amount of waste generated will also increase. Similarly, when the number of family members down, then the amount of waste generated also fell. The increase in the number of settlers for one members will increase the amount of waste generated amounted to 0.143 kg and conversely, a decrease in the number of settlers amounting to 1 members will reduce the amount of waste generated amounted to 0.143 kg.

DISCUSSION

This condition is consistent with the research results of Hendra and Aswadi (2011), which revealed that there is a

positive relationship between the number of family members with the volume of waste generated. This shows that the number of family members will determine the amount of the family's needs (Adiana and Karmini, 2009). In other words, the greater the number of family members, the greater of waste generated. Secondly, the regression coefficient of education level is negative means at the time of household education level rises, the amount of waste generated will decrease, and vice versa. The increase in the education level of household of one level will reduce the amount of waste generated amounted to 0.279 kg and vice versa, household with low educational level every 1 rate would increase by 0.279 kg of solid waste. The results of this study have a fundamental difference of the research that has been done before. According Rahardja *et al* (2005) the higher the person's formal education, the higher the consumption expenditure, which will produce large amounts of waste. At the time of a person or family has a high level of education, the necessities of life is also growing. This is because they have to meet, not just a need to eat and drink, but also needs the information, relationships in the community and the need for self-recognition. Notice of the differences shown from the results of previous studies, the results of this research into the findings of which have properties novelty. This is because the higher of the education levels actually reduce the amount of waste generation. Theoretically, education improves the ability of a person to critically reason and understand issues (Njoroge *et al.*, 2013). Therefore, the level of education will directly improve the efficiency power of a person in a harness or to consume goods necessities of life. Although it is considered to have the complex necessities of life, but the ability of the efficiency of a person can minimize the purchase or selective in buying the goods that needed in organizing their education, therefore the waste generated also be small. Higher education will also make a person to be able to manage the waste generated, either to be reused or recycled into items that are more valuable and useful. Third, the regression coefficient of household income is positive. By the time the income level rises, the amount of waste generated will increase, and vice versa. The increase in the income level of 1 million (rupiah) will increase by 0.634 kg of waste generation and conversely, a decrease in the level of revenues of 1 million (rupiah) will reduce waste generation amounted to 0.634 kg. This condition is not different from the research results of Nicholson (2001) which states that households with low income will spend most of their income to buy basic necessities. In contrast, high-income households will only spend a fraction of the total spending on basic needs, the rest is secondary to the needs and terseier. In other words, the greater the household income, the greater of waste generated. Generally, Miezah *et al.*, (2015) have shown the same result, that is the relationship between the per capita waste generation and household income as well as waste generation and household size.

Conclusion

Based on the analysis and interpretation of the data showed that the number of family members, education level and income level are partially significant effect on waste generation. This is evident from the results of the t-test, with t value greater than t table. While simultaneously the three characteristics of the settler's significant effect on waste generation in the residential in Banyuning Sub-district. This is evidenced from the results of f-test with F value greater than F table. Although both significantly influence waste generation,

but all three social characteristics of residential settlers are giving different determinations:

- The number of family members is a variable that has the lowest positive regression coefficient (0.143) in influencing the amount of waste generation;
- The level of education was the only variable that has the effect of negative regression coefficient (-0.279) to the amount of waste generation, and also become interesting findings and has novelty, since in contrast to results of previous studies; and
- The level of income is a variable that has the highest positive regression coefficient (0.634) in influencing the amount of waste generation.

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