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Community Perceptions of Social and Environmental Health Risks, Associated to Industrial-Residential Overlap in the Small Industrial Estate, Kohat Road, Peshawar

[1]Shandana
[2*]Fazal Ghani -Email- fazalghani033@uop.edu.pk
[3]Muhammad Salman
[4]Ahmad Nangyal
[5]Ghazala Salam
[1]Centre for Disaster Preparedness and Management, University of Peshawar.
[2*]Department of Urban and Regional Planning, University of Peshawar.
[3]Department of Urban and Regional Planning, University of Peshawar.
[4]Department of Urban and Regional Planning, University of Peshawar.
[5]Department of Environmental Sciences, University of Peshawar.

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Corresponding Authors*:

Abstract

This research paper investigates the environmental and social challenges of urban expansion in Peshawar, Khyber Pakhtunkhwa, Pakistan. The study particularly focuses on the industrial zones that have become enveloped by residential developments. The study identifies significant pollution issues, including air, water, and noise contamination, resulting from industrial activities in previously selected industrial areas. Through a structured questionnaire survey of residents near the Small Industrial Estate (SME) on Kohat Road, the research reveals that 100% of respondents report drinking water contamination, and 90% indicate concerns regarding air and noise pollution. The findings further illustrate the social problems associated with industrial operations, including disruptions caused by heavy transport and reluctance to recommend the area for new residential settlement. The paper concludes that the current proximity of industrial units to residential areas poses serious health risks, prompting most residents to advocate for the relocation of industrial zones. The study emphasizes the urgent need for stricter environmental regulations, improved urban planning, and sustainable industrial practices to safeguard public health and environmental integrity amidst ongoing urbanization.

Keywords: Environmental Health Risk, Social Problems, Urban Sprawl, Community Perception, SME, Pollution

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Introduction

Urban sprawl has led to the irregular and unplanned expansion of cities, often engulfing designated industrial areas. This uncontrolled growth has emerged as a direct threat to the health and well-being of urban populations in Pakistan's major cities (Walker, 1976). Industrialization contributes to economic growth; however, its negative impacts, like the emission of toxic effluents into the atmosphere, pose a serious threat to both environmental and public health (Mehmood Y., and Muhammad A. 2025). The industrial zones, once situated on city outskirts, are now surrounded by residential developments, contributing to various environmental and social issues. Existing economic theories highlight that continued innovation, diffusion, and managerial and technical improvements are essential for economic growth. Technological advancements vary significantly in their environmental impact, and therefore, policies designed to promote innovation must be tailored to the specific needs of each industry (Walker, 1976). A study pointed out that the short-term health issues, including cough, sore throat, rhinitis, eye irritation, and dermatitis, were 25% more prevalent among respondents living in industrial areas compared to those in non-industrial areas. Approximately 40% of respondents in industrial areas and 44% in non-industrial areas reported adopting preventive practices to avoid the detrimental effects of air pollution. The study recommended that authorities locate factories away from residential and public areas. Additionally, raising awareness in the public can help mitigate health risks associated with industrial air pollution (Mehmood & Muhammad, 2025).

Pollution caused by industrial activity is a global concern. For instance, a study in the San Francisco Bay and the Sacramento–San Joaquin Delta revealed that trace elements like copper, nickel, and cadmium showed elevated levels due to anthropogenic activities, including urban runoff and wastewater discharge (Flegal, 1991). Similarly, research on low-swirl burners (LSB) indicated that while NOx emissions were unaffected by thermal input, CO and hydrocarbon emissions depended significantly on chamber size (Cheng, 2000). In industrial environments, high concentrations of airborne particles from mechanical processes like cutting and abrasion are linked to various health problems (Vincent, 1995).

In Pakistan, much of the industrial technology used during the 1970s to 1990s was installed when energy was inexpensive and environmental impacts were overlooked. Consequently, pollution levels from these outdated systems are significantly higher compared to many industrialized countries. Industries such as textiles, leather, paper, sugar, fertilizers, and cement—accounting for 80% of total water usage—are major contributors to water pollution. Between 1963 and 1988, six major industrial pollutants increased six to tenfold, while GDP merely tripled, indicating a disproportionately high growth in pollution (World Bank, 1995). Policy inefficiencies further exacerbate environmental problems. Issues such as industrial and domestic wastewater pollution, vehicular emissions, and urban air pollution are symptoms of broader economic policy failures (Faruqee, 1996).

In Khyber Pakhtunkhwa, effluents from industries located in the Small Industrial Estate on Kohat Road have shown alarming concentrations of pollutants like TSS, Fe^{3+}, Mn^{2+}, and Cr^{6+}. These effluents eventually reach the River Kabul, raising serious environmental concerns (Jan, 2002). Similarly, the Hattar Industrial Estate, established in 1985, has contributed to environmental degradation due to untreated industrial waste. In

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response to public complaints, the Sarhad Development Authority initiated the establishment of a medium-sized Combined Effluent Treatment Plant (CETP) after conducting feasibility and site analyses (JEC, 2007). Peshawar, a relatively developed district in Khyber Pakhtunkhwa, hosts various industrial units. Notable areas include Kohat Road, Jamrud Road, and Karkhano Market, where industries such as hosiery, small arms, leather goods, footwear, garments, ghee, soap, flour mills, and steel re-rolling operate (DCR, 1998). Groundwater quality was investigated in urban multi-industrial areas of Peshawar. The main aim of the study was to determine their physicochemical parameters, potentially harmful elements (PHEs) concentration, pollution sources, and public health risks in the above-stated area of Khyber Pakhtunkhwa (KPK), Pakistan. Analysis showed a significant correlation between parameters, with contributions of industrial effluents and wastewater discharge (46.81%), mixed sources (34.05%), and geo-genic sources (19.14%) for drinking water in the study area. The carcinogenic risk (CR) for Cd, Cr, Ni, and Pb, was found within the permissible limits (Tayyab M., 2021).

Study Area

This study is limited to the boundaries of the Kohat Road Small Industrial Estate is located on the right side of Kohat Road, Peshawar. It stretches for 2.4 kilometers. The industrial estate covers a total area of approximately 540 hectares. There are 124 units in the Kohat Road Industrial Estate. 71 are operational, and 53 are closed. The total number of workers is 1452. There are 11 major units in Kohat Road Industrial Estate. Daud's sons' armory is the biggest unit of Kohat Road Industrial (Umar *et al.*, 2020).

Table-1: Detail of Kohat Road Insustrial Estate

Total	Total	Total
Constructed unit	Operational unit	Closed unit
124	71	53

Objectives Of The Study

1. Assess the proximity and nature of industrial-residential interactions in the Small Industrial Estate (SIE), Kohat Road.
2. Explore community perceptions regarding health risks, environmental deterioration and social impact.
3. Identify particular or hazards (air, water, noise, waste) associated with industrial activities.

Methodology

Primary Data

Data was collected via a structured questionnaire survey conducted among residents living near the Small Industrial Estate on Kohat Road, Peshawar. The area was originally designated as an industrial zone, but due to rapid urbanization, it is now surrounded by residential development.The respondents were either the workers or stakeholders of the area. There were also a number of household residing having their jobs and business outside of the Industrial estate.

Secondary Data

Secondary information was obtained through a literature review of academic books, journal articles, websites, and newspaper reports.

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Data Analysis

Data was analyzed by using different computer programms. Mainly the MS Excell was used for data analysis and presentation. Statistical regression model was used to predict the situation.

Results And Discussions

The data and information gathered through questionnaire survey were presented in the following graph and discussed in the following.

Social Issues In The Study Area

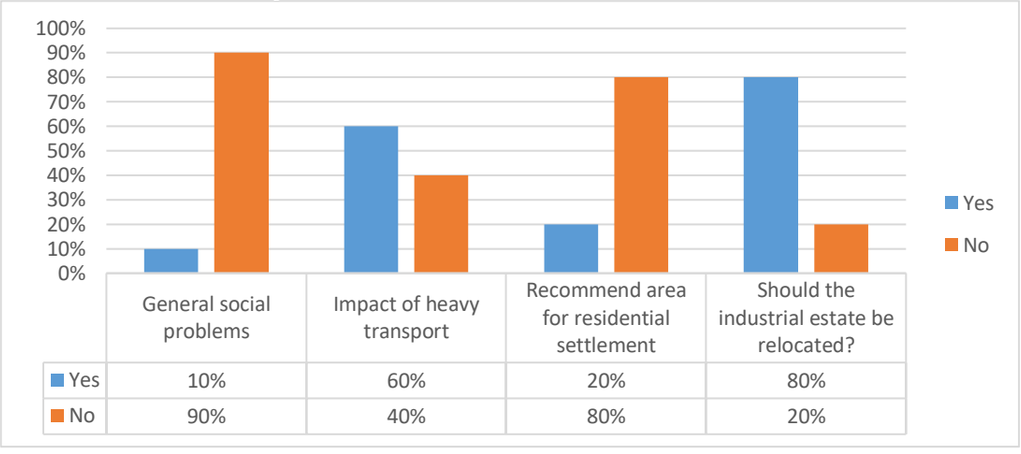

Fig. 1. Social Issues in the Kohar Road Small Industrial Estate Area

The social issues pointed by the residents in the area are presented in the Figure- 1. The issues are discussed in the Table -2.

Table -2.

S.No	Type	Yes	No	Details
1	General social problems	10%	90%	Few issues noted due to security arrangements; transient visitors cause concern
2	Impact of heavy transport	60%	40%	Streets often blocked; increases noise and disrupts local movement
3	Recommend area for residential settlement	20%	80%	Majority discourage new residents due to pollution and poor conditions
4	Should the industrial estate be relocated?	80%	20%	Most favor relocation; some support retention with improved facilities

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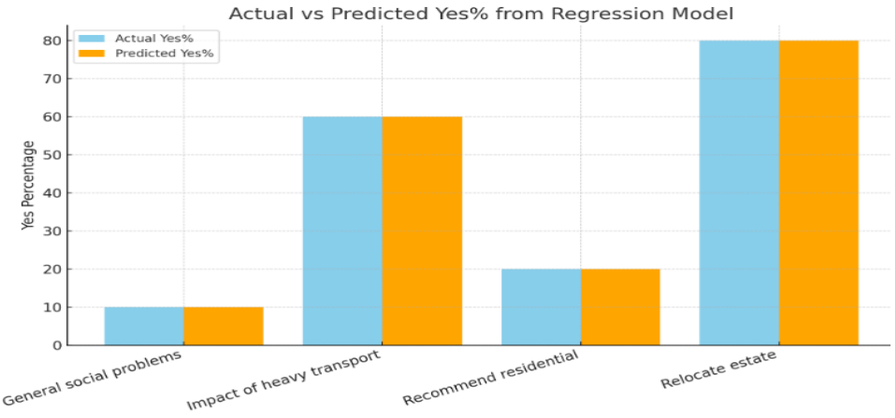

Fig - 2 Regression predictions on a Chart

The graph contrasts the regression model's predicted Yes% with the actual Yes%. Since we only have four points and the regression model was precisely fitted to them, it is not surprising that the projected values and the actual values match exactly.

Environmental Problems In The Study Area

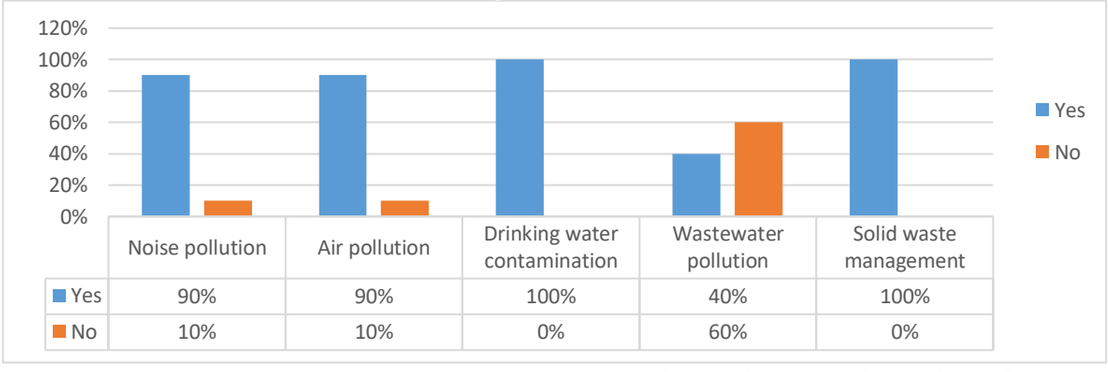

Fig. 3. Community perception based Issues in the Kohar Road Small Industrial Estate Area

The Environmental issues pointed by the residents in the area are presented in the Figure-3. The issues are discussed in the table -3.

Table - 3

S.No	Type	Yes	No	Details
1	Noise pollution	90%	10%	Difficult to distinguish between industrial and highway traffic noise
2	Air pollution	90%	10%	Odors and smoke from burning plastic/tyres
3	Drinking water contamination	100%	0%	Issues include color, odor, solid particles, and microbial content
4	Wastewater pollution	40%	60%	Good drainage reduces visible issues
5	Solid waste management	100%	0%	Industrial waste is openly dumped, causing foul odors

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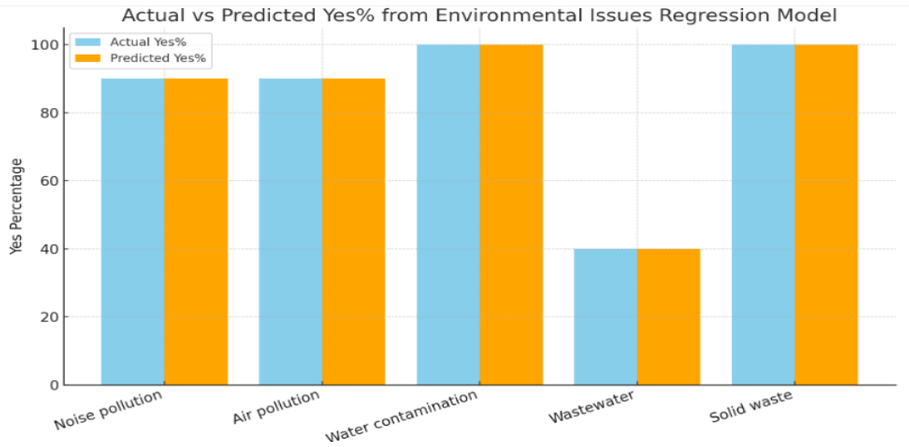
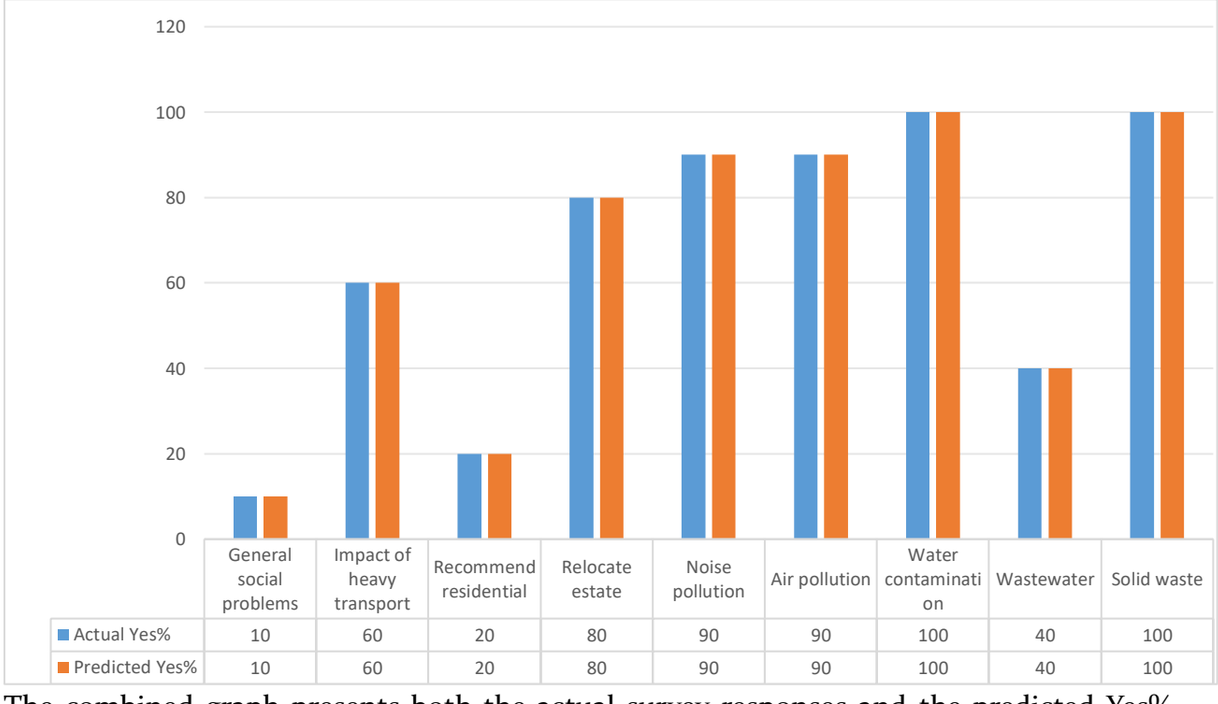


Fig. 4. Showing actual vs predicted Yes% for the environmental issues regression model.

The predicted values perfectly match the actual values.

Combined Chart Below Presents Both The Actual Survey Responses And The Predicted



	General social problems	Impact of heavy transport	Recommend residential	Relocate estate	Noise pollution	Air pollution	Water contamination	Wastewater	Solid waste
Actual Yes%	10	60	20	80	90	90	100	40	100
Predicted Yes%	10	60	20	80	90	90	100	40	100

The combined graph presents both the actual survey responses and the predicted Yes% from the regression models across social and environmental issues. The predicted values perfectly match the actual data, reflecting a high degree of internal consistency in this small-sample exploratory analysis. The chart highlights the major concerns around heavy transport, noise and air pollution, drinking water safety, and solid waste management.

Recommendations

The above results identifying the priority areas for action, particularly in improving environmental conditions and addressing residents' concerns about pollution, transport, and waste management.

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Recommended Socio-Environmental Planning Measures

- Relocate the industrial estate to a designated industrial park on the outskirts.
- Establish a green buffer (e.g., trees, parks, noise barriers) between industrial and residential/commercial areas.
- Allow small-scale commercial activities (shops, services) within residential neighborhoods but restrict heavy industry.
- Introduce special environmental protection zones around sensitive areas (e.g., water bodies, green spaces).
- Reroute heavy transport away from residential streets.
- Improve air quality monitoring and enforcement in industrial zones.
- Upgrade drinking water treatment and regularly test water quality.
- Implement solid waste management plan, including Industrial waste recycling and disposal facilities.Community waste segregation programs.
- Enhance wastewater treatment and expand drainage capacity.
- Delay or limit new residential development near current industrial zones until relocation and environmental remediation are complete.
- Promote affordable housing in low-impact zones with good environmental quality. Provide community amenities (parks, schools, clinics) to improve quality of life.
- Conduct regular community consultations.
- Promote transparency through public reporting on environmental and health indicators.
- Revise urban master plans to clearly separate industrial and residential zones.

Conclusion

The study reveals that urban sprawl in Peshawar has resulted primarily from rapid urbanization, engulfing once-peripheral industrial zones. The close proximity of industrial units to residential areas has created significant environmental threats, particularly in the form of water, air, noise, and solid waste pollution. Additionally, residents face indirect social challenges due to industrial operations and associated transportation.

While a portion of the local population acknowledges the employment opportunities offered by these industries, the majority advocate for relocating such industrial zones outside urban areas to improve health and hygiene standards. The findings emphasize the need for stricter environmental regulations, better planning, and sustainable industrial practices to balance economic growth with public health and environmental preservation.

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