

Develop a Comprehensive System for Prioritizing Employment Risk with the Use of Multi-Criteria Decision (Using Hierarchical Techniques)

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Abstract

This study has tried to detailed quantitative risk assessment methods and techniques Analytical Hierarchy Process (AHP) experts extracting, classifying and structuring them in addition to showing how to use techniques such as multi-criteria decision making technique AHP development a comprehensive system for prioritizing risk job of great importance. The output of this research as a decision support system in addition to the ease with which managers make decisions about the accuracy of decisions, it is recommended they are assured of multiple criteria decision making use of techniques to managers in the risk management process macro projects and organizations, to ensure the efficiency and effectiveness of corrective actions, control and prevention strategies to reduce and control risks in the workplace and promising career cut irreparable effects for the organization and what they do for the community.

Keywords: risk management, multi-criteria decision making technique, Analytical Hierarchy Process (AHP), health, safety, environment

1. Introduction and Statement of Problem

Given the complexities of today's world, the debate on globalization and global village, increased competition and changes have been made in recent centuries, the West has led to the development that over time, attention has been directed towards sustainable development. East as well as Iran, due to the desire and need for interaction with the West is obliged to comply with them and discussions

Considered an integral part of decision management and task management in any way appear to be, in determining the policies of the organization, in the formulation of objectives, organization design, selection, evaluation and decision-making at all management components and basic elements. Although the target, and determine policy and define general policy, the organization should travel path is ascertained, but to lead the organization during this process and to reach the destination, it is necessary to adopt many managers make crucial to the proper operation the possibilities and opportunities that the obstacles and threats to be protected. The decision, in principle forms the principal task, as if to determine objective, policies, strategies, laws and regulations, ways of work, selection and recruitment of human resources, the duties and responsibilities of staff and the administration, control and evaluation their performance of the duties of the director to count, all the measures necessary decisions. Some experts, quality management, quality of decision-making function and believe that the decision is the single most important task of managers, directors usually decide their main task to be considered because it is clear to them that should be explored to promote the goals of the organization are What a way to choose, what to do, whom to charge and what they charge, and work how, where and when performed.

Given the shortcomings in the application of multi-criteria decision-making methods and techniques and offered job in prioritizing risks regarding the integration and systematic prioritization of risks of occupational and non-technical decision support managers in the context health, safety and the environment This research aims to develop a comprehensive system for prioritizing occupational risks after the risk assessment by experts in the field of health, safety and the environment to ensure the accuracy and effectiveness of its decisions.

2. Research History

For study conducted in 2014 by Mandela and his colleagues carried out. In this paper, in order to cope with bugs FMEA and FMEA approach numerical techniques based on fuzzy rules "failure modes and effects analysis" have been proposed. Fuzzy numbers are based on the approach phase, as well as drawbacks such as providing desired suffer a priority. To overcome this disadvantage, the author of a new integrated method based upon the concept of fuzzy similarity measure and developed theoretically possible. Standardization of measurement is used for groups that worth the risk of failure modes in parallel. Theoretically possible to evaluate the procedures used adaptive. The methodology developed to confirm the two cases considered. This article is emphasizing to use the same amount measured FMEA in this particular area is new. This process is somewhat more appropriate value FRPN knows. The phase of the process was considered more appropriate to calculate the uncertainty of input variables used by deformation process. By using theoretically possible we will measure the validity of the evaluation guidelines for compliance with the new field. Practical idea has this point in the process of decision making and risk analysis, failure modes and compare the values of the danger that, with the help acceptance levels. The use of this limited access to information on risk factors and their subsequent weight value. More detailed information, resulting in a more accurate statement of values will FRPN. The author also suggests that future research on the development of the mechanisms FRPN and development carried out in response to the cost structure. So that in future investigations must be to solve problems where adaptive structure itself ambiguous information, and where levels of compliance can be considered as a fuzzy set to be shown.

An article entitled Zheng et al. (2012) have been carried out. This paper is to evaluate the safety and warning level workers examined is hot and humid environments. The author of fuzzy AHP based on trapezoidal fuzzy numbers developed for the safety assessment is used in hot and humid environments. Evaluation index is the system of hierarchy 3 and 10 sub-factors included in the index. Trapezoidal fuzzy numbers to determine the weight of indicators and evaluation of occupational safety performance indicators have been approved. Fuzzy comprehensive evaluation vector is calculated and then the safety index, index of occupational safety, environmental safety indices, index of human safety, the safety and warning Grades were determined. This combination of fuzzy AHP and fuzzy trapezoidal numbers through new scientific methods to assess the safety and warning systems in hot and humid environments used and results achieved reasonable and more comprehensive as the development of evaluation index system, it is believed that this method, the safety and warning systems offer a powerful tool for managers and evaluation in hot and humid environments they provide.

An article carried by Tien et al. This study aimed to develop a systematic risk assessment framework that integrates three QFD, network analysis phase defect modes and effects analysis phase is used. The study of the major types of risks, the causes of hazards in the construction industry as well as the risks and the preventive and improvement actions as it is formed. Although risk assessment study on occupational hazards in the construction industry, but with a few minor modifications can this method in other fields, including civil engineering and construction engineering and applied. The author believes that the issue can practically be promoted in this study: (1) the development of research in a decision support system, which can significantly increase user interest and reduce the time and effort required in the calculations. (2) In this triangular fuzzy numbers were used. However, other types of fuzzy numbers, including bell-shaped trapezoidal fuzzy numbers and fuzzy numbers may be more appropriate that more research is needed to determine appropriate fuzzy numbers.

2.1 Research Methodology

In this study, we tried to prioritize occupational risks in providing integrated model Analytical Hierarchy Process (AHP) with ASA risk assessment techniques used, but the company has been using the model with all the techniques of risk assessment.

The statistical population consisted of contractors in the field of construction and operation of oil and to form a pair wise comparison matrix, industrial safety and occupational health working group of experts in related fields and is associated with the project survey.

In this study, the questions in the form of a questionnaire was developed through interviews and questionnaires, to collect the required data and expert opinions in the form of surveillance experts about the importance and superiority of the relevant factors and specified in the evaluation of used as a benchmark risk and alternatives have been determined. For information on risk assessment, evidence and documents and guidelines defined in this case, oil companies have been used in the study contractor. Input of AHP, risk assessment has been carried out by experts.

In this research technique to determine the relative importance of the criteria and options AHP in risk assessment, data analysis and ultimately prioritize risks related Job. Czech framework and questionnaires based on the list of

pair wise comparison matrices hierarchical structure is defined in the method. Techniques analyze data from the hierarchical structure of the design, formulation and formulation is used in Microsoft Excel. In the second chapter a brief explanation of the process of hierarchical analysis technique that is used will be given.

Hypotheses or Research Questions

1. In this study, it was assumed that the work environment and business risks in the project fully and carefully by experts in specialized areas of industrial safety and occupational health and related techniques have been identified.
- 2 In this study these questions need to be answered: How the hierarchical prioritization of risks Process: How is the job?
3. In general, decision-making in health, safety and environment scopes with a hierarchical process possible?
4. How is hierarchy of a workplace, risk assessment and available jobs in projects?
5. Prioritize business risks by using Analytic Hierarchy Process What will it be?

2.2 Research Findings

In this section, researchers the process step-by-step extraction criteria and sub-criteria, analyze the data collected in the research process, calculation and application of Analytic Hierarchy Process (AHP)) and finally written the final weights obtained the priorities described them.

A) The process of production data to calculate the pair wise comparison matrices incompatibility

After the search, collect and study resources and related documents, document risk assessment carried out by experts in the field have been received and according to which criteria the three areas of health, safety and the environment have been separated from each other. After calculating the RPN (RPN) for each of the three areas of health, safety and the environment, according to Pareto diagram was drawn.

According to figures drawn, high-priority criteria have been identified in each of the three areas of health, safety and environment, an example of Analytical Hierarchy Process (AHP) is selected in accordance with these forms.

After drawing a hierarchical structure, from experts on the importance and impact in the form of questionnaire survey and According to the hierarchical structure of their aggregated and re-drawing is correct. According to the table below in the safety and efficacy of the importance of alternatives in the "electric shock" in the "Stress-relived" is measured according to the experts, the numbers 1 through 5 have their importance.

The assembly experts on the modification of the hierarchical structure of the geometric mean are used and the alternatives of the importance of the structure have been removed. As a result, the hierarchical structure is obtained modified as following:

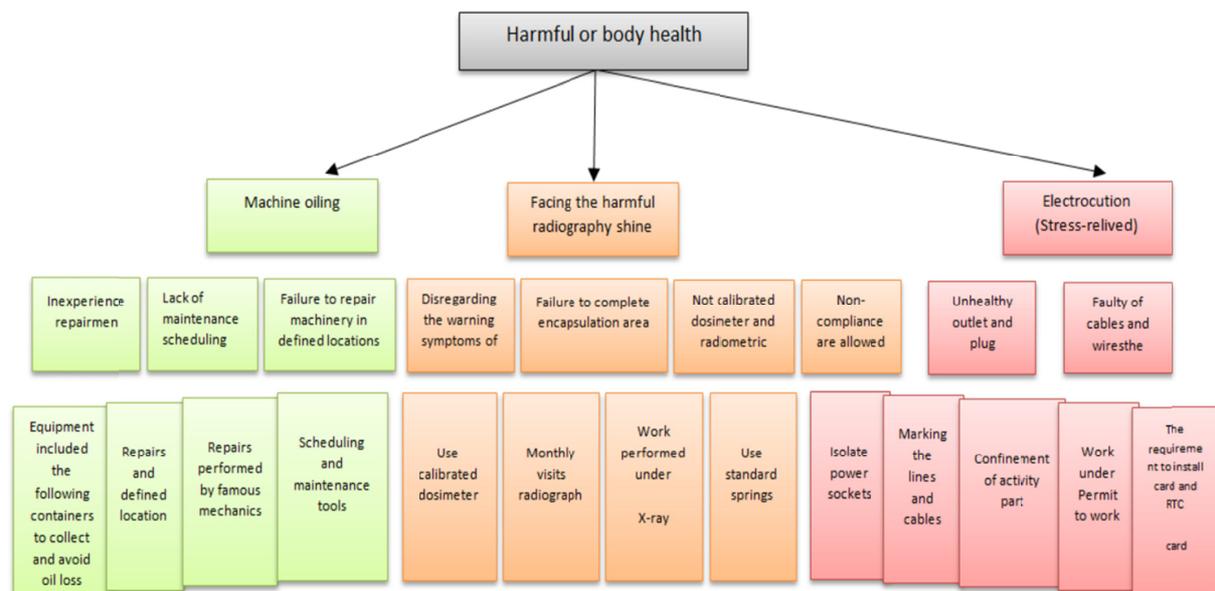


Figure 2. Modified hierarchical structure

According to the hierarchical structure of pair wise comparison matrices Modified Analytic Hierarchy Process (AHP) in three areas of health, safety and the environment were developed.

According to the criteria derived from the stages of their researcher to develop computational file for calculation of relative weights, the final and that's incompatible with experts and completion of intake numbers in the matrix relative weights, the final and inconsistency automatically be calculated.

The matrix is designed, relevant questions designed to get expert opinions.

After receiving the expert respondents, their comments using the geometric mean of the individual alternatives aggregate score achieved and accordingly pairwise comparison matrices in three areas of health, safety and environmental design has been completed in the Excel file.

The relative weights are calculated based on aggregated pair wise comparison matrices, each matrix aggregation inconsistency are calculated and those matrices that is more than 0.1 pair wise comparison matrices specified and individual experts were questioned and examined their corresponding calculated.

3. The Calculation of the Final Weights Alternatives

After this step, the final weights alternative design of the Excel file is extracted. These weights are according to the following table.

Table 1. Final weights obtained for alternatives in each of the three areas of health, safety and environment

Area	Alternative	Weight
Safety	Required to install the card and the RCD	0.31
	Permeate work under hot	0.26
	Confined to the place of	0.05
	Numbered lines and cables	0.04
	Isolation of the electrical socket	0.00
Health	Use of standard springs	0.11
	Work under the hot permeate (with radiography)	0.10
	Monthly examinations, radiographs	0.03
	Using calibrated dosimeters	0.02
Environment	Apply Periodical maintenance machinery	0.043
	Repairs performed by expert mechanics	0.010
	Repairs in the area defined	0.009
	Provided these metal containers to collect equipment and prevent loss of oil	0.006

Table 2. Prioritizing alternatives

Area	Alternative	RPN (RPN)
Safety	Permeate work under hot	0.31
Safety	Required to install the card and the RCD	0.26
Health	Work under the hot permeate (with radiography)	0.11
Health	Use of standard springs	0.10
Safety	Isolation of the electrical socket	0.05
Safety	Numbered lines and cables	0.04
Environment	Apply Periodical maintenance machinery	0.04
Health	Monthly examinations, radiographs	0.03
Health	Using calibrated dosimeters	0.02
Environment	Repairs performed by expert mechanics	0.010
Environment	Repairs in the area defined	0.009
Environment	Provided these metal containers and equipment for collecting oil loss	0.006
Safety	Confined to the place of	0.001

4. The Decision was Based on the Priority

In this step, the results have the research priority by senior managers of the organization. With regard to financial and time constraints and the nature of the project plans to decide on the allocation of the necessary resources and be used appropriate measures.

5. Conclusion

In this study, the researcher has tried using accurate quantitative risk assessment techniques Analytical Hierarchy Process (AHP) experts to extract, categorize and it's structuring. In addition to showing how to use multi-criteria decision-making techniques such as Analytical Hierarchy Process (AHP) in prioritizing occupational risks in the workplace and mitigate the effects of risk management can help them is irreparable. The output of this research is as a decision supports system with the managers. And facilitate decision-making and accuracy of decisions, reassuring them.

The present study suggests the use of multi-criteria decision-making techniques in the process of risk management to managers of large projects and organizations. And reassuring them in terms of efficiency and effectiveness of the measures adopted to reduce and control risks in the workplace and job. And promising to reduce irreparable effects for the organization and what they do for society.

We hope this research organizations and projects of interest to senior managers and professionals in health, safety and the environment. And the application of multi-criteria decision-making techniques to identify high-risk areas and reduce the level of risk is best done.

References

- Liu, H. T., & Tsai, Y. L. (2012). A fuzzy risk assessment approach for occupational hazards in the construction industry. *Safety Science*, 50(2012), 1067-1078.
- Saptarshi, Mandal, J., & Maiti (2014). Risk analysis using FMEA: Fuzzy similarity value and possibility theory based approach. *Journal of Expert Systems with Applications*, 41(2014), 3527-3537.
- Zheng, G. Z., Zhu, N., Zhe, T., & Chen, Y. (2012). Application of a trapezoidal fuzzy AHP method for work safety evaluation and early warning rating of hot and humid environments. *Binhui Sun Safety Science*, 50(2012), 228-239.

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