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Socio-Economic Factors of Rising Air Pollution in Mingora City, Khyber Pakhtunkhwa, Pakistan

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Abstract

The present study has been conducted in Mingora city of Khyber Pakhtunkhwa, Pakistan, and the sole aim was to find out the social and economic factors contributing to the air pollution, which is a serious environmental and public health problem in urban areas of Pakistan, including Mingora city of Khyber Pakhtunkhwa. There are several factors which contribute to this problem; social and economic conditions are the deeply rooted contributing factors in the case of Mingora city. The five most populated and affected union councils were selected to observe the phenomenon. The aforementioned union councils are Saidu Sharif, Haji Baba, Mula Baba, Rahim Abad and Shah Dara. A significant association was found between socioeconomic factors and Air pollution. Permanent citizens of Mingora city prefer using personal vehicles instead of public transport. The lack of public awareness about environmental protection worsens air quality. Rapid urbanization and construction activities are increasing air pollution in Mingora. Furthermore, current pollution levels are a threat to future generations, which leads to air pollution, and the worst Socio-Economic conditions have negatively affected the air quality of Mingora city. In addition, the absence of public transport, preference to personal vehicles, increase in the number of Rickshaws and NCP vehicles have negatively affected Air Quality. Lack of institutional focus, public awareness about environmental protection and poor discipline contribute to air pollution. It is therefore suggested that the residents should be aware of their environment and protect it from pollution by discouraging harmful activities. The concerned authorities should take strict action against air-polluting vehicles. The government and other organizations also take strict and strong action against outdated vehicles and rickshaws, and concentrate on their regulation. They should also observe other industrial and waste disposal activities to get rid of air pollution and restore the beauty of Mingora City.

Key words: Socio-Economic Factors, Air pollution, Urban Environment

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INTRODUCTION

Air Pollution mean the presence of harmful substances in the atmosphere, including poisonous gases, particulate matter, and biological molecules, which negatively affect human health, climate and ecosystem (WHO, 2021). In Pakistan, air pollution has raised as a major environmental and public health concern. Major congested cities are experiencing high levels of air pollutants such as particulate matter ($PM_{2.5}$ and PM_{10}), carbon monoxide (CO), nitrogen oxides (NOx), and sulfur dioxide (SO_2). The generation of these pollutants occurs due to vehicular emissions, industrial activities, burning of solid fuels, and unregulated urban growth (Pakistan Environmental Protection Agency (Pak-EPA, 2020).

Cities play an important role in determining living standards, and with urban populations growing 36% in Pakistan and 56% globally sustainability has become essential. Mingora, Swat is an example for the challenges faced by Pakistani cities due to unplanned urban growth, administrative changes, natural disasters, conflict, and migration. Rapid housing expansion without will planed infrastructure has caused overcrowding and congested mobility issues. As a major tourist hub and climate vulnerable city, Mingora now faces environmental risks, particularly floods, while unsustainable development threatens its economic and human resources (Ullah et al., 2024). The World Air Quality Report (2025) ranked Pakistan among the more polluted countries globally, continuing its position from previous years (IQ Air, 2024). The situation in Mingora is compounded by unique local factors, such as its tax-free status which encourages industrial growth and a high influx of NCP vehicles. A report by the Khyber Pakhtunkhwa Excise and Taxation Department revealed that over 35,263 Non-Custom Pad vehicles were profiled in the region by August 2024 and the total number in Malakand division is 1,10,000. The registered, unregulated vehicles, along with rickshaws and old outdated vehicles, are major contributors to air pollution in the city (Excise and Taxation Department, Khyber Pakhtunkhwa, 2024). Socio-economic dynamics play a key role in accelerating the problem from day next. The lower level poor communities who depend on old vehicles (especially on Rickshaws), cheap fuels (CNG & mob oils), and poor waste disposal practices of people and WASSA (waste disposal administration) contribute significantly to air pollution. As noticed by Khwaja and Khan (2005), that macroeconomic and emission policies, poverty, lack of awareness and failure of environmental regulation authorities are main contributors to pollution across the Pakistan. Distorted policies, old vehicles, outdated technologies and poor urban planning intensify emission and make obstacle in the way of improvement.

According to the Pakistan Forest Institute (2023), green cover in Swat city has declined by nearly 18% in the last 10 to 15 years, contributing to rising temperature levels and worsening air quality, particularly in densely populated areas situated in main cities or in close contact.There is clear increase in health issues among Mingora's residents. The two Local hospitals, Central Hospital and Saidu Teaching Hospital Mingora, have reported a noticeable rise in cases of asthma, chronic cough, allergies, kin irritation and bronchitis over the previous few years. A small-scale health survey was carried out by Saidu Medical College (2023) noted that 36% of outpatients attending chest clinics were found showing symptoms direct linked to poor air quality exposure. Children and elderly people are easy victims due to prolonged exposure to particulate matter and toxic gases, which weakens lung function and cause the risk of long-term respiratory disease. Another important contributing factor to Mingora's air pollution is the unregulated public transport especially rickshaws. The city depends heavily on informal, private transport system, including outdated rickshaws. These vehicles often lack emission control systems and are operated without fitness inspections. According to Transport

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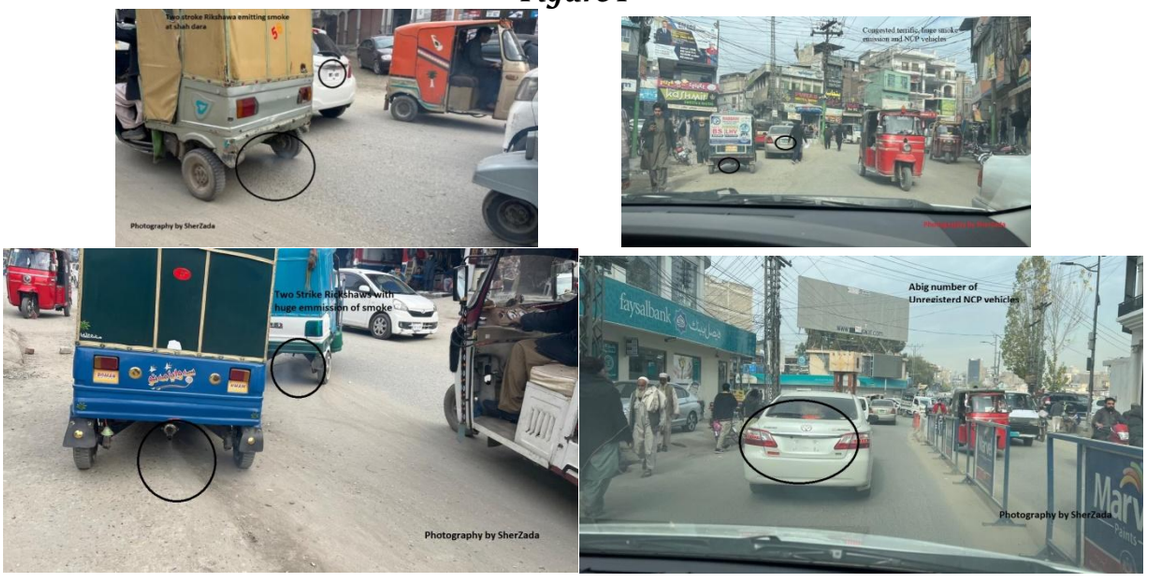
Department KPK (2022) over 70% of registered vehicles in Swat do not undergo annual emission testing, making vehicular pollution.

At policy level the environmental regulation authorities remains weak and ineffectively implemented. Pakistan has environmental laws such as the Pakistan Environmental Protection Act 1997 and provincial environmental quality standards but unfortunately these laws remain unimplemented or limited cities. The Environmental Protection Agency (EPA) KPK face a big problem such as restricted manpower and limited continuous monitoring stations, leading to inadequate air quality reporting. In the absence of reliable real-time pollution data, meaningful policy decisions and public awareness strategies become difficult and impossible to design and implement. In addition, the socio-economic background of Mingora plays an important role in shaping environmental outcomes. Because the city provides micro level businesses, transport work, construction labor and informal markets, which provide income for a significant portion of the population there for urbanization in Mingora is closely related to livelihood needs. These economic activities are essential for household survival but contribute indirectly to the increase in Air pollution levels.

Figure 1



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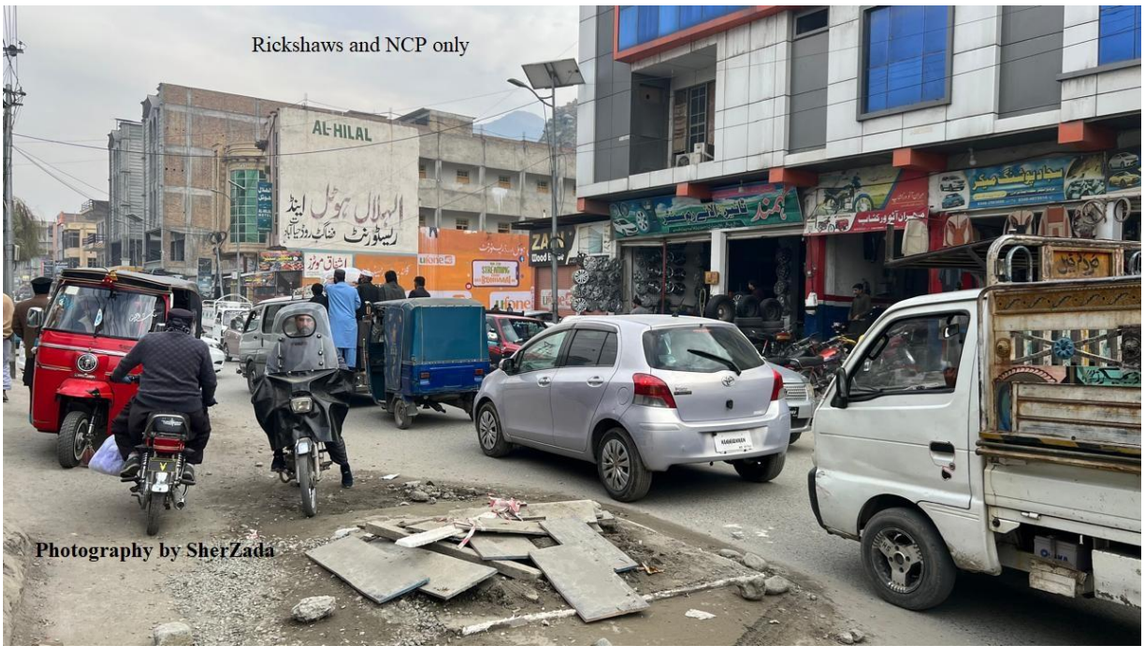
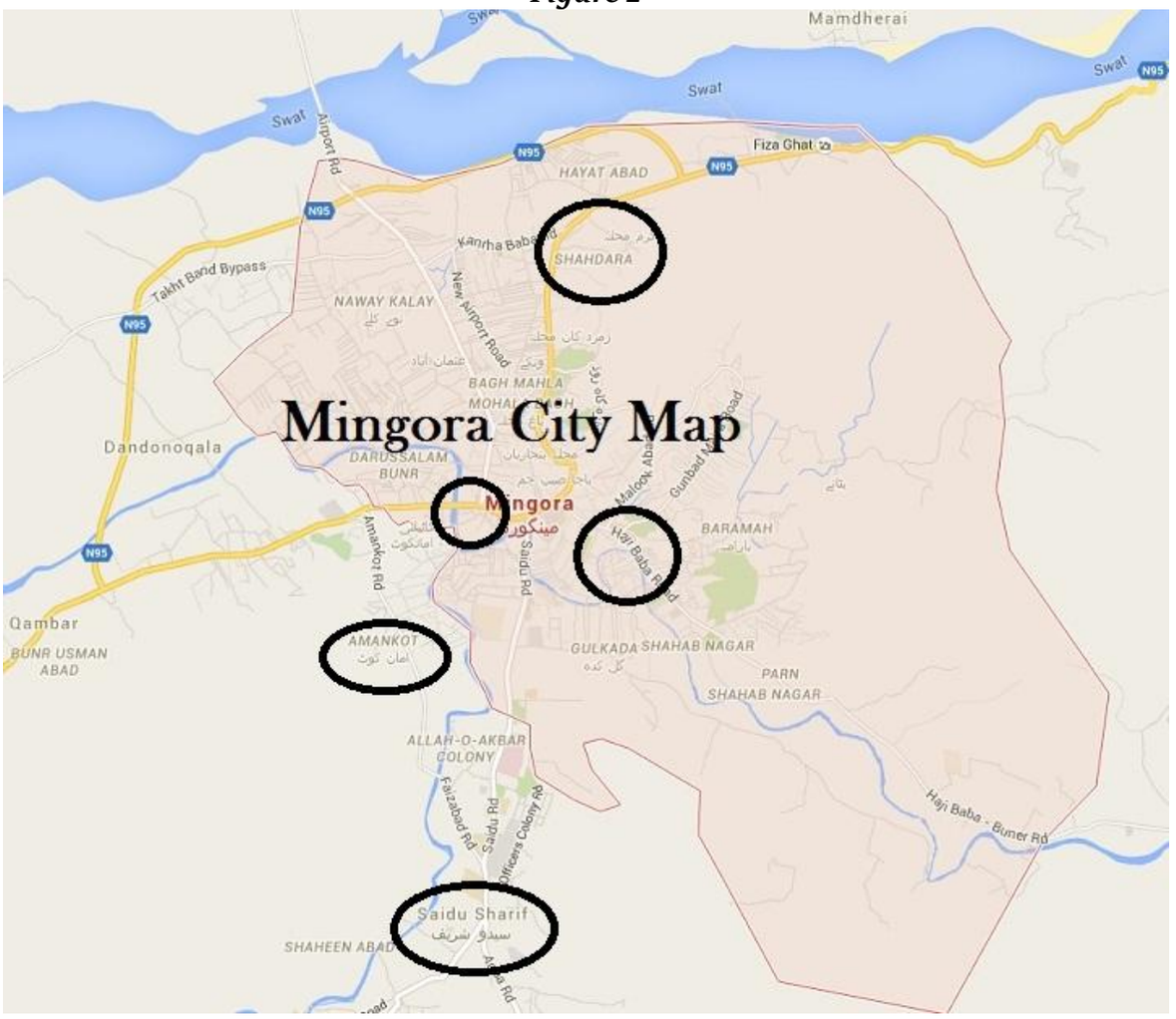


Figure 2



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RESEARCH METHODOLOGY

This study was carried out in 2025 and the nature of the study was quantitative research. The aim of was to examine the socio-economic factors contributing to rising air pollution in Mingora City. Five union councils were selected which are highly affected from pollution due to their location in the main city. According to sample size data were collected from total 150 respondents and distributed in five sets of thirty (30) for 5 Union Councils. Primary data was collected through a structured questionnaire containing both closed-ended and Likert-scale questions related to socio-economic background, transportation habits, and pollution awareness. A simple random technique was followed. After entering into SPSS the data was checked to remove Errors such as duplicate or missing values are identified and corrected to ensure accuracy. Uni variate analysis was conducted at first stage to get frequency and percentile while later chi square test was applied to get association between dependent and independent variables.

Table 1: ***Distribution of the Respondents***

S.No.	Union council	No of respondents
1- (1-30)	Said Sharif	30
2- (31-60)	Haji Biba	30
3- (61-90)	Mula Baba	30
4- (91-120)	Rahim Abad	30
5- (121-150)	Shah Dara	30
Total		**150**

Survey source: 2025

Table 2: ***Conceptual Framework***

Independent variables	Dependent variable
Social factors Economic factors	Air pollution

RESULTS & DISCUSSION

Uni-Variate Analysis

Social Factor and Air Pollution

Social determinants emerged as strong contributors to air pollution. An overwhelming 82.0% of respondents reported that residents prefer personal vehicles over public transport, which aligns with existing literature. Studies in South Asia confirm that increased use of personal vehicles increases fuel combustion and particulate matter emissions, especially in densely populated cities (Bajwa et al., 2023).Furthermore, 89.3% agreed that educational institutions do not adequately teach environmental cleanliness, suggesting inadequate awareness-building. A large proportion (84%) believed that the increasing number NCP vehicles and especially two stroke rickshaws is a major pollutant source.. Similarly, 86% agreed that negligence in vehicle maintenance contributes to air pollution. The results indicate that a large majority 84.7% of respondents agreed that people in Mingora City have lack of awareness about environmental protection, which worsens air quality and contributes to rising air pollution. Additionally, 83.3% indicated that poor traffic discipline increases pollution by causing congestion, idling, and stop-and-go driving. Society also plays a role, 86.7% believed that people are not encouraged to walk or use bicycles.

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Table 03: ***Role of Social factors in air pollution***

S.No	Statements	Yes	No	Don't Know
1	Do permanent citizens prefer personal vehicles?	123(82%)	21 (14%)	6 (4%)
2	Do educational institutions lack focus on environmental cleanliness?	134(89.3%)	10(6.7%)	6 (4%)
3	Do increasing rickshaws/NCP vehicles contribute to pollution?	126 (84%)	15 (10%)	9 (6%)
4	Does negligence toward vehicle maintenance cause pollution?	129 (86%)	12 (8%)	9 (6%)
5	Do you think lack of public awareness about environmental protection worsens air quality?	127 84.7%)	9 (6%)	14 (9.3%)
6	Does poor traffic discipline contribute to air pollution?	125 83.3%)	1610.7%)	9 (6%)
7	Are people not encouraged to walk or use bicycles?	130(86.7%)	8 (5.3%)	12 (8%)

Economic Factor and Air Pollution

Table 4 reported that economic constraints emerged as major determinants as 72% of participants agreed that low income and unemployment compel people to purchase outdated rickshaws for livelihood. Studies show that poverty limits access to green energy vehicles and forces households into cheaper, high emission options (Khan & Raza, 2022). Similarly, 73.3% participants agreed that economic hardship don't allow purchase of eco-friendly vehicles due to higher costs. This supports global findings that affordability remains a major barrier to adopting clean technology in developing economies. On the same way 71.3 % believed that weak economic policies fail to control industrial and vehicular emissions. Majority of the respondents 83.3% believe due to poor economic conditions people refer buying cheap and outdated vehicles/rickshaws. Economic pressures also impact fuel quality 70 % indicated that people use low-quality fuel because it is cheaper. Scientific studies have confirmed that low grade fuel produces higher sulphur and particulate emissions (Iram, 2025). Furthermore, (82%) respondents reported experiencing breathing difficulties during peak traffic hours, indicating direct health impacts from vehicle-related air pollution while 78% people linked rapid urbanization and construction to rising pollution in Mingora.

Table 4: Role of Economic Factors in Air Pollution

S.No	Statements	Yes	No	Don't Know
1	Do low income/unemployment lead to buying outdated rickshaws?	108 (72%)	26(17.3%)	16 (10.7%)
2	Do poor economic conditions discourage eco-friendly vehicles?	110 (73.3%)	28(18.7%)	12 (8%)
3	Do weak economic policies fail to control emissions?	107 (71.3%)	27 (18%)	16 (10.7%)
4	Due to poor economic conditions people refer buying cheap and outdated vehicles.	125 (83.3%)	18 (12%)	7 (4.7%)
5	Do people use low-quality fuel because it is cheaper?	105 (70%)	32 21.3%)	13 (8.7%)
6	Do poverty/unemployment reduce environmental issues?	123 (82%)	18 (12%)	9 (6%)

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7	Are construction activities increasing pollution?	117 (78%)	19(12.7%)	14 (9.3%)

Bi-Variate Analysis

Association between Social Factors and Air Pollution

Table 5 presents the association between socio economic factors and air pollution. The results show a higly significant association between Permanent citizens preferring personal vehicles over public transport contributes to air pollution (p = .001), educational institutions not focusing enough on environmental cleanliness (p = .001), increasing number of rickshaws and NCP vehicles contributes to air pollution (p = .001), social negligence toward vehicle maintenance (p = .001), lack of public awareness worsening air quality (p = .001), poor traffic discipline (p = .001), people not being socially encouraged to use bicycles or walk on foot (p = .001).

From the above discussion it can be concluded that aforementioned factors contributed to the air pollution which is a serious issue and dangerous for our heath so the policy maker should focus to initiate such strategies to mitigate air pollution.

Table 5: ***Association between Social Factors and Air Pollution***

Independent variables (Social Factors)	**Dependent variable**	**Statistics χ^2 (P-Value)**
Do permanent citizens prefer personal vehicles?	Air Pollution	χ^2= 45.559 (0.001)
Do educational institutions lack focus on environmental cleanliness?	Air Pollution	χ^2=67.012 (0.001)
Do increasing rickshaws/NCP vehicles contribute to pollution?	Air Pollution	χ^2=69.461 (0.001)
Does negligence toward vehicle maintenance cause pollution?	Air Pollution	χ^2=68.093 (0.001)
Do you think lack of public awareness about environmental protection worsens air quality?	Air Pollution	χ^2=67.472 (0.001)
Does poor traffic discipline contribute to air pollution?	Air Pollution	χ^2=73.113 (0.001)
Are people not encouraged to walk or use bicycles?	Air Pollution	χ^2=65.662 (0.001)

Association between Economic Factors and Air Pollution

Table 06 present the association between economic factors and air pollution through the application of chi square test. Results show a significant association between air pollution and the statement low income and unemployment leading people to buy outdated rickshaws (p = .001), weak economic policies failing to control industrial and vehicle emissions (p = .001), buying cheap and outdated vehicles due to poor economic conditions (p = .001), people using low-quality fuel because it is cheaper (p = .001), unemployment and poverty discouraging people from caring about environmental uses (p = .001) rapid urbanization and construction activities increasing air pollution (p = .001).

The table revel that economic factors significantly contributing to air pollution. It is therefore suggested to the relevant institution to strictly check and regulate outdated vehicles and impose huge fine to avoid such panic situations.

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Vol. 4 No. 1 (2026)

Table 06: ***Association between Economic Factors and Air Pollution***

Independent variables (Economic Factors)	Dependent variable	Statistics $\chi 2$ (P-Value)
Do low income/unemployment lead to buying outdated rickshaws?	Air Pollution	$\chi 2$= 39.028 (0.001)
Do poor economic conditions discourage eco-friendly vehicles?	Air Pollution	$\chi 2$=38.024 (0.001)
Do weak economic policies fail to control emissions?	Air Pollution	$\chi 2$=50.276 (0.001)
Due to poor economic conditions people refer buying cheap and outdated vehicles.	Air Pollution	$\chi 2$=35.941 (0.001)
Do people use low-quality fuel because it is cheaper?	Air Pollution	$\chi 2$=42.700 (0.001)
Do poverty/unemployment reduce environmental issues?	Air Pollution	$\chi 2$=60.129 (0.001)
Are construction activities increasing pollution?	Air Pollution	$\chi 2$=35.495 (0.001)

CONCLUSIONS

Both social and economic factors were found a major determinants for air pollution. The findings report that permanent citizens prefer personal vehicles, increasing rickshaws/NCP vehicles contribute to pollution, and poor traffic discipline contributes to air pollution. In case of economic factors poor economic conditions, people refer to buying cheap and outdated vehicles. People use low-quality fuel because it is cheaper. The study recommends that the government should take action against all factors contributing to the air pollution as it leads to serious health problems for the local population as well as the entire province.

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