Analysis of Population Density and Family Wellbeing

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Abstract—As a satellite city of Surabaya, Sidoarjo has a population of 1.8 million people spread across 18 districts. Sidoarjo has an area of 714.27 Km^2, so the population density reached 2521 people per Km^2. But the greater the value of population density does not always have a negative impact. The purpose of this research is to know relationship between population density and the number of prosperous families in Sidoarjo 2015 using Pearson Correlation analysis. Based on this research there is a correlation of 85.9% between population density and number of prosperous families which means there is a positive relationship between population density and the number of prosperous families. Sidoarjo which grow into industrial area provides high job opportunity. In addition, house prices in Sidoarjo are relatively cheaper than Surabaya. This makes many people from outside Sidoarjo choose to live in Sidoarjo. This makes the population density and the number of prosperous families being high.

Keywords—population density; family wellbeing; correlation value

I. INTRODUCTION

Population has two important things to see, quantity and quality of the population. Based on quality of population, every poeple wants a prosperous family. Population problems are closely related to family life and family wellbeing as a reflection of family quality [1]. Based on the quantity of population, if the population increases then the number of house needs will also increase. Research conducted in Depok, Sleman in 2012 proves that the rate of population growth is a reflection of the rate of home needs [2]. We know that the total area will not increase, and if it is accompanied by an increasing number of residents, the population density in a region will increase. The higher the population density will provide new problems in an area. But if population density increase can also have a positive impact.

There have been a lot of research that discuss the impact of increasing population density. Research conducted by Gobbi and Croix explains that increased population density will reduce fertility rates [3]. Research conducted by Rahman explains that increased population density has a negative impact on environmental quality in the long run [4]. Research conducted by Liu, Gao and Lu explains that urbanization makes urban population density increasing so as to increase greenhouse gas emissions [5]. Results of a paper discussion on demographics, house prices and mortgage design shows that if population density and income increases will increase house prices and of course the stock of houses will decrease [6]. Research conducted Karantonis in Sidney shows that population growth will increase the demand for housing. If there is no supply of new houses will increase the price of house rent and the selling price of the house [7]. Research conducted by Shabani, Akhari and Esfahani shows that the growth of population density have effect on economic growth [8].

Sidoarjo is a satellite city of Surabaya. Many workers in Surabaya choose to live in Sidoarjo. Most of them choose to live in Sidoarjo because the price of land and houses is cheaper when compared to the price of land and houses in Surabaya. Most of the workers chose Waru Sub-district, Sidoarjo as their home location. This makes the population density in Sidoarjo, especially Waru Sub-district to be very high. One of the effects is frequent jams, especially at 7 and 16 o'clock as can be seen in Figure 1.

Fig. 1. Gedangan Crossroad Conditions [9]

If we want to look more deeply, there is still a lot of impact of high population density in Sidoarjo. Therefore, the purpose of this study is to dig deeper the impact of Population Density in Sidoarjo, including its relationship with family wellbeing.

II. RESEARCH METHODS

In this study we used secondary data obtained from various sources. The study was conducted in Sidoarjo which has 18 sub-districts as can be seen in Table 1.

TABLE 1. LIST SUB-DISTRICT OF SIDOARJO

No	Sub-District	No	Sub-District
1	Sidoarjo	10	Balongbendo
2	Buduran	11	Wonoayu
3	Candi	12	Tarik
4	Porong	13	Prambon
5	Krembung	14	Taman
1	Tulangan	15	Waru
7	Tanggulangin	16	Gedangan
8	Jabon	17	Sedati
9	Krian	18	Sukodono

Population density is calculated as population divided by total land area.

$$\text{Population Density} = \frac{\text{Population}}{\text{Land Area}} \quad (1)$$

To measure family wellbeing, we refer [10] where prosperous families are formed on the basis of legal marriage; Both material and spiritual needs are sufficient; devoted to God; have the same relationship, in harmony, balanced between family members with the community and the environment. Based on the level of wellbeing, the family is classified into 5 groups:

1. Pre-Prosperous Family (PPF)

   Families who have not been able to meet basic needs at a minimum such as learning, religion, clothing, food, home and health.

2. Prosperous Family Stage 1 (PFS1)

   Families can meet basic needs at a minimum (in accordance with basic needs in pre prosperous families) but have not been able to meet the psychological social needs of families such as education, family planning, family interaction and interaction with the environment.

3. Prosperous Family Stage 2 (PFS2)

   Families who can meet basic and psychological needs but have not been able to meet development needs (saving money and obtaining information)

4. Prosperous Family Stage 3 (PFS3)

   Families who can meet the needs of Stage 1 and 2 but have not been able to contribute maximally to the community and play an active role in society

5. Prosperous Family Stage 3+ (PFS3+)

   Families who can meet the needs of phase 1 to 3 and can contribute maximally to the community and play an active role in the community

Meanwhile, to see the relationship of both, can be done with Pearson correlation analysis with the following formula:

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2}\sqrt{\sum_{i=1}^{n}(y_i - \bar{y})^2}} \quad (2)$$

III. RESULT AND DISCUSSION

A. Result

1) Population Density Analysis

To find out the density of population in certain sub-district can be done calculation of population density by using equation 1. The data needed for population density calculation is population and land area. The results of population density calculations can be seen in Table 2.

TABLE 2. POPULATION DENSITY

Sub-District	Population (People)	Land Area (Km2)	Population Density (People/Km2)
Sidoarjo	171444	62.56	2740
Buduran	78588	41.03	1915
Candi	130793	40.67	3216
Porong	56883	29.82	1908
Krembung	57655	29.55	1951
Tulangan	81050	31.21	2597
Tanggulangin	73538	32.29	2277
Jabon	47448	81	586
Krian	108205	32.5	3329
Balongbendo	64894	31.4	2067
Wonoayu	66969	33.92	1974
Tarik	61008	36.06	1692
Prambon	69665	34.23	2035
Taman	188323	31.54	5971
Waru	224512	30.32	7405
Gedangan	108740	24.06	4520
Sedati	98815	79.43	1244
Sukodono	112166	32.68	3432

Based on these results can be seen that Waru Sub-District has the highest population density of 7405 people/Km^2. While the Sub-District has the smallest population density is Jabon District that is equal to 586 Km^2.

2) Family Wellbeing Analysis

Each family must have a family card (FC). FC is the identity of a family. In one FC there is at least 1 person. The number of FCs reflects the number of families. The number of families per sub-district in Sidoarjo District can be seen in Table 3.

TABLE 3. THE NUMBER OF FAMILIES IN SIDOARJO

Sub-District	FC	Person	Person/FC
Sidoarjo	50111	171444	3
Buduran	22310	78588	4
Candi	36469	130793	4
Porong	16805	56883	3
Krembung	17572	57655	3
Tulangan	23725	81050	3
Tanggulangin	20712	73538	4
Jabon	13894	47448	3

Sub-District	FC	Person	Person/FC
Krian	31377	108205	3
Balongbendo	20133	64894	3
Wonoayu	20645	66969	3
Tarik	18299	61008	3
Prambon	21528	69665	3
Taman	49649	188323	4
Waru	61029	224512	4
Gedangan	31072	108740	3
Sedati	24906	98815	4
Sukodono	30782	112166	4

Based on Table 3 it can be seen that the average of 1 family consists of 3 to 4 people in all sub-districts in Sidoarjo District.

The number of each group based on the level of family wellbeing we get from BPS which can be seen in Table 4.

TABLE 4. GROUPING BY FAMILY WELLBEING LEVEL

Sub-District	PPF	PFS1	PFS2	PFS3	PFS3+
Sidoarjo	475	2361	5402	27744	14129
Buduran	556	1202	1698	15214	3640
Candi	1311	2144	6088	21869	5057
Porong	1878	4064	3767	6292	804
Krembung	765	2583	6011	6171	2042
Tulangan	1192	2293	2590	14594	3056
Tanggulangin	1627	2485	4374	8835	3391
Jabon	2265	2516	4031	3570	1512
Krian	1332	5105	8326	13731	2883
Balongbendo	331	3087	4145	10537	2033
Wonoayu	588	1749	2802	13332	2174
Tarik	880	3376	8079	4537	1427
Prambon	846	3281	8922	6217	1262
Taman	1217	5667	12603	23701	6461
Waru	326	6998	20155	22175	11375
Gedangan	448	2049	4413	16555	7607
Sedati	214	325	6462	12507	5398
Sukodono	273	3912	5414	16997	4186

The results of the percentage of each group can be seen in Table 5.

TABLE 5. PERCENTAGE OF GROUPS BASED ON FAMILY WELLBEING LEVEL

Sub-District	%PPF	%PFS1	%PFS2	%PFS3	%PFS3+
Sidoarjo	0.95%	4.71%	10.78%	55.37%	28.20%
Buduran	2.49%	5.39%	7.61%	68.19%	16.32%
Candi	3.59%	5.88%	16.69%	59.97%	13.87%
Porong	11.18%	24.18%	22.42%	37.44%	4.78%
Krembung	4.35%	14.70%	34.21%	35.12%	11.62%
Tulangan	5.02%	9.66%	10.92%	61.51%	12.88%
Tanggulangin	7.86%	12.00%	21.12%	42.66%	16.37%
Jabon	16.30%	18.11%	29.01%	25.69%	10.88%
Krian	4.25%	16.27%	26.54%	43.76%	9.19%
Balongbendo	1.64%	15.33%	20.59%	52.34%	10.10%
Wonoayu	2.85%	8.47%	13.57%	64.58%	10.53%
Tarik	4.81%	18.45%	44.15%	24.79%	7.80%
Prambon	4.12%	15.98%	43.46%	30.29%	6.15%
Taman	2.45%	11.41%	25.38%	47.74%	13.01%
Waru	0.53%	11.47%	33.03%	36.34%	18.64%
Gedangan	1.44%	6.59%	14.20%	53.28%	24.48%
Sedati	0.86%	1.30%	25.95%	50.22%	21.67%
Sukodono	0.89%	12.71%	17.59%	55.22%	13.60%

Based on Table 5 it can be seen that Waru Sub-District has the smallest percentage of PPF group that is 0.53%, followed

by Sedati and Sukodono Sub-District which have percentage of 0.86% and 0.89% respectively. Only after that Sidoarjo Sub-District which is the center of Sidoarjo District is 0.95%.

3) Correlation Analysis of Population Density and Family Wellbeing

Prosperous families are the minimum family included in the PFS1 category. To calculate the number of prosperous families can be done by summing the PFS1, PFS2, PFS3 and PFS3 + groups. Population density and number of Prosperous Families can be seen in Table 6.

TABLE 6. POPULATION DENSITY AND PROSPEROUS FAMILY IN SIDOARJO DISTRICT

Sub-District	Population Density (Person/Km²)	Prosperous Family (Family)
Sidoarjo	2740	49636
Buduran	1915	21754
Candi	3216	35158
Porong	1908	14927
Krembung	1951	16807
Tulangan	2597	22533
Tanggulangin	2277	19085
Jabon	586	11629
Krian	3329	30045
Balongbendo	2067	19802
Wonoayu	1974	20057
Tarik	1692	17419
Prambon	2035	19682
Taman	5971	48432
Waru	7405	60703
Gedangan	4520	30624
Sedati	1244	24692
Sukodono	3432	30509

To know whether there is a relationship between the density of the population and prosperous families can be done with correlation analysis between the two as in equation (2). Correlation analysis result using correlation pearson method got result 85.9%.

B. Discussion

Based on result, the very high population density in Sidoarjo District is located in sub-districts adjacent to Surabaya City such as Waru, Taman, Sukodono and Gedangan. Many workers in Surabaya City make these three sub-districts as their residence. In addition to the fact that the housing prices in Sidoarjo District are cheaper than in Surabaya City, the distance close to where they work to make the main reason.

Based on the level of family welfare, Waru Subdistrict which has the highest population density also has the highest number of prosperous families. The result of the correlation analysis between both of them is 85.9% which means that the population density and the number of prosperous families are closely related. The number of workers from Surabaya City who are minimum classified as Prosperous Family Stage 1 to stay in Sidoarjo make Prosperous Family number in Sidoarjo District especially Waru Sub-District, Taman, Sukodono and Gedangan high. Sidoarjo Sub-District is a place for residents belonging to Prosperous Family Stage 3 and Prosperous

Family Stage 3+ because it is the center of Sidoarjo District. Krian and Candi Sub-District is an industrial area that absorbs a lot of workers who enter the minimum class Prosperous Family Stage 1, because that's Prosperous Family number is high enough.

IV. CONCLUSION

Based on our research there is a correlation of 85.9% between population density and number of prosperous families which means there is a positive relationship between population density and the number of prosperous families. Increased of population density does not always have a negative impact on the number of prosperous families. With the availability of new jobs and property prices are still cheaper than Surabaya, making the population density of Sidoarjo increasing, and also increase the number of prosperous families.Sidoarjo which grow into industrial area provides high job opportunity. In addition, house prices in Sidoarjo are relatively cheaper than Surabaya. These factor make many people from outside Sidoarjo choose to live in Sidoarjo. This makes the population density and the number of prosperous families being high.

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