Universiti Teknologi MARA Cawangan Perak

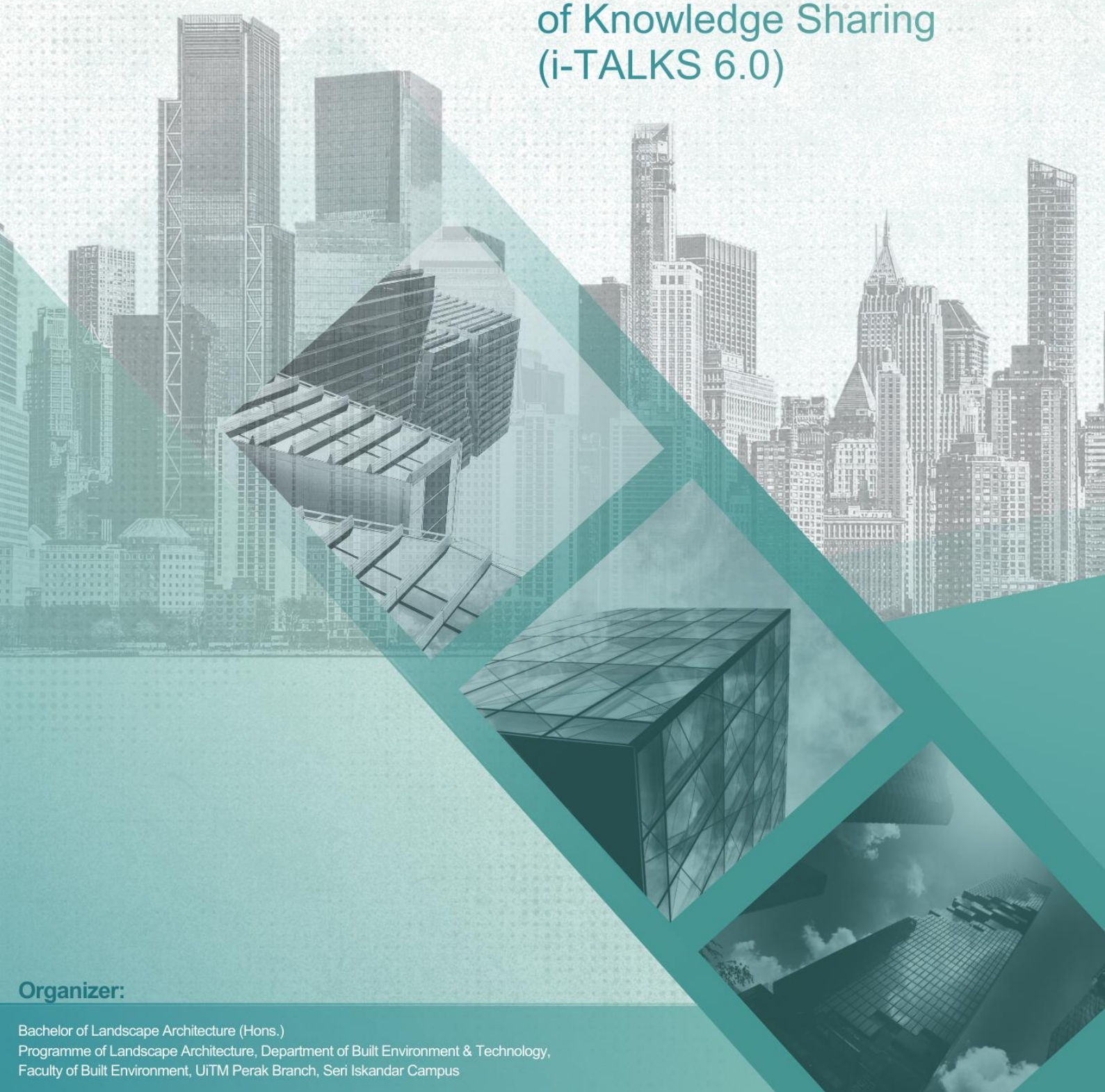
ناتورا studio

TALKS 6.0
THE ACCLAIMED LANDSCAPE OF KNOWLEDGE SHARING
"Harmony in Spaces : Blending Heritage, Nature and Design"

eISSN 3120-3337

PROCEEDING OF

6th Conference On The Acclaimed Landscape of Knowledge Sharing (i-TALKS 6.0)



Organizer:

Bachelor of Landscape Architecture (Hons.)
Programme of Landscape Architecture, Department of Built Environment & Technology,
Faculty of Built Environment, UiTM Perak Branch, Seri Iskandar Campus

TALKS 6.0

THE ACCLAIMED LANDSCAPE OF KNOWLEDGE SHARING

"Harmony in Spaces : Blending Heritage, Nature and Design"

PROCEEDING OF

6th Seminar On
The Acclaimed Landscape of Knowledge Sharing
(TALKS) 6.0

Organized By:

Landscape Architecture Seminar (LAN653)
Semester October 2025 - February 2026
Bachelor Degree in Landscape Architecture
UiTM Seri Iskandar Campus

PUBLISHED

31 March 2026

PUBLICATION FREQUENCY

Published twice a year in May and September

Alamat :

Unit Penerbitan UiTM Perak,
Pejabat Jaringan Industri, Masyarakat dan Alumni (PJIM&A)
Universiti Teknologi MARA, Perak Branch,
32610 Seri Iskandar Perak, Malaysia
05-3742716
uitmperakpress@gmail.com

PROCEEDING OF

6th Conference On
The Acclaimed Landscape of Knowledge Sharing
(TALKS) 6.0

@Unit penerbitan UiTM Perak, 2026

eISSN 3120-3337

9 773120 333006

All rights reserved. No part of this publication may be reproduced, copied, stored in any retrieval system, or transmitted in any form or by any means; electronic, mechanical, photocopying, recording, or otherwise;without permissions on writing from the director of Unit Penerbitan UiTM Perak, Universiti Teknologi MARA, Perak Branch 32610 Seri Iskandar Perak, Malaysia

Cover Design : Nur Alia Fatihah Binti Muzapar
Typesetting : Nur Farisha Fariza Binti Mohd Zaini

EDITORIAL BOARD

EDITORS-IN-CHIEF

Assoc. Prof. Ts. Dr Siti Rasidah Md Sakip

REVIEWERS

PM. Ts. Dr Norhafizah Abdul Rahman
PM. Ts. Dr Siti Rasidah Md Sakip
LAr. Dr Helmi Hamzah (CA)
LAr. Dr Norizan Mt Akhir
LAr. Dr Zulkefle Ayob
IDr Dr Nadiyanti Mat Nayan
Ts. Dr Izham Abd Ghani
Dr Nur Huzeima Mohd Hussain
Dr. Wan Noor Anira Wan Hj Ali @ Yaacob
Dr Suriati Ahmad
Dr Nor Izana Mohd Shobri
LAr. Ahmad Zamil Zakaria
LAr. Atikah Raihanah Amir
LAr. Azran Mansor
LAr. Khairul Adham Ibrahim
LAr. Nur Hanim Ilias
LAr. Ruwaidah Borhan
Ts. Mohd Zulhaili Teh
Azrul Bahaluddin
Falihin Jasmi
Norasikin Hassan
Siti Syamimi Omar

Organized by,
Landscape Architecture Seminar (LAN653)
Programme of Landscape Architecture
Semester October 2025 – February 2026

ORGANISING COMMITTEE

Chairman : Assoc. Prof .Ts. Dr Siti Rasidah Md Sakip

MAIN SECRETARIAT

Project Director : Mohammad Aznel Bin Ahmad Kamal
Deputy Project Director :Nur Alia Fatihah Binti Muzapar
Marketing/Promotion/Welfare Team :-
Nur Hafizatul Akma Binti Mohd Yusri | Nur Adeena Binti Zainul Asri |
Hani Syafiqah Binti Hamdi | Nur Laili Balqis Binti Noorhafis | Nur Aiman Widad Binti Rosli | Nur Damia Humaira Binti Yusdi | Siti Zulaikha Binti Khairul Anuar | Nurul Nailatul Husna Binti Husin |
Technical Support Team :-
Danish Saputra Bin Asmadi | Muhammad Amirul Farhan Bin Kamaruzaman | Mohammad Farrish Emil Hakimi Bin Ahmed Halemee | Siti Nurul Balqis Binti Mohd Ariff | Nur Iffah Nadhirah Binti Azizan | Siti Safiyyah Binti Abdul Majid | Nurul Nadrah Binti Rosli | Nur Bahiyah Binti Abu Naim | Shaqira Emelya Fatiha Shahril Fitri | Muhammad Irsyad Daish Bin Mohd Kamal El Asyeeq | Arsyad Jazli Bin Suhazeli | Noralya Balqis Binti Syed Guntur | Mohammad Aznel Bin Ahmad Kamal
Design Team :-
Muhammad Amsyar Farhan Bin Kamaruzaman
Muhammad Akmal Bin Abdul Talib
Editorial Team :-
Nur Farisha Fariza Binti Mohd Zaini
Nur Alia Fatihah Binti Muzapar
Additional Support Task :-
Muhammad Hazim Bin Nordin
Zawanie Fatini Binti Mohd. Jamzury
Aazib Luqman Bin Hisyamudin

Eco-Sensitive Design Approaches for Air Quality Improvement in Industrial Urban Areas: A Case Study of Pasir Gudang, Johor

[1]Siti Zulaikha Najwa Abdul Majid, [2]Noraini Bahari

[1,2,3,4]Faculty of Built Environment
University Technology Mara (UiTM) Kampus Puncak Alam, Selangor.

Abstract

In Pasir Gudang, which happens to be the industrialized city of Malaysia, air pollution by factories is a major issue. This study makes a personal examination of air quality issues in that area with the aim of identifying how an optimal landscape design may be utilized in reducing pollution and ensuring that the levels of heat within it remain low in an environment conscious manner.

Various research methods are combined in the study. It has the technical aspect, which quantifies such parameters as PM, PM, NO 2, and VOCs around the city. Other means were mixed up as well, observing what is going on on the ground, employing checklists and going through secondary data. A larger part of the air quality information was provided by the Department of Environment Malaysia and such sites as MyEQM and APIMS, which monitor air pollution rates in different monitoring stations.

After the data was in, the research group could map out the locations with the worst pollution, the effectiveness of existing green spaces, and attempted to have an idea of how the locals living in the area feel about the immediate environment. What stood out? The pollution and lack of natural air filtration are higher in the neighbourhoods adjacent to the factories due to the absence of the trees or green areas.

These results indicate the importance of designing such landscapes in a responsible manner in case the city aims at addressing air pollution, alleviating urban heat, and ensuring that people remain healthy. Eventually, this paper can provide designers and planners with a certain sense of direction when it comes to the task of making factory areas in Pasir Gudang greener and healthier to all.

Keyword: Air Quality, Eco-Sensitive Design, Pasir Gudang, Urban Landscape, Industrial Pollution

INTRODUCTION

Arizona has a major problem with air pollution and it has been a harsh hit in our health; more so in matters concerning breathing, and heart diseases. Children suffer the most; WHO (2022) and Guo et al. (2019) state that over 90 percent of children are living in the regions where the air is not safe. A big reason? Industry. There are factories and the like that release every type of ugly gases, chemicals, and micro-particles into the air.

A study by Munsif et al. (2021) notes that the air emitted by such locations may also contain heavy metals which may destroy lungs and increase health hazards further. this is also a problem to malaysia. It is the greatest contributor of industrial pollution in its area (DOE, 2017). Pasir Gudang, is at the heart of it - one of the most industrialized towns in the country and it has not been spared by the pollution case, courtesy of the unleavened

industrialization (Dominick et al., 2012; Rahman, 2017).

Attempting to address these issues, individuals have begun to resort to environmentally-friendly design within such industrial zones as Pasir Gudang. Green ideas such as green corridors or green buffers also aid in cooling things down and purifying the air, and make the environment overall more acceptable (Wai et al., 2022; Wu and Liu, 2023). In this paper, I consider the quality of air in Pasir Gudang, and how the eco-friendly design would make it a far healthier place to live.

LITERATURE REVIEW

Air Pollution and Human Health

Air pollution remains one of the colossal environmental issues, which affect millions of lives worldwide. The research continues to indicate that long-term exposure to polluted air increases the chances of obtaining lung problems, heart conditions, and an earlier than expected death. Children are the most affected and, to be honest, the most, since their organisms are still developing, and as such, they are unable to resist the harm so well as adults do. Even in the current year of 2016, over 543,000 under five year olds died due to the non-clean air they had to breathe all over the world.

The problem will not leave despite the current efforts by various countries to improve the situation internationally. More than 90% of the global children are exposed to unhealthy air every year (WHO, 2018). It is the industrial activity that deserves the majority of the blame, and it implies factories and plants continuing to release poisonous gases, chemicals, and particles (Munsif et al., 2021). Stuff like carbon monoxide, hydrocarbons, carbon dioxide (CO_2), and nitrous oxide is still linked to more health problems and early deaths (Bauleo et al., 2018; Fareed et al., 2020; Rahman et al., 2021).

Additionally, industries release air pollutants that consist of fine particles and toxic elements such as cadmium, lead, and zinc, causing chronic damage to the respiratory tracts (Dai et al., 2015). Although stricter policies and legislation remain associated with the improvement in air quality in Europe and the United States, air pollutants remain high in many rapidly growing and densely populated regions in Asia (Jerrett, 2015)

Industrial Air Pollution in Malaysia

In Southeast Asia, Malaysia is ranked as the third-largest industrial source of pollutants after Indonesia and Thailand (Department of Environment [DOE], 2017). The major source of air pollution in Malaysia includes power plant stations, traffic emissions, and industrial manufacturing, which grow in parallel with the development of the economy (Salahudin et al., 2013; Sentian et al., 2019). During the period from 1996-2015, the remarkably accelerated increase in car ownership and industrialization caused serious degradation of air quality on both national and regional scales (Abdullah et al., 2012; Afroz et al., 2003)

Air Pollution Issues in Pasir Gudang

Pasir Gudang is one of the most notable instances of rapid industrialization in Malaysia. As one of the major industrial centers hosting petrochemical, heavy industries, and port-related industries, this city has long been plagued by severe air pollution issues (Dominick et al., 2012). Studies have revealed high levels of particulate

matter, particularly PM 10, in Pasir Gudang which is due to the emission of the same by the industrial neighbors (Dominick et al., 2012).

Even though the governmental bodies like Malaysian Meteorological Department (MET) and Department of Environment (DOE) tend to constantly monitor air quality, industrial development leads to an aggravation in air pollution occurrences in 2019, as there are no preventative measures taken (Rahman, 2017). In March of 2019, toxic waste was introduced to Sungai Kim Kim when it happened, and approximately 2,000 people became victimized, the majority being school children (Rahman, 2017). Scenarios such as this demonstrate that there are actual issues pertaining to the way the environment is handled, particularly to those who stay near the industry sectors.

Air Pollution Studies and Environmental Risk in Pasir Gudang

Researchers (Abdul Halim et al., 2022) found that air pollution in Pasir Gudang isn't just coming from local factories. During the Southwest monsoon, air currents from West Sumatra carry in pollutants - HYSPLIT modeling and GIS mapping helped pin that down. A three-day backtracking showed how this wind brings extra pollution right into the region.

Looking closer at the area with GIS, their buffer analysis revealed anywhere from 17 to 60 factories packed within just a kilometer of the affected schools. So, it's pretty clear the kids there face a high risk of exposure (Abdul Halim et al., 2022). Weather details like where the wind's blowing, how fast it moves, and temperature shifts all play into how these pollutants spread across Pasir Gudang (Mansor et al., 2022).

Environmental Management Through Eco-Sensitive Design

The whole concept of eco-sensitive design is developing natural systems into our ways of forming our built environment to ensure the environmental quality remains under control (Wai, Tariq, and Muttil, 2022). It is proven that the green corridors, vegetative barriers and vertical gardens do not only beautify the landscape, but also trap airborne particles and maintain airflow, particularly when busy industries or urban areas are involved (Wu & Liu, 2023). In addition, such a design style aids in reducing air and surface temperatures in industrial zones, therefore, such places become less stuffy (Wai et al., 2022).

Go even farther, and you will find that intelligent planning of the landscape in the right places can potentially impose a restriction on the accumulation of pollutants, in other words, it serves as a buffer between factories and residential areas (Lee, Tran, & Yu, 2023). As the industrial world grows with its activities and as the waste gets accumulated all around the world, eco-sensitive design has ceased to be something nice to have and has turned into a necessity that cities have to rely on to help the environment become more resilient (Nasir & Rahim, 2022). A good example that can be given is the case of Malaysia: in places that are highly industrialized such as Pasir Gudang, employing landscape-based design has already had a tangible effect on air quality (Abd-Ghafar, Said, and Yeo, 2025).

STUDY AREA

Study Area

The study boundary is focused on selected residential areas within Pasir Gudang, particularly around Taman Tanjung Puteri and its surrounding environment. This focused boundary was chosen to align with the limited number of respondents and to ensure that the data collected reflects direct experiences of communities living close to industrial activities (Figure 1).



Figure 1: Study Area in Taman Tanjung Puteri, Pasir Gudang
(Source: Google Earth 2025)

METHODOLOGY

Research Approach

In this research work, a mixed-method approach is pursued whereby the questionnaire study and observation study are used together for the analysis of air pollution problems, thermal discomfort problems, and the capabilities of eco-sensitive landscape design in Pasir Gudang. The implementation of a mixed-method study is quite prevalent within the realm of environment and urban study research because it offers the ability to combine numerical results with understandings that are contextually situated (Creswell & Plano Clark, 2018). In the context of industrial settings, the situation within the environment is reflected in terms of numerical expressions of the situation in addition to being contextually situated within the community that is exposed to it.

Quantitative Method: Questionnaire Survey

The questionnaire survey is utilized in the present study as the primary quantitative method for collecting numerical data on the aspect of public perception of air quality, heat exposure, and eco-sensitive design strategies. Questionnaires are widely used in researching environmental perception, given that they allow the researcher to quantify attitudes, experiences, and levels of agreement among respondents in a systematic manner (Creswell & Plano Clark, 2018).

In this study, residents and relevant stakeholders in Pasir Gudang, including workers and students, are asked to complete a structured questionnaire using a 5-point Likert scale. Perception of air quality, thermal comfort, green infrastructure and eco-sensitive design, policy, and future planning involves four main aspects. Surveys through the Likert scale are widely used in studies concerning environmental quality and urban comfort since they allow performing statistical analyses that identify general trends and levels of agreement through frequency distribution, mean score, and percentage. Wai, Tariq, & Muttil, 2022

The quantitative data gathered through the questionnaire enables the researcher to tap into the prevalent perceptions that exist with regard to pollution, heat discomfort, and the support that exists for ecological-sensitive landscaping. The methodological framework followed appears to align with previous studies that utilized perceptions gathered through surveys for the determination of environmental quality and effectiveness of landscaping for industrial or high-density environments (Lee et al., 2023).

Furthermore, this research uses secondary air quality data to validate the evaluation of pollution conditions in Pasir Gudang. These secondary data were collected from the Department of Environment (DOE) in Malaysia using the Monitoring System MyEQM/APIMS, where official Air Pollution Index data is collected from continuous air quality stations.

The most proximal observation post in regard to the above-mentioned research is CA34J (Pasir Gudang), as it observes air quality that is affected by industrial and municipal activities in that region. The API reading obtained from the above-mentioned observation post is based on major pollutants such as $PM_{2.5}$, PM_{10}, NO_2, SO_2, CO, and O_3, while PM (both $PM_{2.5}$ and PM_{10}) is considered as the major contributor within the industrial region.

This approach of using existing secondary data is common in studies that relate to environmental and urban planning studies, especially where the study is on human perception and design approaches rather than using methodical laboratory measurement of substances (Abdul Halim et al., 2022; Mansor et al., 2022). Using existing monitoring results of air quality helps to interpret results and validate findings of air quality problems.

Qualitative Method: Site Observation

The results of the questionnaires had some distinct patterns which were clear but did not indicate all what was on the ground. This is why the primary emphasis was relocated in observing the site. Site observation forms part of the fundamental approach in studies pertaining to the environment and planning in matters touching on the assessment of spatial quality, landscape elements, and environmental stresses.

This will involve visiting Pasir Gudang and taking a close examination of such things as the amount of vegetation there, availability of shade, presence of green buffers, use of various zones, and the appearance of environmental stress. The point is that you can not really judge such things as eco-sensitive design just by reading numbers you have to see what there really is. These physical details are usually the comfort and performance of a landscape that are visible (Wu and Liu, 2023). There is also site visit with photos taken to aid in observing what is in the field in future.

Advantages Site observation It is possible to examine whether the green infrastructure that is being promised on or off paper is on the ground and does it perform the way it is supposed to according to eco-sensitive design

requirements. It is one of the common methods to consider green infrastructure and urban resilience that provides a better view of the environmental quality than only statistics (Sabri and Ponrahono, 2024).

Integration of Quantitative and Qualitative Methods

Mixing the information of the survey and the observations made on the ground contributes to making the research stronger and more credible. The survey numbers provide an idea of what the majority of the population believes and to what extent they concur with specific items whereas the qualitative notes allow peeking a bit further into the reasons behind such opinions. To illustrate, most of the grievances that people complained about heat were that they lacked shade and had to contend with sun-dried soil. Things related to air quality tended to be concerned with the proximity of homes and factories to one another.

As Creswell and Plano Clark (2018) mention, the primary benefit of a mixed method consists of triangulation: a particular body of findings can be supported by another. In this case, the combination of survey data and real-life observations is particularly effective in the case of the natural environment, where individuals pay attention to what they see, which is tightly connected to what occurs around a certain person.

Method of Data Analysis

This research funding gathered both the survey and field research data in Pasir Gudang. The questions included people on the quality of the air, the temperature they feel comfortable with, and the perceptions on the design of the environment being eco-sensitive and the local planning. Their responses were supported by observations made on the sites. To add to it, the provisions of the MyEQM/APIMS system (managed by the department of Environment in Malaysia) assisted in assigning serious figures to the pollution levels such as PM 2.5, PM 10 or even NO 2.

In fact, everything was considered through the combination of basic statistics, the results of the survey answers, and more qualitative, presence observations on the site (Raffee et al., 2019; Mansor et al., 2022). By adding the accounts of what others reported, what actually was seen and hard numbers of what was detected by air monitoring, one gets a more comprehensive view of the problem of local pollution and where eco-sensitive development may be demanded in the future.

Analysis of questionnaire.

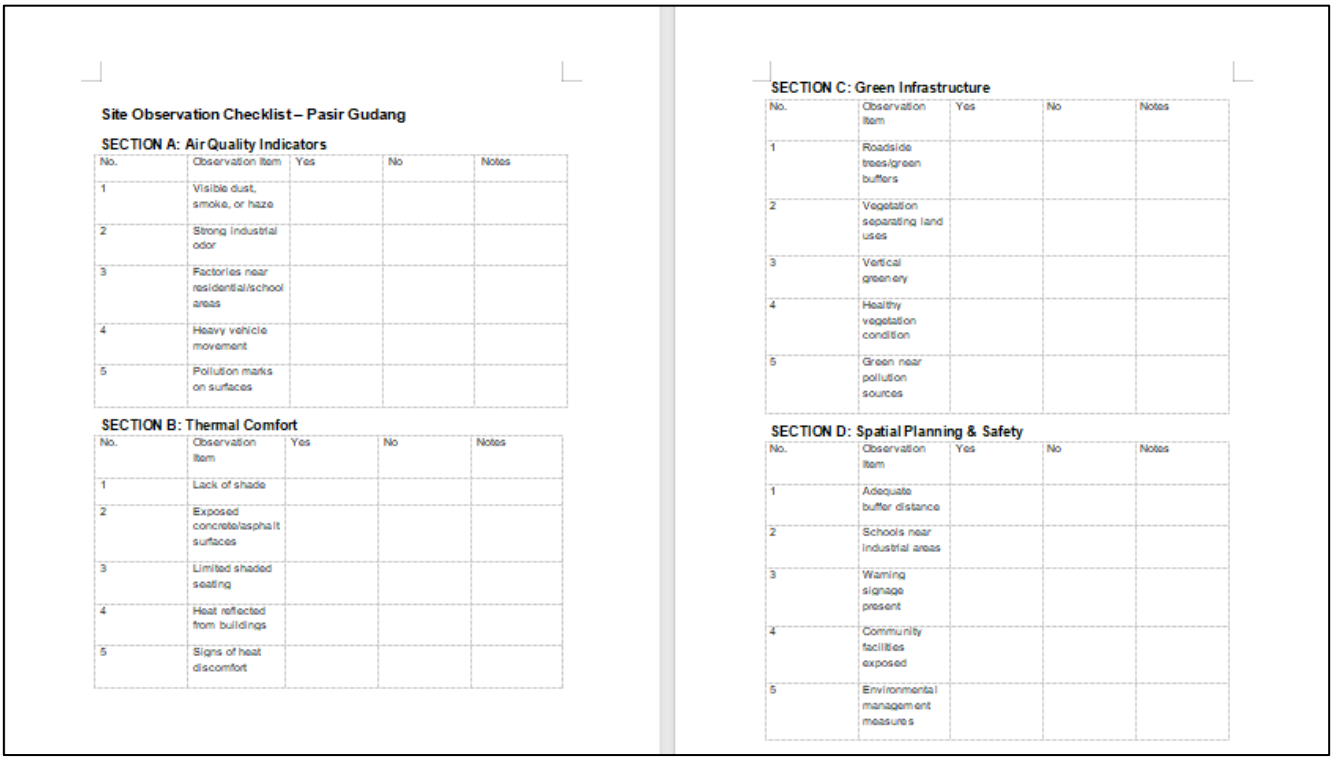
We conducted a small amount of statistical analysis on the responses on the questionnaires. They each answered on a five-point Likert scale with 1 meaning Strongly Disagree and 5 Strongly Agree. This assisted in us examining the frequency with which people selected particular responses, the percentage distribution and the mean of each statement. This is a common method used by researchers when it is necessary to investigate the feelings of people regarding the quality of air and the problems with the environment in the city (Mansor et al., 2022; Wai et al., 2022).

All Microsoft Excel was used to manage all the questionnaire data. We converted the responses into figures enabling us to analyze them and then proceeded to place the results in a format that is easy to observe using bar graphs.

Data Analysis of Site Observation.

The information gathered during the site observations was represented using the qualitative concept of description which involves the use of an observation guide. Site factors that define the site and determine the environmental factors like land cover/ vegetation, the availability of shade, buffer use, distance between the industrial and residential location and visual environmental stress parameters were determined and measured through the use of a description guide to summarize the observations so that the environmental sensitivity of the site can be easily assessed.

This approach adheres to the established principles of classical qualitative research in the field of landscape studies, whereby observation is a necessary adjunct in ascertaining spatial phenomena (Creswell, 2018; Wu & Liu, 2023).



Site Observation Checklist – Pasir Gudang

SECTION A: Air Quality Indicators

No.	Observation Item	Yes	No	Notes
1	Visible dust, smoke, or haze			
2	Strong industrial odor			
3	Factories near residential/school areas			
4	Heavy vehicle movement			
5	Pollution marks on surfaces			

SECTION B: Thermal Comfort

No.	Observation Item	Yes	No	Notes
1	Lack of shade			
2	Exposed concrete/asphalt surfaces			
3	Limited shaded seating			
4	Heat reflected from buildings			
5	Signs of heat discomfort			

SECTION C: Green Infrastructure

No.	Observation Item	Yes	No	Notes
1	Roadside trees/green buffers			
2	Vegetation separating land uses			
3	Vertical greenery			
4	Healthy vegetation condition			
5	Green near pollution sources			

SECTION D: Spatial Planning & Safety

No.	Observation Item	Yes	No	Notes
1	Adequate buffer distance			
2	Schools near industrial areas			
3	Warning signage present			
4	Community facilities exposed			
5	Environmental management measures			

Secondary Air Quality Data Analysis

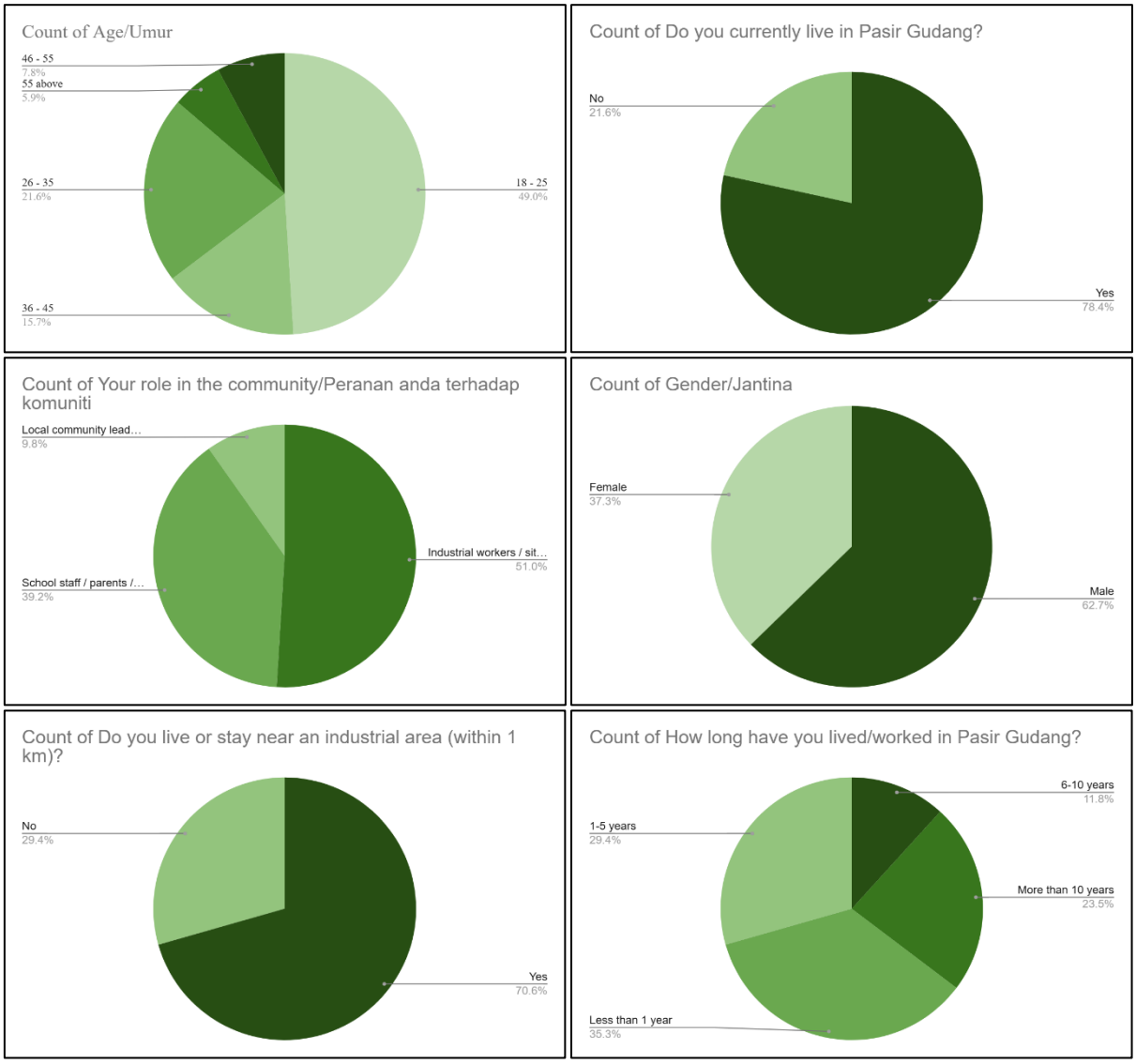
Descriptive analysis was done for the secondary data of air quality obtained from the DOE monitoring system. API records were reviewed to identify the general air quality conditions, the categories of pollution (Good, Moderate, Unhealthy), and recurring pollution trends that have been and are still affecting Pasir Gudang. This analysis seeks to ascertain if the level of pollution recorded by the official monitoring station corresponds to the public perception of deteriorating air quality as collected through the questionnaire survey.

Other studies have focussed their analysis on hourly or chemical-level data, whereas in this study, API values are used as an environmental indicator to support the interpretation of community responses. API data are appropriate for perception-based and design-oriented studies where air quality data is used to enhance contextual understanding rather than to perform atmospheric modelling.

RESULTS AND DISCUSSION

Respondent Profile Analysis

Descriptive statistics were then used to summarize the background characteristics of respondents, such as residential status, proximity to industrial areas, and daily exposure to the outdoors. This helps in setting perception-based responses in context, since the environment people are exposed to depends on location and daily activity patterns.



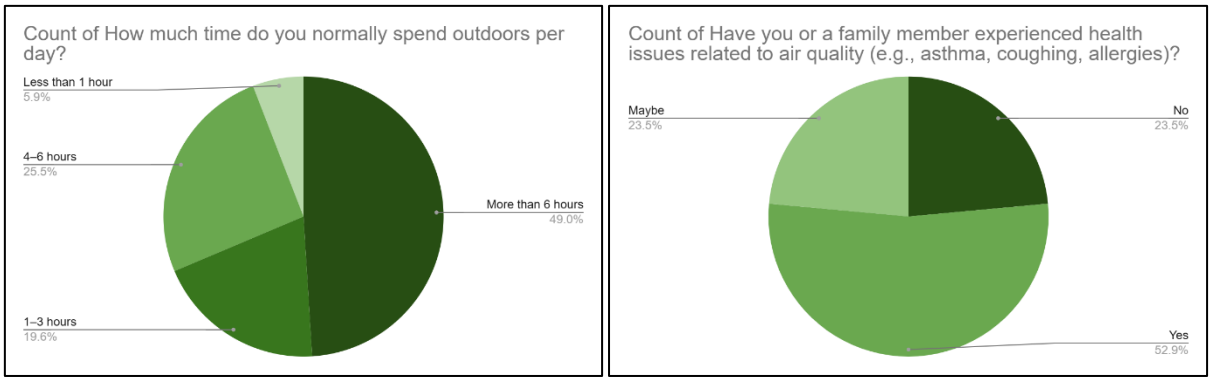


Figure 2: Demographic Profile of Respondents

(Figure 2) illustrates the demographic details of the respondents. The demographics include gender, age, and type of respondent. The findings from the study reveal that the participants were composed of different genders, which will ensure that there is no bias. The study will obtain different opinions regarding air quality due to the gender variability.

As for the distribution of respondents according to their ages, most of the respondents were of working ages. This is quite imperative because people who belong to this category have the potential of being in contact with outdoor environments through their working and activity schedules, especialy in the industrial area of Pasir Gudang.

Involves the categories of respondents. Most respondents belong to residents and industrial workers, followed by individuals associated with schools and finally individuals associated with the community. This is fitting because residents and industrial workers are directly exposed to industrial heat and environmental hazards.

Thus, it may be concluded from the demographic profile that the subjects are relevant to the goals of the study and have hands-on knowledge of the environment in focus.

Perception of Air Quality

Therefore, two key indicator questions were selected from the questionnaire that reflect the perception of the air quality for the respondents. These questions were chosen because they reflect overall air quality trends and identify the perceived sources of pollution, which are the key issues developed in this study.

The results of the survey show that most of the respondents agreed that the air quality in Pasir Gudang has deteriorated compared to previous years. This perception was in agreement with the secondary air quality data obtained from the DOE monitoring station, indicating that the area is experiencing recurring pollution episodes.

Moreover, most of the respondents believed industrial activities contributed much to poor air quality. This supports the finding of the previous studies that outlined the influence of industrial emission on the level of air pollution in Pasir Gudang (Abdul Halim et al., 2022; Mansor et al., 2022).

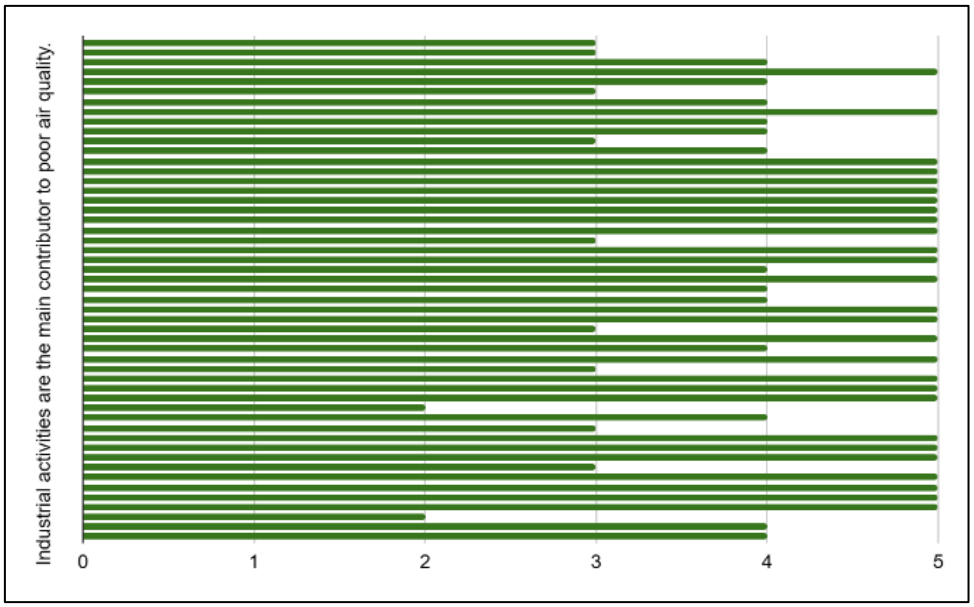


Figure 3: Air quality trend bar chart

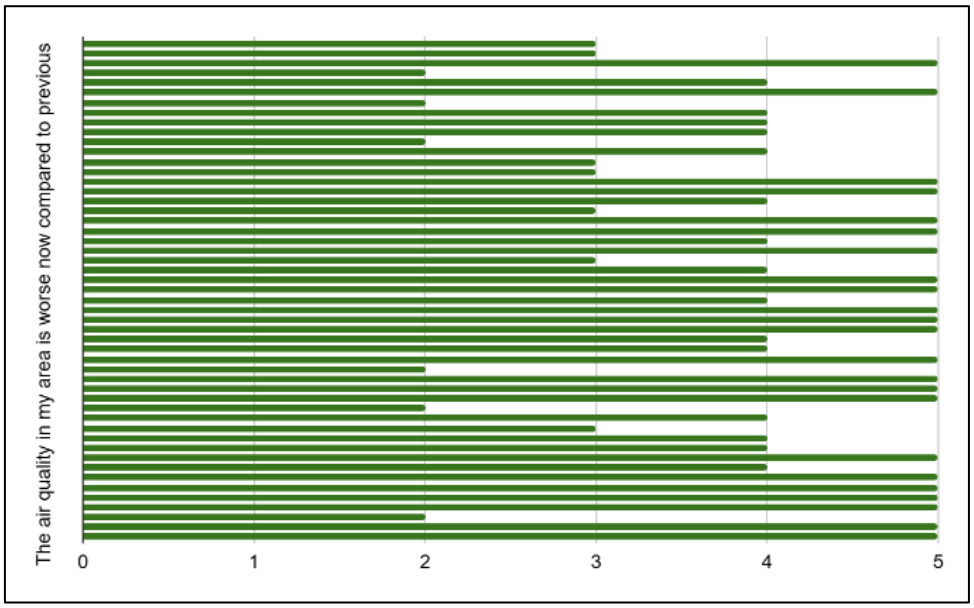


Figure 4: Industrial source bar chart

Table 1: Descriptive statistics (mean, standard deviation) for Section A

Statement	Mean	Interpretation	SD Value	Interpretation
The air quality in my area is worse now compared to previous years.	4.08	Agreement	1.03	Moderate variation
I often experience dust, smoke, or	3.98	Agreement	1.19	Moderate

noticeable haze around my neighborhood.				variation
Industrial activities are the main contributor to poor air quality.	4.27	Agreement	0.89	Moderate variation
Poor air quality affects my daily comfort and outdoor activities.	4.09	Agreement	0.90	Moderate variation
I believe air pollution poses serious long-term health risks to residents.	4.54	Agreement	0.80	Strong agreement among respondents

Table 1 categorizes the survey about the quality of air in Pasir Gudang. The fact that the air in my area is unhealthy compared to the past few years had the most average score which basically indicates that people think the air is unhealthy. Standard deviation was low indicating that the majority were in agreement regarding this.

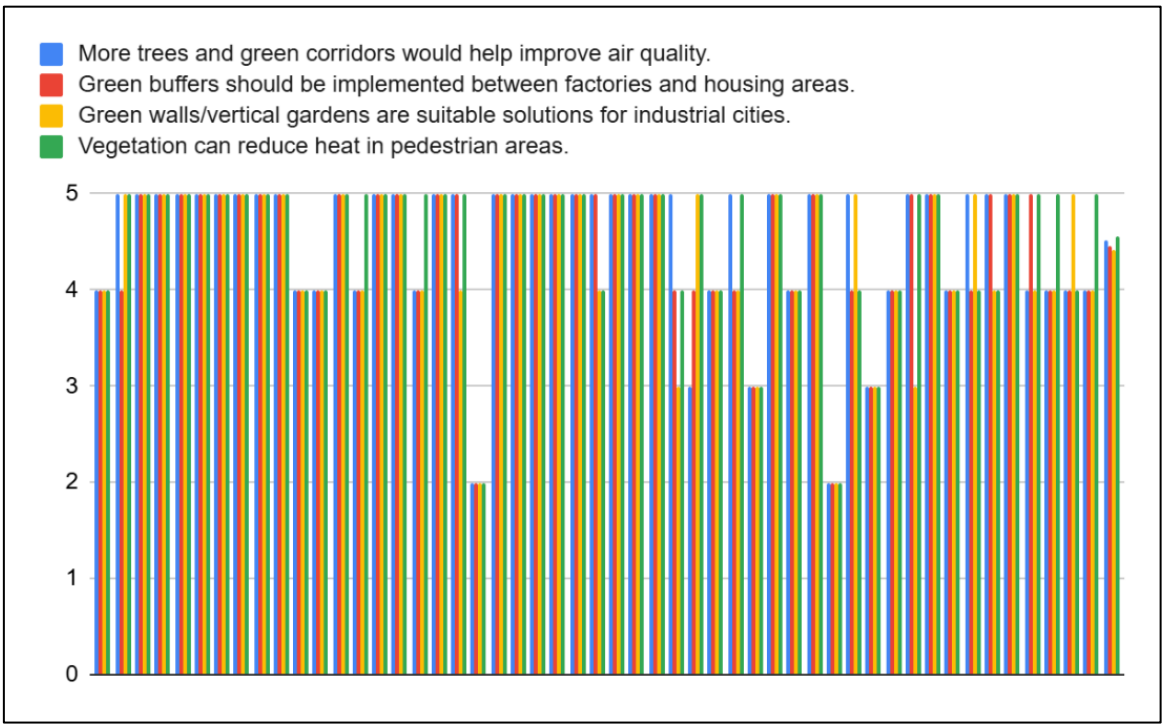
The idea that industrial activities are a major cause of the poor air quality also had people concurring heavily thus the statement had a high mean. That is in line with the findings of previous researchers - Abdul Halim et al. (2022) report and Mansor et al. (2022) also mention industrial emissions as a key source of pollution in the area.

Perception to Eco-Sensitive Design and Green Infrastructure.

The results in Section C suggest that the support is overwhelming in the being of the environment-sensitive measures of design. Most of them agreed that there should be trees, green belts and vegetation buffers that will help to improve air circulation and shield against heat. The concept of the vertical gardens was also acceptable as being a good answer to industrial cities.

The results support Wu and Liu (2023) and Sabri and Ponrahono (2024), who have shown that vegetation-based approaches can effectively remove particulate matter concentration and improve thermal comfort. The belief of the respondents towards eco-sensitive design as a protective function indicates that people have become increasingly aware of nature-based solutions for polluted settings

Table 2: Agreement level summary for green infrastructure measures



Air Quality Conditions Based on Secondary Data

From the secondary data gathered using the DOE air quality monitoring station located at Pasir Gudang, the study area has had intermittent periods of moderate to unhealthy air conditions over the past years. The air-quality particulates, such as PM_{10}, $PM_{2.5}$, have been identified as major contributing factors for air pollution, which tends to align with the industrial nature of the location, namely Pasir Gudang. The air-quality particulates provided by governmental databases support the findings of the study, which identified that air pollution was detrimental to outdoor comfort, with most respondents identifying haze, dust, or other effects of air pollution. The convergence of the two databases appears to confirm that fears of air pollution tend not to be devoid of merit but rather consist of elements that may be quantified. The installation of industrial plants situated adjacent to residential, as well as other institutions, tends to emphasize further measures related to the environment, such as green belts, for instance, or green corridors.

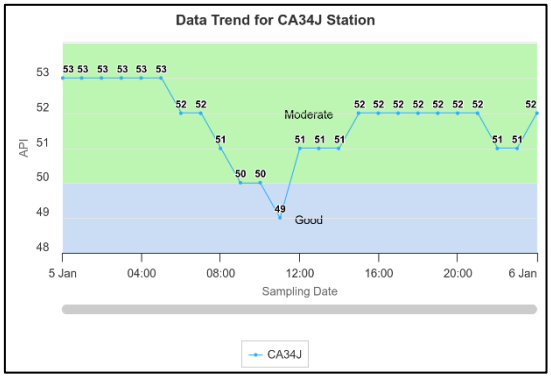
Table 2: Agreement level summary for green infrastructure measures

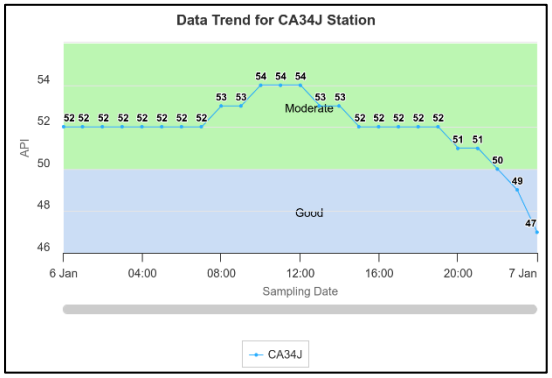
Statement	Mean	Interpretation	SD Value	Interpretation
More trees and green corridors would help improve air quality.	4.50	Agreement	0.78	Moderate variation
Green buffers should be implemented between factories and housing areas.	4.45	Agreement	0.75	Moderate variation

Green walls/vertical gardens are suitable solutions for industrial cities.	4.41	Agreement	0.80	Strong agreement among respondents
Vegetation can reduce heat in pedestrian areas.	4.54	Agreement	0.75	Moderate variation

Air Quality Conditions Based on Secondary Data

From the secondary data gathered using the DOE air quality monitoring station located at Pasir Gudang, the study area has had intermittent periods of moderate to unhealthy air conditions over the past years. The air-quality particulates, such as PM_{10}, $PM_{2.5}$, have been identified as major contributing factors for air pollution, which tends to align with the industrial nature of the location, namely Pasir Gudang. The air-quality particulates provided by governmental databases support the findings of the study, which identified that air pollution was detrimental to outdoor comfort, with most respondents identifying haze, dust, or other effects of air pollution. The convergence of the two databases appears to confirm that fears of air pollution tend not to be devoid of merit but rather consist of elements that may be quantified. The installation of industrial plants situated adjacent to residential, as well as other institutions, tends to emphasize further measures related to the environment, such as green belts, for instance, or green corridors.





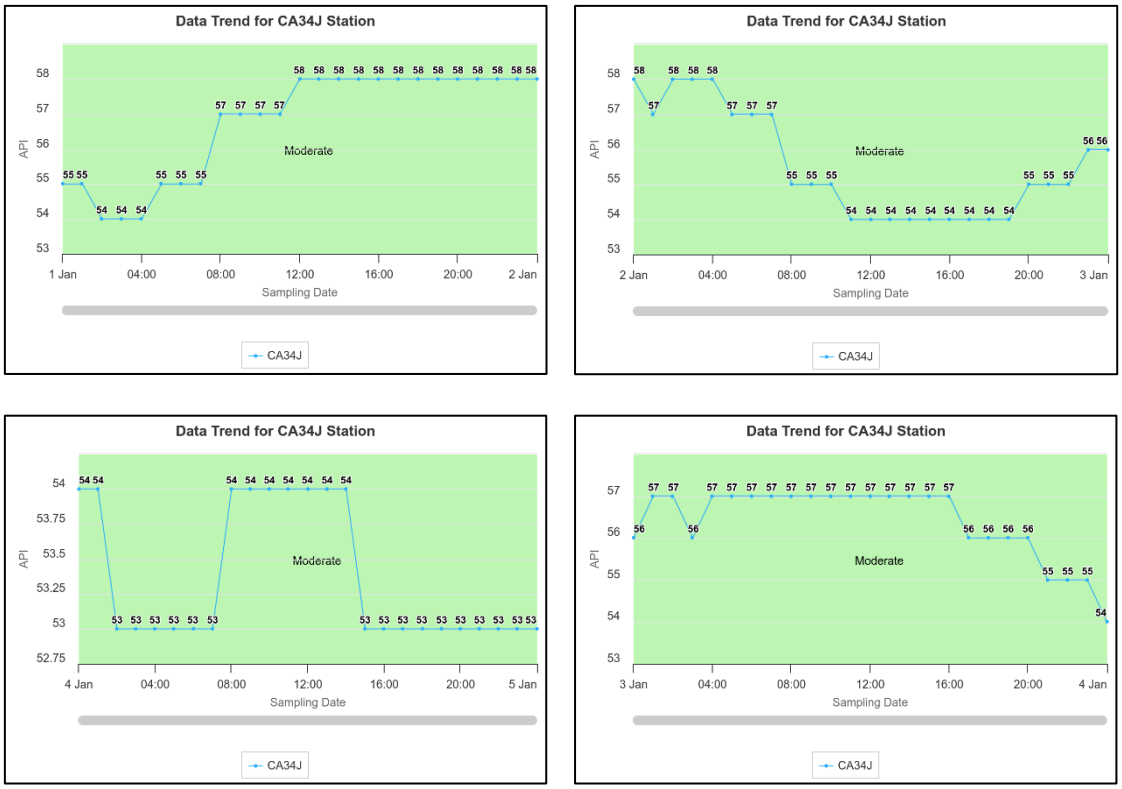


Figure 6: Trends of $PM_{2.5}$ and PM_{10} Levels in Pasir Gudang
Source: MyEqms

Table 3: Summary of total hours and days, and max values of PM10 in Pasir Gudang

Day	Total Hours	Max PM_{10}
1	24	58
2	24	58
3	24	57
4	24	54
5	24	53
6	24	54

Site Observation Findings

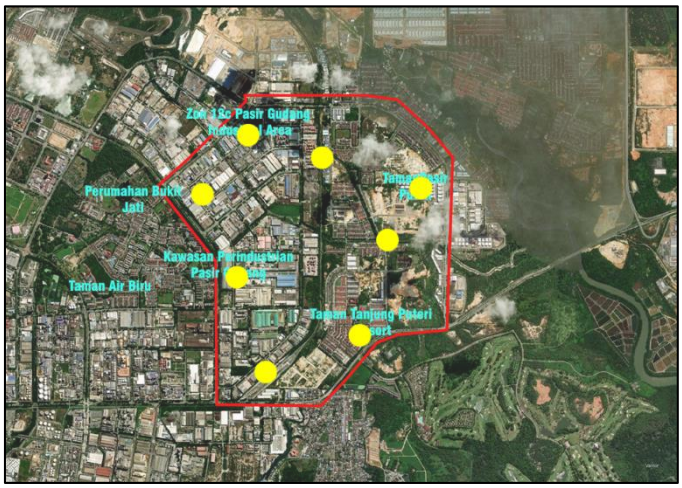


Figure 7: Residential-Industrial Interface point.

The responses obtained in the survey on air quality in Pasir Gudang are divided in Table 1. The greatest average score was found in the statement The air quality in my area is worse than it used to be, and in the statement, it essentially displays that people believe that the air has deteriorated. The standard deviation is very minimal indicating that most people agreed on this.

Data collected on the observation of the site was coded and split into an analysis using a simple descriptive method. All the checklist items were aggregated under major headings: indicators of air pollution, the comfort of the location in terms of the temperature, continued industrial operation, and green areas and possible sources of exposure. This method simply eases the process of understanding the way each kind of land use is a reflection on the local setting (Bowen, 2009).

It became quite evident during the visits to the industrial areas that the quality of the environment in such zones was poorer than in others, such as Zon 18C and the Pasir Gudang Industrial Area were places where haze, strong smell of chemicals, transportation of large vehicles and the lack of trees were the main elements present in those zones. All these are evidence of high level of exposure to environmental pollution and very low curbing by environmental features as well.

Residential areas such as Perumahan Bukit Jati and Taman Pasir Putih were moderate air gauges in comparison to this. The presence of dust and odor had been known in some instances; indeed, less common than in the industrial areas. Although this area has a bit of vegetation, lacks proper buffers between the residential grounds and the industries is a great danger to the communities.

The environmental conditions based on environmental factors like greenery and heat in Taman Tanjung Puteri Resort were apparently better based on observation points. These green areas and shaded areas enhance the outdoor environment. Yet, due to the absence of green buffers, this area may also be influenced by pollution by the industries in the adjacent area.

In total, the findings of the checklist indicate rather distinct differences in environmental quality with the location. Observations of spots which are nearer to industrial establishments are poorer in quality, whereas the presence of green spaces nearby creates the difference. The fact is that the data are representative of the extent to which green landscaping could be effective, and how much the latter could be required even at the locations where factories and residential districts are placed in proximity to each other.










Figure 8: Residential-Industrial Interface point.

DISCUSSION

Combining survey findings and what is actually in the field will better give a picture of the issues of air quality and what the design requires in Pasir Gudang. The missing or nonfunctioning in the area itself can be verified with the help of the feedback provided by the people, and the checking of the site, provides the information about what the community is concerned with. This provides some kind of real-life support to both of these sets of information, and it also renders eco-friendly design as a decent choice o

CONCLUSION

The study examined perceptions and behavior of residents in Pasir Gudang to air quality, heat and local environmental policy. Majority of the citizens are uncomfortable with decreasing air quality - particularly when it comes to dust, smoke, and factories.

However, have it your way, the calls to stiffer environmental regulations, greener building construction and increased opportunities of the locals to participate are also accompanied by a lot of energy. People appear to understand that some planning is needed to make the place a healthier place to live.

If such cities desire fresher air and more livable environments, then it will boil down to prudent planning of cities, increasing green zones, and allow the communities to contribute to it. What people think and observe here should actually influence the way decisions are made on ways of making the city livable.

REFERENCES

Abd-Ghafar, N., Said, I., & Yeo, Z. X. (2025). The effectiveness of modular living wall systems for heat reduction: A case study of an urban transformation center in Pasir Gudang. *Malaysian Journal of Sustainable Environment, 12*(1), 45–58.

Abdul Halim, N. D., Abdullah, M. M., Mansor, A. A., & Ahmad, F. (2022). Trajectory-geospatial approach using HYSPLIT model in determining air pollution sources at Pasir Gudang industrial areas. *Geografia–Malaysian Journal of Society and Space, 18*(4), 19–34.

Abdullah, A. M., Afroz, R., & Hassan, M. N. (2012). Air pollution and its health impacts in Malaysia. *Environmental Science and Policy, 23*, 56–64.

Afroz, R., Hassan, M. N., & Ibrahim, N. A. (2003). Review of air pollution and health impacts in Malaysia. *Environmental*

Research, 92(2), 71–77.

Bauleo, L., Bucci, S., Coluccia, A., & Cesaroni, G. (2018). Air pollution and mortality: A multi-city study. *Environmental Health, 17*(1), 1–10.

Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal, 9*(2), 27–40.

Creswell, J. W. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). Sage Publications.

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). Sage Publications.

Dai, Q., Bi, X., Wu, J., Zhang, Y., Wang, J., Xu, H., & Feng, Y. (2015). Characterization and source identification of heavy metals in particulate matter from industrial areas. *Atmospheric Research, 164–165*, 109–118.

Department of Environment Malaysia. (2017). *Malaysia environmental quality report*. Ministry of Natural Resources and Environment.

Guo, C., Zhang, Z., Lau, A. K. H., Lin, C. Q., Chuang, Y. C., Chan, J., & Jiang, W. K. (2019). Effect of long-term exposure to fine particulate matter on lung function decline and risk of chronic obstructive pulmonary disease. *American Journal of Epidemiology, 188*(3), 570–578.

Hashim, N. A., Kamarulzaman, N., & Hamzah, N. (2023). Mapping of greenhouse gas concentration in Peninsular Malaysia industrial areas using UAV-based sniffer sensors. *Remote Sensing, 15*(1), 255.

Jerrett, M. (2015). Global geographies of air pollution. *The Lancet, 386*(9991), 2240–2241.

Khomenko, S., Cirach, M., Pereira-Barboza, E., Mueller, N., Barrera-Gómez, J., Rojas-Rueda, D., & Nieuwenhuijsen, M. (2021). Premature mortality due to air pollution in European cities. *The Lancet Planetary Health, 5*(3), e121–e134.

Lee, S., Tran, T., & Yu, X. (2023). Green infrastructure and air pollution: Evidence from highways connecting two megacities in China. *Journal of Environmental Management, 326*, 116639.

Lelieveld, J., Klingmüller, K., Pozzer, A., Burnett, R., Haines, A., & Ramanathan, V. (2020). Effects of fossil fuel and total anthropogenic emission removal on public health and climate. *Proceedings of the National Academy of Sciences, 117*(24), 13529–13536.

Mansor, A. A., Abdullah, M. M., & Halim, N. D. A. (2022). Diurnal trend of particulate matter concentration at industrial areas using multivariate analysis. *International Journal of Integrated Engineering, 14*(2), 214–222.

Munsif, S., Zubair, M., Aziz, A., & Ahmed, M. (2021). Industrial emissions and their impacts on air quality. *Environmental Science and Pollution Research, 28*(8), 10213–10225.

Nasir, N. A. M., & Rahim, S. A. (2022). Climate adaptation strategy via urban green space: A bibliometric analysis. *Journal of Asian Geography, 2*(1), 1–15.

Rahman, H. A. (2017). Industrial pollution and environmental governance in Malaysia. *Asian Journal of Environment, 8*(2), 33–47.

Sabri, S., & Ponrahono, Z. (2024). Greening the city: Criteria and indicators for evaluating the effectiveness of small urban parks in promoting urban resilience to climate change. *Planning Malaysia, 22*(1), 1–15.

Sentian, J., Mahmud, M., & Hassan, M. N. (2019). Urban air quality trends in Malaysia. *Atmospheric Environment, 203*, 121–132.

Wai, K. M., Tariq, M., & Muttil, N. (2022). A systematic review on urban green infrastructure for thermal comfort in high-density urban contexts. *Water, 14*(16), 2496.

World Health Organization. (2018). *Air pollution and child health: Prescribing clean air*. WHO Press.

World Health Organization. (2022). *Air quality and health*.

Wu, J., & Liu, Z. (2023). Impacts of building environment and urban green space features on urban air quality: Focusing on interaction effects and nonlinearity. *Buildings, 13*(12), 3111.