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Comparative Study Between Pre and Post-Implementation of Several Policies: Air Quality Index in DKI Jakarta

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ABSTRACT

The poor air quality in DKI Jakarta raises concerns among the public and harms health. Therefore, the people of the capital asked the government to act quickly to overcome this problem. The government's response was to provide several policies. Starting from August 11 until the end of August 2023, the government has issue up to 7 policies that are expected to overcome the pollution problem in the capital city. This research wants to see whether there is a difference in air quality in DKI Jakarta before and after the follow-up provided by the government. Daily recorded air quality index data is taken from a database, namely AQAIR. The data obtained was analyzed using the Wilcoxon Signed Ranks Test to see whether there were differences before and after the government issued the policy. After analyzing the data, the results showed that there was not sufficient evidence to state that there were significant differences related to air quality in DKI Jakarta before and after the policies issued by the government. Based on this, it seems that the policies issued by the government to overcome pollution are still not enough or not appropriate. Therefore, other alternative solutions are needed so that air quality problems can be resolved as soon as possible.

Keywords: Air Quality Index, Jakarta, Air Pollution, Policy Implementation, Wilcoxon Test.

A. INTRODUCTION

Air pollution is one of the trending topics discussed by public society, both in formal and informal discussion forums. According to IQAIR in 2022, Indonesia was one of the top 30 countries with poor air conditions. IQAIR is a database that measures air quality in various places. The place with the highest air pollution in Indonesia is the country's capital, DKI Jakarta. Poor air quality primarily impacts health problems (Yudiskara, Dwidasmara, & Widiartha, 2023). Many problems of morbidity and premature death are caused by air pollution (Fidanova, Zhivkov, & Roeva, 2022). In addition, blood lipid health can be disrupted due to bad air (Zhang, et al., 2023). Air pollution increases the risk of cancer in people exposed to respiratory problems (Ertiana, 2022). Air pollution also affects children's growth (Anis & Sulistyaningrum, 2023). Children's growth can be disrupted because bad air causes respiratory tract infections, which is one of the

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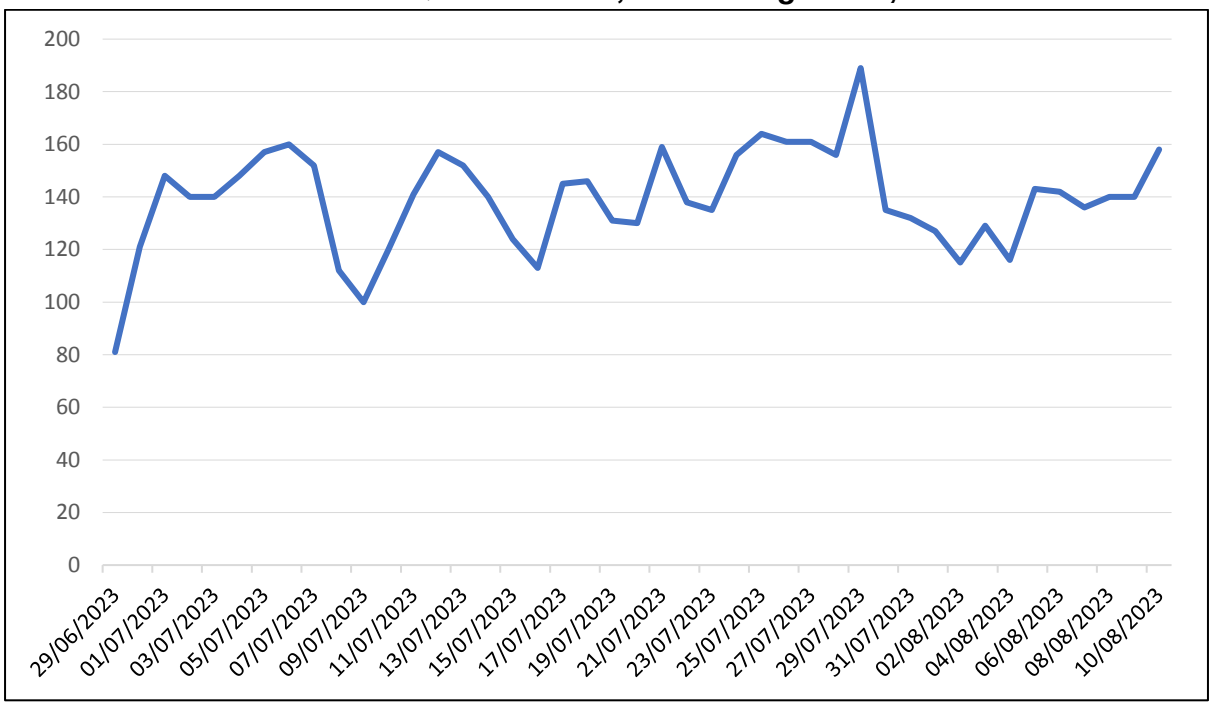
main causes of unhealthy conditions in babies and children (Garmini & Purwana, 2020). (Ertiana, 2022).

The time when Jakarta became the city with the worst air quality occurred on August 10 2023 (CNBC Indonesia, 2023). With an Air Quality Index (AQI) value of 156, far above Dubai in the United Arab Emirates and Lahore in Pakistan, whose AQI values are 140 and 134 respectively. Figure 1 shows the air quality conditions in DKI Jakarta from June 29, 2023 to August 10, 2023:

Figure 1.
Jakarta's AQI on June 29, 2023 - August 10, 2023



(Source: Secondary Data, 2023)

Figure 1 provides information related to air quality in DKI Jakarta. Data trends tend to be stable without any significant increases or decreases. If averaged over a period of 43 days, the value is around 139. The AQI was measured from six air pollutants, namely PM2.5, PM10, carbon monoxide, sulfur dioxide, nitrogen dioxide and ground-level ozone. The United States Environmental Protection Agency (EPA) categorizes the Air Quality Index as follows:

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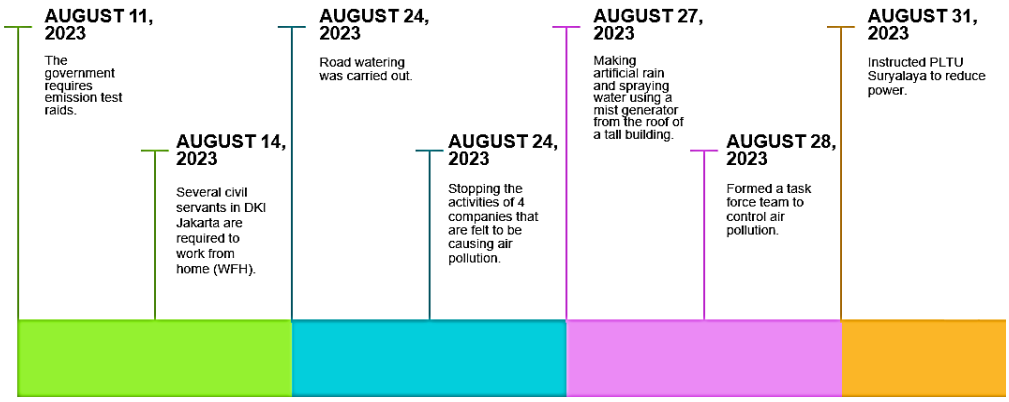
Table 1. AQI Categorization

AQI range	Healthness level	Color
0-50	Good	Green
52-100	Moderate	Yellow
101-150	Unhealthy for Sensitive Groups	Orange
151-200	Unhealthy	Red
201-300	Very Unhealthy	Purple
301+	Hazardous	Maroon

(Source: The United States Environmental Protection Agency (EPA))

From Table 1, the AQI average on June 29, 2023 – August 10, 2023 is 139, which means unhealthy for sensitive groups. The anxiety felt by Jakarta residents regarding the poor air conditions in their environment has prompted the government to immediately follow up and find a solution. The problem of air pollution has become a concern for the government. Controls related to air pollution must be managed well by the government (Saly & Metriska, 2023). According to (Saly & Metriska, 2023), one of the efforts that the government must make to control air pollution in Indonesia is to establish strict policies and regulations. In the context of regional autonomy, the DKI Jakarta government must be able to develop regional potential and create various strategies so that the situation becomes better as well. (Hasibuan, 2018). Finally, in August 2023, the government began to make several policies that attempt to deal with the problem of air pollution in the capital city. Air quality management policy is part of health policy which is one of the efforts that can influence a collection of institutions, organizations, companies and health service system financing plans.

Figure 2.
Seven policies that Jakarta government issued to address the air pollution



(Source: Secondary Data, 2023)

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On August 11 2023, the DKI Jakarta Provincial Government announced an emissions test raid, this was carried out because according to the government motor vehicle emissions are one of the highest contributors to pollution in the capital city. (BBC, 2023). This is an implementation of DKI Jakarta Provincial Regulation No. 2 of 2005 concerning Air Pollution Control. The technical aspect of the raid is that officers stop vehicles at certain points to check for proof of passing the emissions test. Otherwise, they will be tested immediately on the spot. If the vehicle does not pass the emissions test, the police will give the tickets immediately. (Jafari, Charkhloo, & Pasalari, 2021) research results also show that the most common policies and strategies implemented to overcome air pollution in most countries are in the transportation sector. Removing or limiting energy sources, especially the use of solid fuels, is considered to be an effective action.

On August 14 2023, several civil servants in DKI Jakarta were instructed to work from home (WFH). The research conducted by (Inaku, 2020) found that air quality improved during WFH on the Covid-19 pandemic. Although this WFH policy is only applied to civil servants, It is hoped that pollution can be reduced as soon as possible. This immediately became a special concern for President Joko Widodo. The President with a number of Ministers and officials from the Governor of DKI Jakarta held a meeting and determined that civil servants would have to WFH with 50% WFH and 50% working in the office.

On August 24, 2023, road watering was held in the Hotel Indonesia roundabout area, using a water cannon vehicle from Brimob Polda Metro Jaya. The policy related to road watering is implemented twice a day, also with the help of a fire engine and several fire extinguishers. But this actually caused controversy. Several doctors, even the Minister of Health - Budi Gunadi Sadikin, criticized that this could actually increase PM2.5 levels. Apart from that, the Ministry of Environment and Forestry also made a policy to stop the activities of 4 companies that were felt to be causing air pollution. Four of the companies are paper producers and the other three are coal companies. Even 5 other companies that are felt to cause air pollution are also under strict supervision.

Another policy that was introduced was artificial rain, which was implemented on August 27 2023. The Head of BMKG emphasized that this weather modification is expected to reduce air pollution which is exacerbated by dry season conditions. Apart from that, a trial of air spraying using a mist generator from the roof of a tall building

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was also carried out. Furthermore, on August 28 2023, President Joko Widodo also appointed Ministry of Coordinating for Maritime and Investment Affairs (Menkomarves) - Luhut Binsar Pandjaitan to handle Jakarta's air pollution. Luhut Binsar Pandjaitan then formed a task force team to control air pollution. The government has also openly stated that the Steam Power Plant (PLTU) is one of the biggest contributors to the bad air in DKI Jakarta. Also, on August 31 2023, Minister of State-Owned Enterprises (BUMN) - Erick Thohir instructed PLTU Suryalaya to reduce its power so that pollution would immediately improve. This is the last policy issued by the government during August.

The government's response to overcome this problem was to issue several policies. It is hoped that real action from this policy can reduce pollution levels in the capital city. To determine whether the policy can actually reduce or make a change, one way is to compare air quality conditions before and after the policy was made. This can be used because air conditions can be quickly measured when changes occur. One example is based on data obtained by IQAIR, Jakarta on August 17, 2023, which at that time was a national holiday. Almost many residents are celebrating independence in their living environment, many offices are closed so that residents' activities are not as busy as usual. On that day, the air quality index could drop to 99. This brings DKI into the moderate health level category. But this condition is difficult to carry out every day because Jakarta is very congested. If it has to be closed or continues to be enforced like the conditions on Independence Day, then there needs to be a much more in-depth study. Therefore, the government is trying various other alternatives which are expected to reduce air pollution. Based on this, researchers conducted tests to see whether there were differences in air quality conditions before and after the policy was issued to overcome the problem of air pollution.

B. METHOD

In this research, researchers used the theory of policy success and failure (McConnell, 2010a). In accordance with the intent of this theory, it states that the success and failure of a policy is reciprocal. This means that whether the success or failure of a policy still has beneficial value. If the policy is a success then the problem is resolved. Meanwhile, if a policy is considered a failure, then the failure to resolve the problem still has beneficial value, namely contributing to improving a policy. Based on the purpose of this research, it wants to know whether or not there are differences

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in air quality before and after the birth of the policy in line with the theory of success and failure. Because, whatever the results of the policies issued to overcome the problem of air pollution will definitely still provide meaning.

This study uses a quantitative approach. The data used in this research is air quality index (AQI) data. The data source is the IQAIR database (https://www.iqair.com/). In this data set, 80 air quality index (AQI) data from 29 June 2023 to 22 September 2023 were used. Data for the period 29 June 2023 to 10 August 2023 are AQI values before the policies issued by the government. Meanwhile, data from 11 August 2023 to 22 September 2023 is the AQI value in DKI Jakarta after the government issued several policies to overcome air pollution.

This research uses comparative analysis. There are several procedures that must be carried out before choosing which analysis technique is most suitable. Here are the steps:

1. Check the data scale used, whether interval or ratio
2. Test the homogeneity of the data group
3. Test the normality of group data;
4. Determine comparative analysis techniques. If the assumption of homogeneity or normality is met then a parametric statistical analysis technique, namely the Paired Sample T-Test can be used (Agresti, Franklin, Klingenberg, & Posner, 2018), but if the homogeneity or normality test is not met then an alternative that can be done is to choose a non-parametric statistical method, namely Wilcoxon Signed Ranks Test (Nugroho, 2008).

C. RESULTS AND DISCUSSION

AQI data is data on a ratio scale. The AQI value data before the policy and after the policy are paired data. After the data scale is appropriate, proceed with data homogeneity testing. Homogeneity testing was carried out using Levene's Test. The test criteria are by comparing the significance value (p-value) with the α value (significance level). The significance level chosen was 5%. The Levene's Test results are as follows:

Table 2. Homogenity Test Results

		Levene Statistic	df1	df2	Sig.
AQI	Based On Mean	0.662	1	78	0.418

(Source: Data Analysis using SPSS Software, 2023)

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Table 2 shows that the significance value is more than alpha (Sig.=0,418 > 0.05 = α). This means that the variance of the AQI values before and after the policy issued by the government is homogeneous. The assumption of homogeneity has been fulfilled so it can be continued by carrying out the Mann Whitney Test.

The next step is test of normality data. The results of the normality test on AQI value data before and after the policy are as follows:

Table 3. Normality Test Results

	Kolmogorov-Smirnov			
	Policy Implementation	Statistic	df	Sig.
AQI	Before	0.096	43	0.200
	After	0.231	37	0.000

(Source: Data Analysis using SPSS Software, 2023)

Table 3 shows that the AQI value data before the policy issued by the government to deal with air pollution problems in DKI Jakarta was not normally distributed. This can be seen from the sig value. = 0.200 > 0.05 = α. Meanwhile, the AQI value data after the policy was issued provides the conclusion that the data is normally distributed. Because the data groups before and after the birth of the policy have different distributions, it is not possible to continue testing using the Paired Sample T-Test. Using the Wilcoxon Signed Ranks Test can be a solution to see whether there are differences in AQI values before and after the policy issued by the government.

Before going into the results of the Wilcoxon Signed Ranks Test, first look at the condition of the average ranking of AQI values in the conditions before and after several policies applied.

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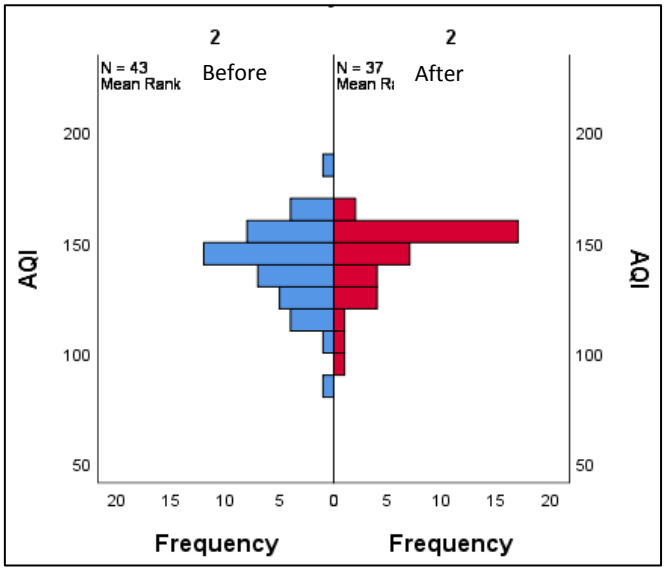
Figure 3.
Mean of Rank AQI between pre and post-implementation of several policies.



(Source: Research Result, 2023)

Seen from picture 3, The average AQI value before the government made policies was 37.52, lower than the average AQI value after the government made various policies, which was 43,96. The mean difference does not prove a certainty that the difference is a statistically significant difference. The difference in meaning can be proven after carrying out the Wilcoxon Signed Ranks Test. The table of test results obtained is as follows:

Table 4. Wilcoxon Signed Ranks Test Results

	After – Before Policy Issued
Z	-.638[b]
Asymp. Sig. (2-Tailed)	.524

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks

(Source: Data Analysis using SPSS Software, 2023)

The Asymptotic Sig. value (2-sided test) = 0.524 > 0.05 = α. Based on the test results, there is not enough evidence to say that there is a difference in air quality in DKI Jakarta between before and after the implementation of various policies.

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Figure 4.

Jakarta's AQI from June 29, 2023 until September 22, 2023

(Source: Research Result, 2023)

Figure 4 explains the condition of AQI values in the capital city for the period 29 June 2023 to 22 September 2023. The blue line is the air quality condition before the policy was issued and the red line is after the government issued several policies. The graph shows that there was no significant increase or decrease in the AQI value after the government issued the policy. Apart from that, the average AQI for the period 11 August 2023 – 22 September 2023 is 144 or classified as unhealthy air quality.

In other words, the policies issued by the government in an effort to reduce air pollution in DKI Jakarta are still not visible. Although basically policy is not the main factor that causes changes in air quality, it is hoped that the policies issued here can contribute to reducing poor air quality. (McConnell, Understanding Policy Success: Rethinking Public Policy, 2010b) said that even though the policies issued have not provided the desired results, these failures can contribute to improving, increasing or limiting failures in a policy. Apart from that, based on theory x, the results of this research will not provide policy recommendations on what should be done to change conditions or problems for the better.

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D. CONCLUSION

The test results show that there is not enough evidence to say that there is a difference in air quality in DKI Jakarta between pre and post-implementation of various policies. In other words, there is no real difference in air quality conditions in DKI Jakarta between pre and post-implementation of several policies issued by the government. This is also illustrated by the average value in conditions before the policy and after the government issued several policies. It can be seen that the average is still in the unhealthy air quality category. This air problem cannot be taken lightly, because of the various negative impacts that can occur. Based on these conditions, perhaps the government can improve existing policies or create other policies that can change air conditions for the better. Healthy air conditions will result in a comfortable life and a much healthier society.

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