

ORIGINAL RESEARCH PAPER

A Conceptual Model for Identifying and Ranking Environmental Risks in Industrial Parks (A Case Study of Hashtgerd Industrial Estate)

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ABSTRACT

Introduction: The main purpose of this study was to identify and evaluate environmental problems and their ranking and to determine the conceptual model of environmental impact assessment (EIA) in industrial parks. Accordingly.

Material and Methods: In this study, environmental infrastructure issues were classified into five sections. The decision-making trial and evaluation laboratory (DEMATEL) technique was also employed to establish the relationships between the criteria. Moreover, the analytic network process (ANP) was utilized to determine their weight.

Results: Examining the internal relationships between the variables correspondingly revealed that cultural and economic criteria were the most influential. On the other hand, the biological criterion was very effective. The ANP results also showed that the "low share of environmental investment" as an indicator was an economic criterion with a normal weight of 0.80, which was of utmost importance among the other defined cases.

Conclusion: It was concluded that the definition of conceptual models in EIA processes can make it possible to examine and analyze the criteria and indicators affecting evaluation processes.

Keywords: Environmental, Risk, Industrial city, FMEA, DEMATEL, ANP

1. INTRODUCTION

Currently, there are many concerns about the environmental risks of industrial parks. The most important risks posed by the development of such estates are habitat destruction, air pollution, hazardous industrial wastewater, harmful solid waste, noise and radiation, soil contamination, dangerous materials, leakage, climate change, and industrial accidents. The severity of the risks in industrial parks has also reached the extent that many researchers have considered their rapid and effective control as one of the basic requirements in the management of such estates (1). It is also necessary to pay attention to social issues, such as unauthorized occupations and constructions, unprincipled harvesting and exploitation of water and soil resources, as well as conversion and land use change in assessing the environmental risks of industrial parks (2). In this sense, there is consensus

among researchers and managers regarding the importance of environmental risks in industrial estates. The key to managing environmental risks is to identify and prioritize them. Based on the risk results, appropriate short- and long-term solutions can be thus adopted (3). Therefore, the main purpose of this study was to provide a conceptual model of environmental risks in an industrial park in Iran.

2. MATERIALS AND METHODS

At the first step, the risk level of the identified environmental hazards was evaluated according to the expert opinions, and the results of risk analysis and evaluation were examined using the Failure Modes and Effects Analysis (FMEA) process (Table 1). As shown in Table 1, the highest risk is related to the priority of wastewater production, gas emissions, and water pollution. The results of

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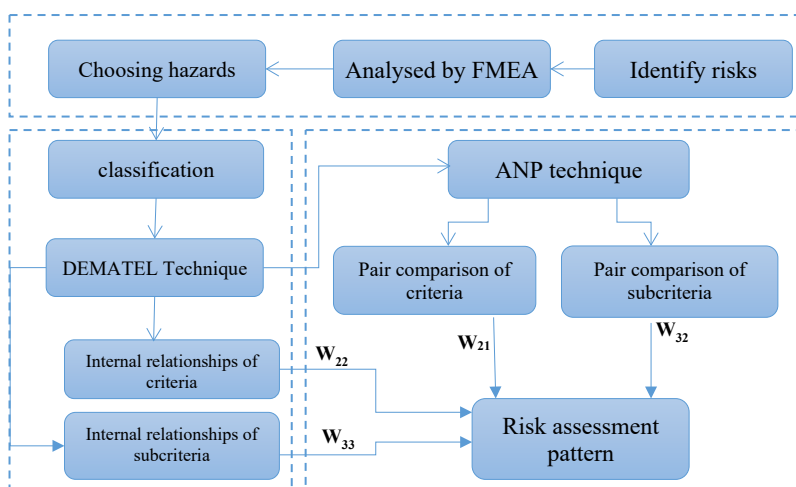


Fig. 1: The proposed framework is a Hybrid DEMATEL-ANP –FMEA approach

Table 1: Identified risk with FMEA technique

Rank	Result	RPN	D	O	S	Symbol	Sub criteria	Main criteria
20	High	32.3	2.5	3.5	3.7	S ₁₁	Development of urban safety	Social (C1)
16	High	33.6	2.6	3.7	3.5	S ₁₂	Land used change	
4	High	39	2.5	3.9	4	S ₁₃	Water source management	
21	High	32.3	2.8	3.2	3.6	S ₁₄	Ownership	
23	Low	16.4	2.2	2.4	3.1	S ₁₅	Unsafe development	
27	Low	10.1	1.9	2.3	2.3	S ₁₆	Slope / fault	
3	High	40.4	2.8	3.8	3.8	S ₂₁	water	Biological (C2)
19	High	32.4	2.5	3.6	3.6	S ₂₂	outbreak	
5	High	39	2.7	3.8	3.8	S ₂₃	Plants	
6	High	38	2.7	3.8	3.7	S ₂₄	Animals	
22	Medium	28.9	2.5	3.4	3.4	S ₂₅	Stress	
17	High	33.7	2.6	3.5	3.7	S ₃₁	Investment	Economical (C3)
12	High	34.6	2.6	3.6	3.7	S ₃₂	Cost of waste water treatment	
11	High	35	2.7	3.5	3.7	S ₃₃	Cost of recycle	
10	High	35	2.7	3.6	3.6	S ₃₄	Safety equipment	
28	Low	86.2	1.7	2.3	2.2	S ₃₅	Income of residents	
26	Low	11.2	1.8	2.6	2.4	S ₃₆	Energy	
1	High	42.6	2.8	3.9	3.9	S ₄₁	Waste water	Physical & Chemical (C4)
2	High	40.8	2.9	3.8	3.7	S ₄₂	Chemical agent	
13	High	34.3	2.8	3.4	3.6	S ₄₃	Aero cell solid	
14	High	34.2	2.5	3.6	3.8	S ₄₄	Solid waste	
15	High	32.7	2.4	3.8	3.7	S ₄₅	Green space	
29	Low	8.1	1.6	2.2	2.3	S ₄₆	Physical agent	
25	Low	11.9	1.7	2.7	2.6	S ₄₇	Wind direction	
9	High	35	2.7	3.6	3.6	S ₅₁	Native culture	Cultural (C5)
18	High	33.7	2.6	3.7	3.5	S ₅₂	Energy consumption	
7	High	37.5	2.6	3.9	3.7	S ₅₃	Safety warning sign	
8	High	37.3	2.8	3.6	3.7	S ₅₄	Transportation	

solving the decision-making trial and evaluation laboratory (DEMATEL) model to determine causal relationships in the main environmental risk criteria are also illustrated in Table 2. In this sense, the biological factor is the most influential indicator and the social

3. RESULTS AND DISCUSSION

are the most effective criteria in environmental risks. Besides, the results showed that two biological and physical-chemical factors had been affected and three social, biological, and cultural criteria could be assumed as cause or effect.

According to the results obtained from the analytic network process (ANP) model for the sub-criteria, the first three priorities were:

- a. "Low share of environmental investment" indicator with a normal weight of 0.80, as the most important one
- b. The indicator of "residents' lack of awareness about the importance of environmental issues" with a normal weight of 0.699, as the second priority
- c. "High costs of construction of wastewater treatment plants" indicator with a normal weight of 0.677, as the third priority

According to the obtained results, the conceptual model of the EIA of the industrial estates is shown in Fig. 2.

4. CONCLUSION

In the present study, using the decision-making models, an attempt was made to provide a conceptual model for assessing the environmental risks of industrial parks. According to the research on EIA conducted in Iran and due to the expansion of various industries in industrial estates as well as pollution rate of these industries, few studies has been unfortunately done on EIA in these parks. The results of this research can be thus used in other studies related to health, safety, and environment (HSE) risks, and the model presented in other resource evaluation processes can be exploited. In this model, the

affected and the influential factors were identified, as clearly stated in the model. Some parameters could be thus effective in creating or developing industrial parks with an environmental approach that should be considered and evaluated. In this study, factors such as sociocultural risks were among those emphasized in the development of industrial estates.

5. ACKNOWLEDGMENT

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