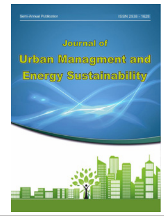
Int. J. Urban Manage Energy Sustainability, 6(2): 1-14, 2025

International Journal of Urban Management and Energy Sustainability (JUMES)

Homepage: http://www.ijumes.com



ORIGINAL RESEARCH PAPER

Exploring the Social Dimension of Community Resilience Against Air Pollution: Assessment and System Thinking in Tehran's District Six

Shayan Estifaei[1], Ghazaleh Goodarzi[2], Seyed Ali Razavian Amrei[3*]

1 M.Sc., Construction Management and Engineering, Delft University of Technology, Independent Researcher, Tehran, Iran
2 Ph.D. Department of Urban Planning, Faculty of Technical and Engineering, , Islamic Azad University, N.T., Tehran, Iran
3 Associate Professor, Department of Civil Engineering, Payame Noor University (PNU), P.O. Box, 19395-3697 Tehran, Iran.*

ARTICLE INFO

Article History:
Received 2025-02-07
Revised 2025-03-14
Accepted 2024-06-01

Keywords:
Air pollution; Sentinel 5P;
Spatial approach; Urban policy;
Urban resilience

DOI: 10.22034/IJUMES.2025.2052874.1290

ABSTRACT

Urban air pollution is a major environmental challenge that poses serious threats to public health and the resilience of urban communities. Traditional assessment approaches often overlook the complex interactions within urban systems and their long-term consequences. This study focuses on Tehran's District 6, aiming to evaluate the relationship between air pollution and urban resilience, particularly among vulnerable social groups. A structured quantitative and spatial analysis was conducted using air quality data from the year 2024. The analysis focused on key pollutants including nitrogen dioxide, sulfur dioxide, and ozone. These data were integrated with Sentinel-5P satellite imagery through a geographic information system to assess spatial distribution patterns. Social and demographic indicators such as population, population density, number of households, and vulnerability of specific groups were overlaid to identify zones of increased exposure. The results showed that pollution levels in District 6 frequently surpassed acceptable thresholds, especially in densely populated areas. High-risk zones were identified where vulnerable populations—including children, the elderly, and women of reproductive age—face elevated exposure. These patterns suggest significant disparities in how environmental risks affect different social groups, raising concerns about social resilience in the face of persistent air pollution. While the study reveals important insights into the spatial and social dimensions of air pollution, it also highlights the complexity of assessing urban resilience. Future research should adopt a multidimensional framework that reflects the unique social, environmental, and institutional context of each urban area. Moreover, integrating economic tools such as cost-benefit analysis is essential for evaluating the feasibility and impact of policy responses.

Running Title: Air Pollution and Social Resilience in Tehran's Sixth District

NUMBER OF REFERENCES
24

NUMBER OF FIGURES
08

NUMBER OF TABLES
02

*Corresponding Author:
Email: *razavian@pnu.ac.ir*
Phone: +989123480192
ORCID: https://orcid.org/0000-0002-3344-8069

INTRODUCTION

Air pollution represents one of the most significant environmental challenges in urban areas. As air pollution becomes a growing threat, it not only affects public health but also undermines various factors that contribute to community resilience in urban areas. Community resilience refers to the ability of social, economic, and environmental systems to adapt, withstand, and recover from various challenges and hazards (Krishnan et al., 2023, Zeng et al., 2022, Datola, 2023, Amirzadeh et al., 2022). This concept plays a crucial role in the sustainability of communities (Razavian Amrei et al., 2024) and involves the ability and expertise of the society in managing adverse impacts and to recover quickly from potential disruptions (Kammouh et al., 2019). Tehran, as the capital of Iran, faces severe air pollution issues, with air quality frequently reaching unhealthy levels throughout the year. The city's primary pollutants include particulate matter sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), and ozone (O_3), primarily originating from heavy traffic, industrial activities, fossil fuel combustion, and unfavorable meteorological conditions. Among Tehran's districts, District 6 is one of the most important administrative, commercial, and cultural hubs. Due to its high vehicle density, heavy daily traffic, and the presence of high-traffic urban centers, this district experiences severe air pollution. Additionally, District 6 is home to numerous healthcare, academic, and residential facilities, leading to a significant floating population during the day, thereby increasing the importance of assessing air pollution and its impact on citizens. Given these conditions, monitoring air pollution levels and evaluating their effects on community resilience in this district is of particular importance.

Current air pollution monitoring studies focus on isolated techniques, lacking a resilience-driven approach. Most frameworks remain static, overlooking long-term system evolution and cross-sectoral interactions. Additionally, system thinking is often reduced to simple cause-and-effect analyses and lack the ability to capture how interconnected systems exacerbate pollution. This gap highlights the need for a more interconnected, and resilience-driven approach. This study examines air pollution levels in District 6 of Tehran and their impact on social resilience. Using a quantitative and spatial analysis approach, it assesses pollution through, system analysis monitoring data and the Air Quality Index (AQI) analysis, analyzes pollutant distribution via geographic information system and remote sensing, and compares findings with social resilience indicators to identify high-risk areas.

Air Pollution

Cities, as major centers of population and economic activity, are particularly vulnerable to the adverse effects of their climate. In this context, the intensity and frequency of stressors place significant stress on urban areas. These stressors not only impact the environment but also affect citizens. Among the most pressing urban stressors is air pollution. Air pollution, the presence of harmful substances in the atmosphere which poses serious risks to human health and the environment and can be found in various types (Bai et al., 2018).

Types of Air Pollution

The primary types of air pollution can be categorized into two main groups according to their sources (Fig. 1): Outdoor and Indoor sources (Jiang et al., 2016). Outdoor sources of air pollution include various outdoor biological processes that release pollutants into the atmosphere possibly by intervention from human activities. These sources are typically industrial production, forest and brush fire, garbage burning, and emission of transport and can contribute to overall air quality (Jiang et al., 2016). Indoor air pollution is a vital aspect of overall air quality, since people spend a significant amount of time indoors (Carslaw et al., 2024, Martins et al., 2025). The sources of indoor air pollutants often differ from outdoor sources and can lead to diverse health impacts (Martins et al., 2025).

Classification of Pollutants and possible health impacts

The pollutants fall into two main categories: primary, secondary. Primary pollutants are directly emitted from sources like particulate matter (PM2.5), Nitrogen oxides (NO_2), Sulfur-dioxide (SO_2), and Carbon- Monoxide (CO) (Almetwally et al., 2020). In contrast, secondary pollutants, such as Ozone, form through chemical reactions in the atmosphere (Nirala et al., 2023).

Exposure to aforementioned pollutants can lead to both acute and chronic health effects. Short-term exposure to pollutants can cause respiratory issues (Chen and Chen, 2020). Over time, long-term exposure can result in chronic respiratory diseases such as asthma and bronchitis. The World Health Organization (WHO) underscores that individuals in polluted areas are at a higher risk of developing chronic conditions. Furthermore, air pollution affects reproductive health. Studies indicate that exposure to pollutants can lead to adverse pregnancy outcomes, including low-weight infants (Niu et al., 2022). Furthermore, Vulnerability to air pollution varies across age groups. For instance, children and elderly individuals are particularly susceptible due to their developing or compromised respiratory systems (Namdeo et al., 2011).

Current studies for monitoring air Pollution impacts in the literature

While current studies on air pollution monitoring provide valuable insights, they primarily adopt detached approaches rather than an integrated systems-thinking perspective. The existing literature often focuses on distinct monitoring techniques, such as remote sensing (Taheri et al., 2025), ground-based observations (Nazarian et al., 2025), and epidemiological studies (Fathi et al., 2025).

A key limitation in the existing research is the lack of resilience thinking in air pollution monitoring. Most studies emphasize data collection and analysis but do not consider how various aspects of a community are impacted by the disruptive characteristics of air pollution. According to Taheri et al., 2025, a comprehensive analysis has been conducted by examining time-series data on air quality during different periods in Tehran. However, technical analyses alone are insufficient to equip decision-makers with a proper understanding of the issue. A social approach can help decision-makers gain a broader perspective.

Furthermore, air pollution research predominantly evaluates pollution through a static lens, focusing on pollutant levels at specific points in time rather than assessing the long-term resilience of communities. While Fathi et al., 2025 examined the health impacts of pollutants on a specific age group, it is crucial to recognize that communities are composed of more diverse elements, and potential threats cannot be limited to one demographic. Additionally, current studies tend to follow a risk management approach rather than resilience thinking.

Additionally, air pollution monitoring is often treated as an isolated process and its integration with other critical sectors is overlooked. While system thinking is sometimes applied as per (Hurtado, 2019. Kirkpatrick et al., 2023), it is often abstract and limited to simple cause-and-effect analyses rather than a deeper exploration of how interconnected systems influence each other. This narrow approach overlooks the fact that different systems such as transportation networks, industrial activities, and urban development can not only contribute to pollution but also exacerbate its impacts.

Community Resilience

When addressing air pollution, it is essential to broaden our perspective to consider entire communities. According to the Cambridge Dictionary, “community” refers to a group of people who live in a specific area or share common interests, social groups, or nationalities. If a community is considered a system it can be seen as more than just a group of individuals. This perspective includes all the social elements of the community as well. With the increasing frequency of stressors, it is essential to protect and strengthen these communities against potential risks (Razavian Amrei et al., 2024). Thus, community resilience can be defined as a community's ability to cope with crises and recover quickly afterward (Cutter et al., 2014; Sharifi, 2016; Kammouh et al., 2019). This characteristic enables communities to respond effectively to various challenges and threats and return to a stable and improved state.

Community resilience consists of five main dimensions: infrastructure resilience, social resilience, economic resilience, environmental resilience, and organizational resilience (Cutter et al., 2014). Social resilience responses to the question of what specific indicators communities should satisfy in order to be measured as resilient can vary depending on the context and the aspects being considered. However, the core framework of this dimension includes indicators related to population (See Tab. 1), as air pollution can have multiple health impacts on different age groups across both genders. Furthermore, the number of households and population density can contribute to a proper understanding of the urban system.

Table 1: Social Dimension Indicators

		Indicators	Unit	Reference
Social Dimension	I1	Population	People	(Cutter et al., 2014, Kammouh et al., 2019)
	SI1	Male	People	
	SI2	Female	People	
	SI3	Male over 65 Years	People	
	SI4	Female over 65 Years	People	
	SI5	Male Under 5 Years	People	
	SI6	Female Under 5 Years	People	
	SI7	Female population at the age of fertility	People	
	I2	Population Density	People per Area	(Cutter et al., 2014, Kammouh et al., 2019)
	I3	Households	Number	(Cutter et al., 2014, Kammouh et al., 2019)

MATERIALS AND METHODS

This research adopts a quantitative, spatially-oriented methodology divided into three main stages: air quality assessment, remote sensing-based spatial analysis, and social resilience evaluation. In the first stage, air pollution levels in District 6 of Tehran are assessed using data from local air quality monitoring stations in 2024. Key pollutants, namely O_3, CO, NO_2, and SO_2 are analyzed. The Air Quality Index is calculated for each pollutant, and descriptive statistical methods are employed to explore concentration patterns. The data is also normalized to evaluate seasonal variations and temporal fluctuations throughout the year. In the second stage, remote sensing data is used to map and analyze the spatial distribution of air pollutants. Sentinel-5P satellite imagery for 2024 is obtained from Google Earth Engine and processed in a Geographic Information System environment. The study area is clipped to the boundaries of District 6, and relevant spectral bands corresponding to the target pollutants are extracted. To enable spatial interpolation, raster datasets are converted into point features using the "Raster to Point" tool. Subsequently, the Inverse Distance Weighting technique is applied to generate continuous surface maps illustrating pollutant concentration gradients across the district. These interpolated layers are validated using ground station data to enhance the accuracy and reliability of the spatial models. In the third stage, spatial outputs from the air

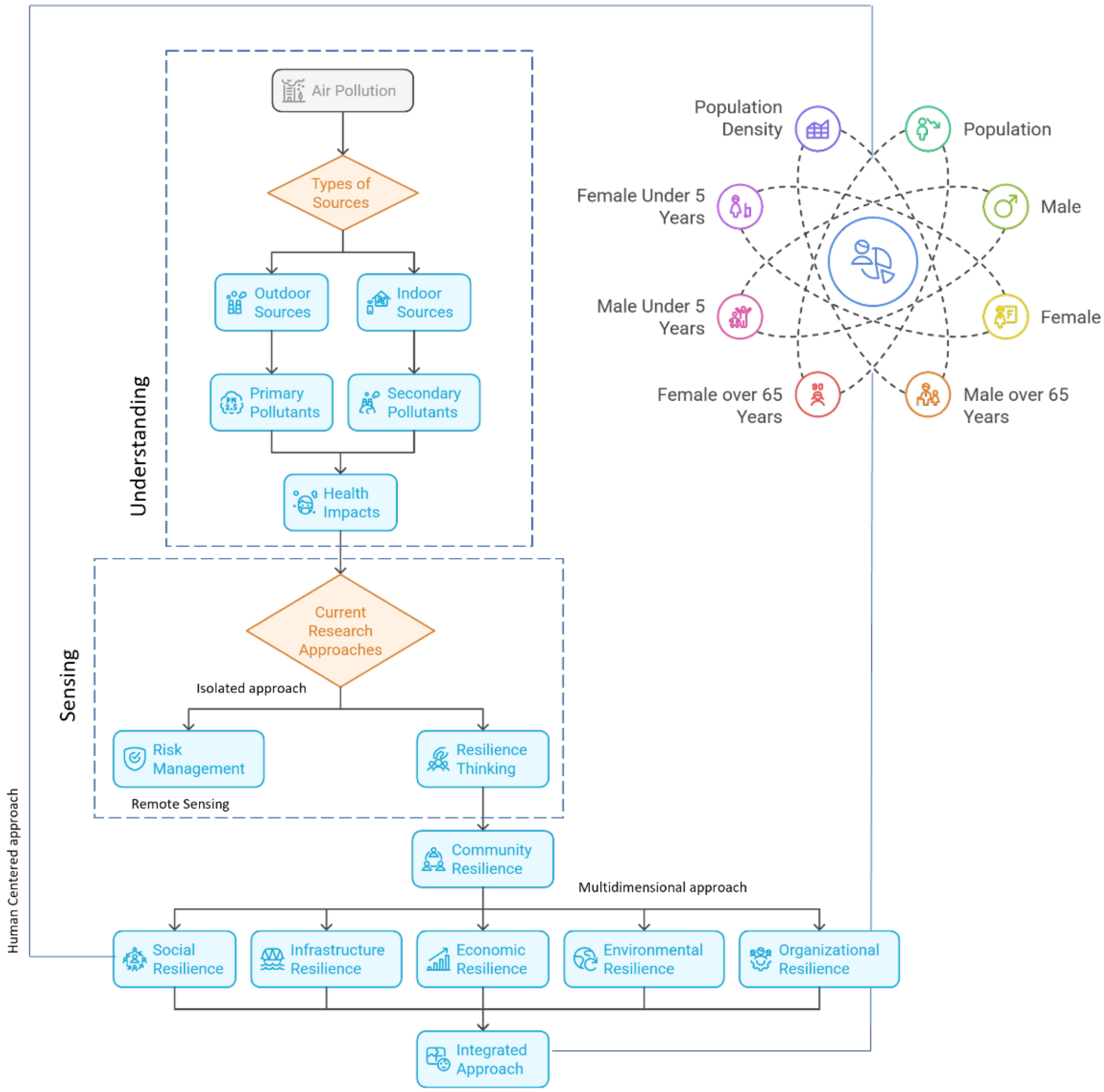


Figure 1: Conceptual Model for Assessing the Impact of Air Pollution on Social Resilience

pollution analysis are overlaid with demographic indicators to assess social resilience. Factors such as population, population density, number of households, and the vulnerability of specific population groups are considered. GIS-based overlay techniques are used to identify areas where high levels of air pollution intersect with low resilience metrics. The resulting composite maps help visualize spatial disparities and support the development of targeted environmental and social policies.

Study Area

District 6 of Tehran, located in the heart of the capital, is a central and significant area characterized by prominent geographic and transportation features (See Fig. 2). This densely populated and highly trafficked district has a considerable impact on Tehran's economic, cultural, and social developments. Situated near major highways and streets, it facilitates urban communications. Vali Asr Street, the longest street in the Middle East, is a main artery, influencing traffic and accessibility. With a high concentration of office buildings, commercial spaces, residential areas, educational institutions, and healthcare services, District 6 is one of the busiest areas in Tehran. Its proximity to metro stations and BRT lines makes it a crucial public transportation hub, particularly important during peak traffic hours, when the district faces heavy traffic and air pollution.

DISCUSSION AND FINDINGS

System Analysis

Tehran, as a megacity, includes various urban systems, such as transportation, residential, and industrial sectors. To identify potential pollutant sources, a system matrix analysis has been developed (See Fig. 3). Based on existing literature, transportation and industrial systems are recognized as the primary contributors to urban pollution, and Tehran is no exception. In the matrix, these systems are positioned in the rows, while residential systems being the most exposed to pollutants are placed in the columns. The intersections between these systems and their respective subsystems illustrate two types of relationships: one representing a direct physical interface (marked with red circles) and the other indicating a pollutant-based interaction (marked with blue circles). The latter relationship suggests that, while the system contributes to pollution, there is no direct physical interface between it and other systems.

Fig. 4 highlights the major sources of air pollution in District 6 of Tehran, pinpointing key locations where emissions originate, accumulate, and potentially impact surrounding areas. Significant contributors include high-traffic roads, industrial zones, power plants, and areas with extensive fuel combustion activities. Through buffer analysis, high-risk zones have been identified, marking areas most affected by emissions. These buffered regions indicate potential hotspots for elevated pollutant concentrations, offering valuable insights, although further assessments are required for a comprehensive evaluation. While this provided valuable insight, a more precise assessment of dispersion requires detailed raster analysis using Sentinel satellite data.

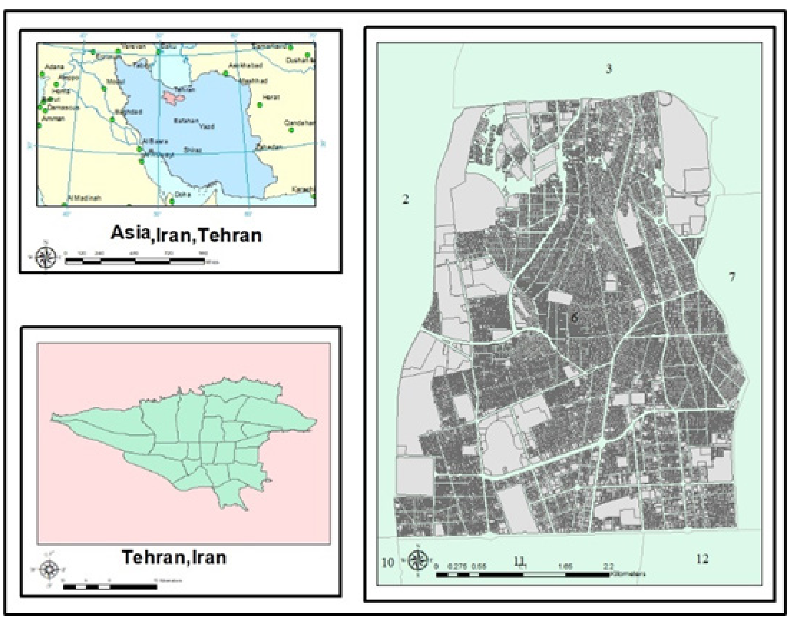


Fig 2: Location of the 6th district of Tehran

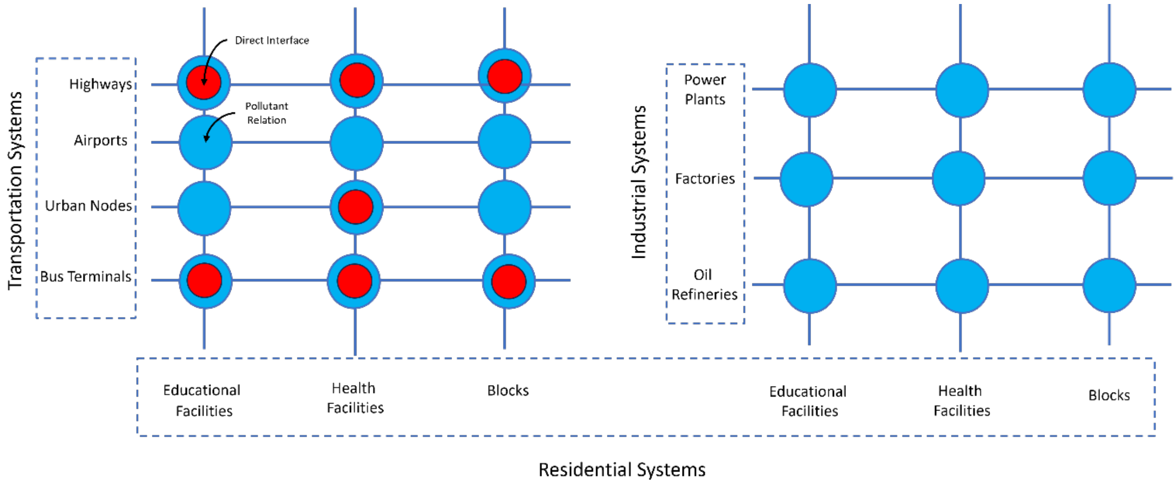


Fig. 3: System Analysis Matrix

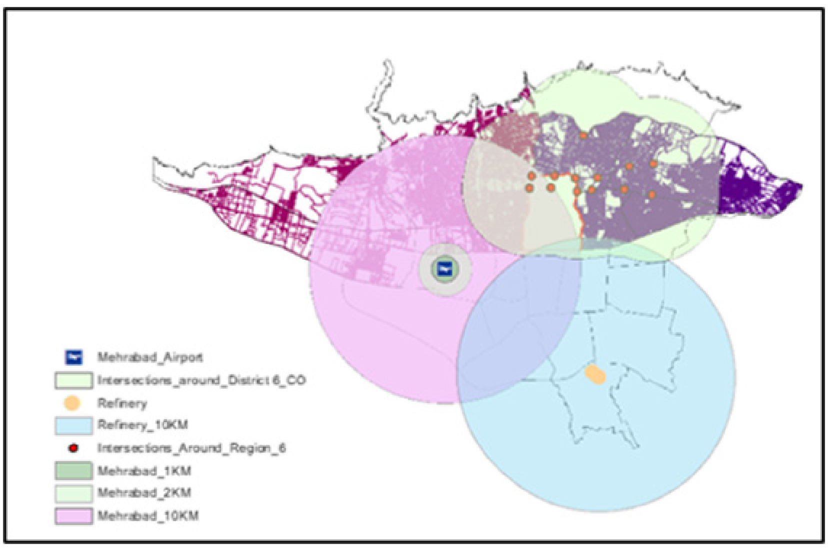


Fig. 4: Potential Pollutant Sources in the Vicinity.

Pollution Dispersion

Air pollution levels in District 6 of Tehran exhibited distinct seasonal fluctuations throughout 2024 (See Fig 5). During spring, the number of clean air days was highest, likely due to favorable meteorological conditions and reduced industrial and vehicular emissions. However, in colder months, the phenomenon of temperature inversion trapped pollutants near the surface, significantly deteriorating air quality. Additionally, during late August, periods of intense solar radiation triggered photochemical reactions, leading to increased ozone formation. These conditions caused AQI values to exceed 150 (unhealthy levels) on several occasions, posing serious health risks to both sensitive populations and the general public.

To analyze the dispersion pattern of pollut-

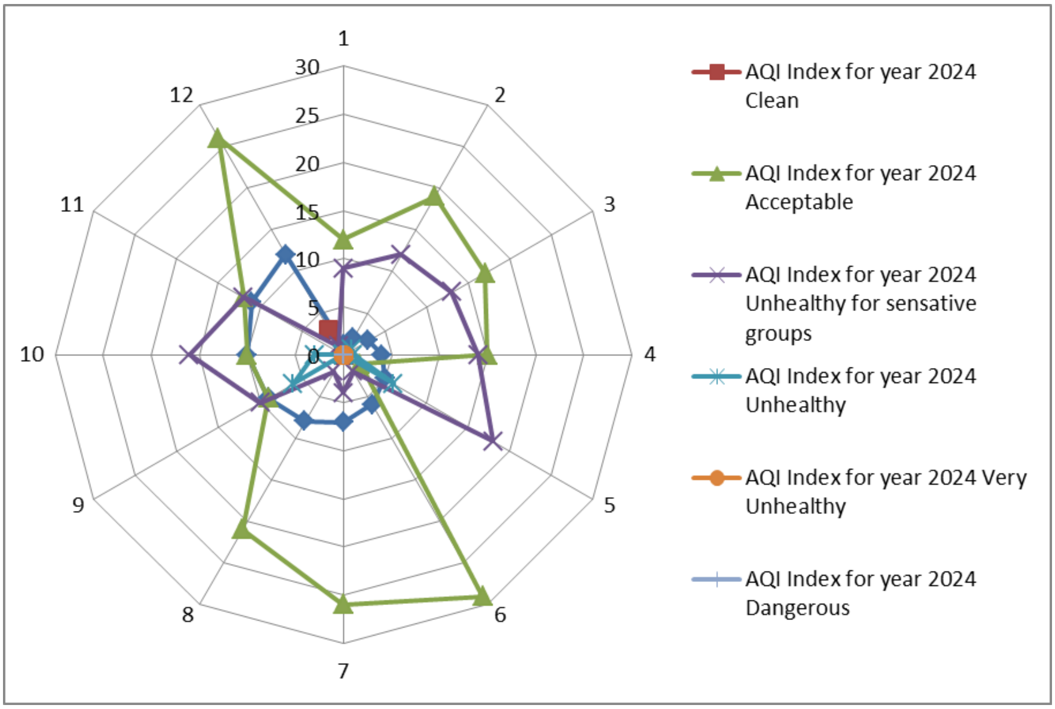


Fig. 5: Monthly Variability of AQI Index in district 6 of Tehran.

ants in District 6 of Tehran more accurately, satellite images were also utilized. Satellite images, due to their wide coverage and ability to capture spatial and temporal variations in pollution, enable a more comprehensive analysis of air quality conditions. Accordingly, Sentinel satellite images were used, and the obtained data were processed using ArcGIS software. Initially, these images were converted into various layers and overlaid on the spatial layer of Tehran's districts. The analysis of Sentinel raster images for O_3, CO, NO_2, and SO_2 in District 6 of Tehran revealed specific pollution distribution patterns (See Fig. 6). Higher O_3 concentrations were observed in areas with continuous sunlight exposure and high traffic, particularly during warm hours, due to chemical reactions between O_3 precursors like NO_2 and volatile organic compounds. The annual pattern analysis indicated intensified O_3 levels near Mehrabad International Airport, which, considering wind patterns, transport pollutants to distant areas. While this suggests the airport's role in regional pollution, it doesn't definitively establish it as the primary source. Nonetheless, the airport's impact on Tehran's overall pollution cannot be overlooked.

Raster analysis showed CO levels significantly increase around highways and high-traffic intersections, primarily due to incomplete fuel combustion in vehicles. CO pollution is more prominent in the northern part of District 6, suggesting contributions from adjacent areas and traffic congestion points. Similar to CO, NO_2 concentrations are higher near busy roads and high-traffic zones, mainly originating from vehicle emissions. Raster image analysis confirmed that CO and NO_2 are typically released simultaneously, reinforcing the shared source of emissions. SO_2 is especially concentrated near major industrial areas and regions with high fuel combustion activities, such as power plants, chemical industries, and refineries. Satellite

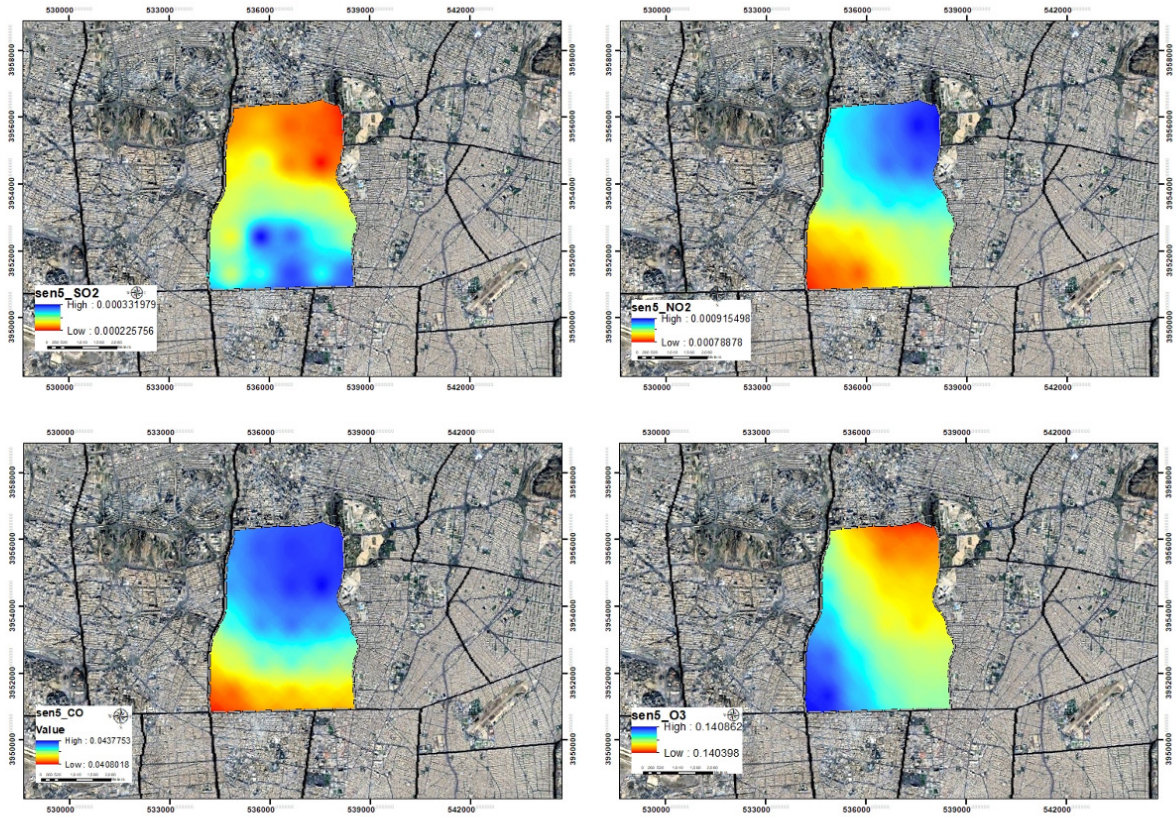


Fig. 6: Raster Images of Air Pollutants from Sentinel-5P for the Year 2024 . A visual analysis of the spatial distribution and temporal trends of various air pollutants throughout 2024 is shown in Fig. 4.

image analysis identified emission sources, including Tehran Refinery and Besast Power Plant, contributing to SO_2 pollution in District 6. Higher SO_2 concentrations were observed near these sources, particularly during peak industrial activity periods.

Social Dimension

Citizens play a crucial role in assessing social resilience, as resilience without considering their needs and conditions would be merely theoretical. One key social resilience indicator is population. Air pollution exposure however is not uniform across demographics but it is shaped by age, gender, and spatial distribution, all of which influence social resilience. This study analyzed population density using spatial statistical methods, including Getis-Ord Gi (GETIS ORD), to identify clusters of concentrated population groups. The findings indicate higher population density in the western parts of District Six compared to other urban areas (See Fig. 7). This pattern is also observed among vulnerable subgroups, meaning high-density areas increase exposure rates to air pollution. Residents near major highway intersections and bus corridors face continuous exposure to pollutants, putting them at risk of long-term health issues. Sensitive groups, such as children and the elderly, residing in high-pollution areas are particularly vulnerable. These groups are at greater risk of developing chronic respiratory and cardiovascular diseases, which can disrupt their daily lives.

For instance, Women of reproductive age are a particularly sensitive group, as both the mother and the fetus's health are directly influenced by disruptive factors of air pollution. Air pollution, therefore, impacts two individuals simultaneously. This study found that a large number of women of reproductive age in District 6 are exposed to various air pollutants, with higher population density in the western part of the district (See Fig. 8). This group consists of 5,051 individuals exposed to sulfur dioxide, 80,304 individuals exposed to carbon monoxide, 80,304 individuals exposed to nitrogen dioxide, and 69,508 individuals exposed to ozone (See Tab. 2). One notable observation is the distinction between men and women in exposure levels. For SO_2 pollution, men (7,996 people) experience slightly higher exposure than women (7,317 people). However, for CO and NO_2 pollution, women have higher exposure numbers, with 127,949 women affected compared to 122,849 men. This difference might be due to social factors such as time spent indoors versus outdoors, occupational exposure, or general population distribution. Another significant trade-off exists between young children and the elderly. The number of individuals over 65 years old exposed to CO pollution is 9,903 males and 10,154 females, whereas exposure among children under 5 years old is 8,844 males and 8,563 females. Although elderly individuals have a slightly higher exposure rate, both groups are considered vulnerable populations due to weakened immune systems and respiratory sensitivity.

Finally, the numbers reveal a trade-off between households and population density. A total of 84,896 households are exposed to CO, while 356,412 individuals are affected. Since household exposure might indicate indoor pollution sources such as cooking emissions or vehicle fumes. Therefore, the concentration of pollutants in densely populated areas could be a major concern for public health.

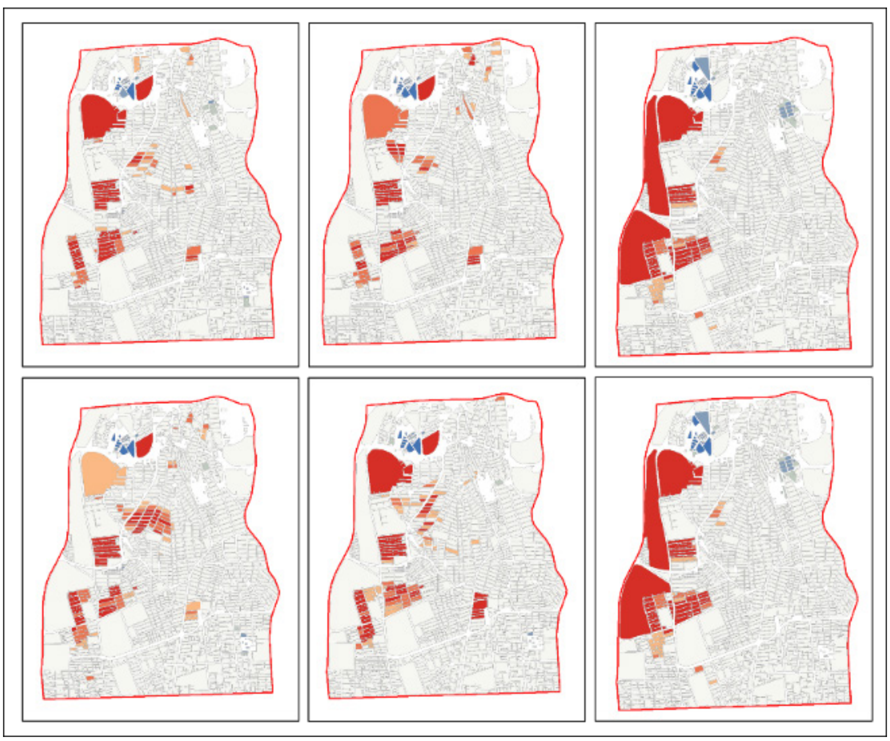


Fig. 7: Density of Sensitive Age Groups in the Sixth District. density of sensitive age groups, focusing on individuals over 65 and children under 5 within the Sixth District (both genders) is shown in Fig. 7.

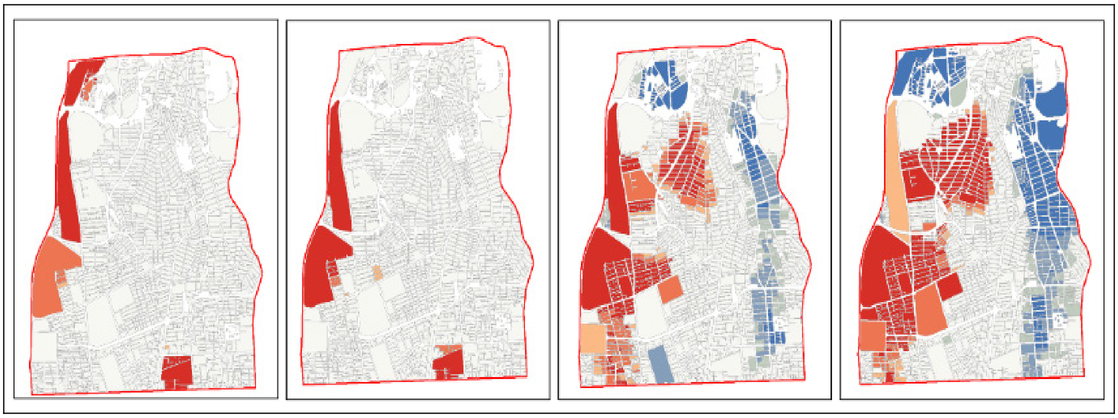


Fig. 8: Density of Individuals in Fertility Age in the Sixth District. the distribution and density of individuals in fertility age (typically 15-49 years old) within the Sixth District is shown in Fig. 8.

Table 2: The Exposed Demographics

Demographics	Unit	SO2	CO	NO2	O3
Population	People	15313	250753	250753	214970
Male	People	7996	12284	12284	105721
Female	People	7317	127949	127949	109249
Male over 65 Years	People	421	9903	9903	7954
Female over 65 Years	People	436	10154	10154	8245
Male Under 5 Years	People	528	8844	8844	7712
Male Under 5 Years	People	490	8563	8563	7448
Female population at the age of fertility	People	5051	80304	80304	69508
Population Density	People per Area	11641	356412	356412	303534
Households	Number	4623	84896	84896	71799

RESULT AND CONCLUSION

Urban air pollution remains a pressing challenge, particularly in densely populated areas where multitude of hazards disproportionately affect vulnerable communities. This study aimed to explore the social dimension of air pollution, assessing the exposure demographics in Tehran's District Six through a social resilience-thinking approach.

To achieve this objective, a multi-method approach was employed, combining system matrix analysis, spatial statistical techniques, and Sentinel satellite imagery to examine pollution dispersion. The study integrated demographic data in order to highlight how pollution interacts with transportation, residential, and industrial sectors. These analytical tools enabled the identification of key pollution sources, including high-traffic roads, industrial zones, and areas with extensive fuel combustion. Additionally, GIS-based methods such as buffer analysis and raster image interpretation allowed for a more detailed assessment of spatial pollution patterns to identify areas where exposure risks are intensified. Tehran, as a megacity, consists of various interconnected urban systems, with transportation and industrial sectors identified as the primary sources of air pollution. A system matrix analysis was conducted to explore the interaction between these systems and the residential areas most exposed to pollution. This analysis revealed two main types of interactions: direct physical interfaces, where systems are in close proximity, and pollutant-based interactions, where emissions impact areas without direct contact. In District 6 of Tehran, key pollutant sources include high-traffic roads, industrial activities, power plants, and fuel combustion sites that are mostly not directly interfaced with the district but impacting the citizens. Citizens play a pivotal role in assessing social resilience, as any measure of resilience that overlooks their specific needs and living conditions remains purely theoretical. A fundamental social resilience indicator is population; however, exposure to air pollution is not uniformly distributed across demographic groups. Instead, it is shaped by factors such as age, gender, and spatial distribution, all of which critically influence social vulnerability and resilience.

In this study, population density was analyzed using spatial statistical methods. The Getis-Ord Gi* statistic package was used to detect significant clustering of population groups. The results revealed higher population densities in the western parts of District Six compared to other urban areas. Notably, this pattern was also prevalent among vulnerable sub-populations, implying that densely populated areas correlate with increased exposure levels to air pollution. Citizens living near major highway intersections and public transport corridors are subjected to continuous pollutant exposure with the risk of long-term health complications. This is particularly concerning for sensitive groups, such as young children and the elderly, who are more susceptible to developing chronic respiratory and cardiovascular diseases that may severely disrupt their quality of life and social functioning. Are we truly resilient in the face of these findings? This remains a challenging question to answer, as resilience is inherently context-specific and shaped by local conditions. The findings of this study clearly highlight that the population of District 6 is significantly exposed to air pollutants, particularly vulnerable groups such as children, the elderly, and women of reproductive age. However, while these findings offer valuable insights into social resilience, that only represent one dimension of a much broader resilience framework. To develop a more thorough understanding, future research must incorporate context-specific indicators tailored to the unique social, environmental, and institutional characteristics of both the city and the country. Moreover, air pollution resilience assessment should not be limited to social aspects alone. Integrating tools like cost-benefit analysis can offer an economic perspective, helping to balance the trade-offs between policy interventions and their financial implications. Such an approach would enable decision-makers to design more informed, sustainable, and context-relevant policies that not only address social resilience but also consider economic feasibility and long-term effectiveness in building a resilient city.

REFERENCES

Almetwally, A. A., Bin-Jumah, M., & Allam, A. A. (2020). Ambient air pollution and its influence on human health and welfare: an overview. Environmental Science and Pollution Research, 27(20), 24815–24830. https://doi.org / 10.1007 / s11356 - 020 - 09042-2

Amirzadeh, M., Sobhaninia, S., & Sharifi, A. (2022). Urban resilience: A vague or an evolutionary concept?. Sustainable Cities and Society, 81, 103853. https://doi.org/10.1016/j.scs.2022.103853

Bai, L., Wang, J., Ma, X., & Lu, H. (2018). Air pollution forecasts: An overview. International journal of environmental research and public health, 15(4), 780. https://doi.org/10.3390/ijerph15040780

Carslaw, N., Bekö, G., Langer, S., Schoemaecker, C., Mihucz, V. G., Dudzinska, M., ... & Shaw, D. (2024). A new framework for indoor air chemistry measurements: Towards a better understanding of indoor air pollution. Indoor Environments, 1(1), 100001. https://doi.org/10.1016/j.indenv.2023.100001

Chen, F., and Chen, Z. (2020). Cost of economic growth: Air pollution and health expenditure. The Science of the Total Environment, 755, 142543. https://doi.org/10.1016/j.scitotenv.2020.142543

Cutter, S. L., Ash, K. D., & Emrich, C. T. (2014). The geographies of community disaster resilience. Global Environmental Change, 29, 65–77. https://doi.org/10.1016/j.gloenvcha.2014.08.005

Datola, G. (2023). Implementing urban resilience in urban planning: A comprehensive framework for urban resilience evaluation. Sustainable Cities and Society, 98, 104821. https://doi.org/10.1016/j.scs.2023.104821

Fathi, G., Mohammadi, A., & Ghafari Gilandeh, A. (2025). Geographical evaluation of the epidemiology of respiratory diseases in the regions of Tehran. Journal of Environmental Science Studies, 9(4), 9378-9372. https://doi.org/ 10.22034/jess.2024.432716.2196

Hurtado, J. H. (2019). Air Pollution and Sustainability Changes: A Systems Thinking Analysis of the Air Quality of the Metropolitan Area of Monterrey, NueVo León, Mexico. Visualizing Systemic Influences and Pathways for Sustainable Change. COOLEST STUDENT PAPERS AT FINLAND FUTURES RESEARCH CENTRE 2018–2019, 22.

Jiang, X. Q., Mei, X. D., & Feng, D. (2016). Air pollution and chronic airway diseases: what should people know and do?. Journal of thoracic disease, 8(1), E31. https://doi.org/10.3978/j.issn.2072-1439.2015.11.50

Kammouh, O., Noori, A. Z., Cimellaro, G. P., & Mahin, S. A. (2019). Resilience Assessment of urban communities. ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems Part a Civil Engineering, 5(1). https://ascelibrary.org/doi/10.1061/AJRUA6.0001004

Krishnan, S., Aydin, N. Y., & Comes, T. (2023). RISE-UP: Resilience in urban planning for climate uncertainty-empirical insights and theoretical reflections from case studies in Amsterdam and Mumbai. Cities, 141, 104464. https://doi.org/10.1016/j.cities.2023.104464

KIRKPATRICK, L., ADJIMAN, C. S., APSIMON, H., BERRY, A., DE NAZELLE, A. U. D. R. E. Y., MIJIC, A., ... & WORKMAN, M. (2023). Systems thinking for the transition to zero pollution.

Martins, C. (2022). Air pollution and health – the importance of air monitoring and burden of disease for attaining SDGs. European Journal of Public Health, 32(Supplement_3). https://doi.org/10.1093/eurpub/ckac129.018

Martins, C., Teófilo, V., Clemente, M., Corda, M., Fermoso, J., Aguado, A., ... & Viegas, S. (2025). Sources, levels, and determinants of indoor air pollutants in Europe: A systematic review. Science of the Total Environment, 964, 178574. https://doi.org/10.1016/j.scitotenv.2025.178574

Namdeo, A., Tiwary, A., & Farrow, E. (2011). Estimation of age-related vulnerability to air pollution: Assessment of respiratory health at local scale. Environment International, 37(5), 829–837. https://doi.org/10.1016/j.envint.2011.02.002

Nazarian, A., Abedi, Z., Nasiri Pour, A. A., & Haji Seyed Mirzahoseini, A. (2025). Evaluation of the effects of air pollution on hospitalization and death due to corona crisis in Tehran. Disaster Prevention and Management Knowledge (quarterly), 15(1), 4-4. https://doi.org/10.32598/DMKP.15.1.887.1

Nirala, N. K., Chopra, L., & Manikanika, N. (2023). Review of indoor air pollution Cause and remedy. IOP Conference Series Earth and Environmental Science, 1110(1), 012056. https:// doi.org/10.1088/1755- 1315/1110/1/012056

Niu, Z., Habre, R., Chavez, T. A., Yang, T., Grubbs, B. H., Eckel, S. P., Berhane, K., Toledo-Corral, C. M., Johnston, J., Dunton, G. F., Lerner, D., Al-Marayati, L., Lurmann, F., Pavlovic, N., Farzan, S. F., Bastain, T. M., & Breton, C. V. (2022). Association between ambient air pollution and birth weight by maternal Individual- and Neighborhood-Level stressors. JAMA Network Open, 5(10), e2238174. https://doi.org/10.1001/jamanetworkopen.2022.38174

Razavian Amrei, S. A., goodarzi, G., & Fattahi, M. (2024). Comprehensive Model for Evaluating Urban Resilience in Crisis Management., ( ), -. https:// doi.org/10.1001/10.30495/jupm.2024.33748.4545

Sharifi, A. (2016). A critical review of selected tools for assessing community resilience. Ecological Indicators, 69, 629–647. https://doi.org/10.1016/j.ecolind.2016.05.023

Soleimani, M., & Amini, N. (2017). Source identification and apportionment of air pollutants in Iran. Journal of Air Pollution and Health, 2(1).

Taheri, A., Khorsandi, B. & Alavi Moghaddam, M. A long-term analysis of oxidant (OX=O3+NO2) and its local and regional levels in Tehran, Iran, a high NOx-saturated condition. Sci Rep 15, 2521 (2025). https://doi.org/10.1038/s41598-024-82709-9

Zeng, X., Yu, Y., Yang, S., Lv, Y., & Sarker, M. N. I. (2022). Urban resilience for urban sustainability: Concepts, dimensions, and perspectives. Sustainability, 14(5), 2481. https://doi.org/10.3390/su14052481

HOW TO CITE THIS ARTICLE
Estifaei, S. , Goodarzi, G. and Razavian Amrei, S. A. (2025). Exploring the Social Dimension of Community Resilience Against Air Pollution: Assessment and System Thinking in Tehran's District Six. (e724968). International Journal of Urban Management and Energy Sustainability, (), e724968
DOI: 10.22034/IJUMES.2025.2052874.1290