Integrating Fuzzy Prioritization Method and FMEA in the Operational Processes of an Automotive Company

G. Nilay Yücenur, Beykent University, İstanbul, Turkey
İpek Atay, Okan University, İstanbul, Turkey
Senem Argon, Acron Bilşim & Okan University, İstanbul, Turkey
Eda Fulya Gül, Kayalar Kimya & Okan University, İstanbul, Turkey

ABSTRACT

This study includes a risk analysis application. In the article the authors analyzed insurance department’s operational processes between October 2015 to April 2016 with a Failure Mode and Effect Analysis (FMEA) of an automotive firm. In the FMEA application, the article summarized engineers and managers opinions during process development and benefitted from these engineers and managers for analysis of these failures one by one. In application study is constructed on data transfer systems analysis among dealer, insurance departments and insurance companies for risk management. The purpose of this study is for the sample company revealing all failures, the reasons for these failures and making a risk analysis of these failures. In this study, for all determined failures was the calculated risk level with the occurrence, severity, and detection score, and preventive functions were organized according to these risk level scores. Using the fuzzy prioritization method for the evaluation of failures, more objective evaluations were attempted and suggestions for the prevention of failures have improved RPN values of 5 failures. In this way, the 5 failures RPN values are lower than 100.

KEYWORDS
Failure Mode and Effect Analysis, Fuzzy Prioritizationing Method, Insurance Sector, Risk Analysis

INTRODUCTION

In today’s World, the development of technology, globalization, and constant changes in customer demands bring about and create a serious atmosphere among companies. Knowledge is one of the key factors of success and development in today’s Firms (Siadat, Abdollahi, Garshasbi, 2017). At this point, companies which provide similar products with similar costs are required to have outstanding processes with high quality and flawless products. Being compatible with their environment, responsive to customer demands, applying an efficient management approach through strategic planning, applying these plans and assessing outcomes and through a cycle of constant learning is the best solution for companies to move a step further in this difficult competitive environment.

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Risk is unavoidable for all people in their daily lives, public and private sector organizations and all other enterprises in competitive environment. In literature, there are many accepted definitions of risk in use. The common concept in all definitions is uncertainty of outcomes. Where they differ is in how they characterize outcomes (Berg, 2010). For assessing and classifying the risk, it is necessary to talk about risk management.

Risk analysis may be summarized as the determination of the priorities of the risks after identifying the hazards. In risk analysis methods, first of all the potential hazards are identified, then disclosed hazards are scored according to each parameter of the preferred risk analysis method, and a hazard score is obtained. According to hazard score, the level of hazard acceptance, precaution decisions and priority measures of the precaution may be determined (Dağsuyu, Göçmen, Narlı, & Kokangül, 2016).

Failure Mode and Effects Analysis (FMEA) is one of the best ways of analyzing potential risks and reliability problems in the production cycle in many industries. It provides an easier way for manufacturers to recognize the risks, take quick actions and mitigate failures.

In literature there are lots of studies about FMEA in different research fields. For example Trafialek and Kolanowski (2014) applied FMEA for audit of HACCP system, Chen and Wu (2015) constructed an effective prevention mechanism for MSW lifecycle using FMEA, Oldenhof et al. (2011) used consistency of FMEA in the validation of analytical procedures, Stojkovic, Marinkovic, Jaehde, and Manser (2016) used FMEA to reduce patient safety risks related to the dispensing process in the community pharmacy setting, Ochrana, Půček, and Plaček (2015) used FMEA for the analysis of corruption in Bulgaria, Jiang, Jiang, Ding, and Liu (2015) applied FMEA in a clinical chemistry laboratory and Afshari, Issa, and Radwan (2016) used FMEA to evaluate barriers to the greening of existing buildings using the leadership in energy and environmental design rating system.

In spite of all these papers there are only two papers about FMEA and insurance sector. Ghasemi, Mahmoudvand, and Yavari (2016) applied of the FMEA in insurance of high-risk industries in Iran’s gas refineries and Shahrami et al. (2013) utilized of FMEA method in increasing the revenue of emergency department. Also, there are some studies in insurance sector. For example, Ravasan and Mansouri (2015) investigated auto insurance sector’s customer segmentation, Copeland and Cabanda (2018) analyzed publicly held insurance industry.

After literature review, it is clear that this paper is the first study about risk analysis with FMEA method in an automotive insurance sector. Our case study focuses on our sample company which is a part of Turkey insurance sector about automotive insurances. We examined our company’s risk analysis by FMEA method under fuzzy environment.


In lots of current studies identified risks are assessed with crisp numbers or fuzzy numbers are used in different parts of studies. In order to make a more accurate risk assessment and to work out the subjectivity of the decision makers, the failures were evaluated with triangular numbers in this paper. The fuzzy numbers were used in the first phase of the paper, so the research has been tried to be advanced with an objective point of view.

In this study, our goal is to analyze the risk analysis of located failures of insurance department of Volkswagen Dogus Finance Company’s operational processes and to determine the risk values by using linguistic variables in risk analysis under fuzzy environment then minimize these values by proposed precautions and suggestions.
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