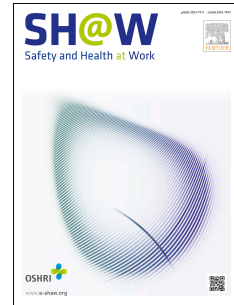


Accepted Manuscript

Evaluation of the Impact of Redundancy and Teamwork on Resilience Engineering System by applying FDEA and ANOVA approaches in a Large Petrochemical Plant

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PII: S2093-7911(16)30015-4

DOI: [10.1016/j.shaw.2016.04.009](https://doi.org/10.1016/j.shaw.2016.04.009)

Reference: SHAW 171

To appear in: *Safety and Health at Work*

Received Date: 27 April 2015

Revised Date: 30 March 2016

Accepted Date: 28 April 2016

Please cite this article as: Azadeh A, Salehi V, Mirzayi M, Evaluation of the Impact of Redundancy and Teamwork on Resilience Engineering System by applying FDEA and ANOVA approaches in a Large Petrochemical Plant, *Safety and Health at Work* (2016), doi: 10.1016/j.shaw.2016.04.009.

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The Impact of Redundancy and Teamwork on Resilience Engineering Factors by Fuzzy Mathematical Programming and Analysis of Variance: A Large Petrochemical Plant

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Abstract

Background: Resilience engineering (RE) is a new paradigm that can control incidents and reduce their consequences. The integrated RE (IRE) includes four new factors, namely self-organization, teamwork, redundancy, and fault-tolerance in addition to conventional RE factors. This study aimed to evaluate the impacts of these four factors on RE and determine the most efficient factor in an uncertain environment.

Methods: The required data was collected through questionnaire in a petrochemical plant in June 2013. 115 respondents including 37 managers and 78 operators answered the questionnaires. Fuzzy data envelopment analysis (FDEA) was used in different α -cuts in order to calculate the impact of each factor. Analysis of variance (ANOVA) was employed to compare the efficiency score means of the four above-mentioned factors.

Results: The results showed that as α approached zero and the system became fuzzier ($\alpha=0.3$ and $\alpha=0.1$), teamwork played a significant role and had the highest impact on the resilient system. In contrast, as α approached one and the fuzzy system went toward a certain mode ($\alpha=0.9$ and $\alpha=1$), redundancy had a vital role in the selected resilient system. Therefore, redundancy and teamwork were the most efficient factors.

Conclusion: The approach developed in this study could be used for identifying the most important factors in such environments. The results of this study would help managers to have better understanding of weak and strong points in such industries.

Keywords: Petrochemical plant; Resilience engineering (RE); Fuzzy data envelopment analysis (FDEA); Teamwork; Redundancy

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