8th International Conference on BUSINESS Management and Finance

ICBMF

27 - 29 March 2025

# Integration of a Risk-Based Approach for the Validation of a Simulation-Supported Combustion Process as Part of a University Research Project

**Gross Christina[1], Grundl Larissa[2], Sander Philip[3], Trapp Christian[4]**

*University of the Bundeswehr Munich, Germany*

## Abstract

University research projects usually aim to create innovations. All research and innovations inherit risks arising from uncertainties in the requirements or procedures. Risk management, therefore, has an important impact on the management of these projects to achieve objectives and ensure that risks are handled correctly. For this reason, this paper develops a risk management concept based on a single case study for university research projects. For this purpose, a 3D simulation of an innovative combustion process for a car engine is examined. The simulation focuses on meeting the challenges based on higher efficiency, lower emissions, and the use of alternative fuels. To investigate this at the management level an adapted risk management procedure for the detailed combustion model gets integrated into the project plan. This aims to determine if the developed model and the simulation can be used for forecasts. The project plan includes base costs (personnel resources, computer resources), uncertainties (physical model accuracy), risks (new developments, incompatibility of the models) as well as a detailed event tree analysis. The model is validated using a Monte Carlo simulation, aiming to improve the handling of risks and the accuracy of the simulation. The relation between the simulation results compared to the development- and computing times is examined. This procedure intends to optimize the decision-making process for models and simulations to meet the time and budget constraints to improve the achievement of objectives and the quality of the research results. In addition, the classification and resilience of the simulation results should be obtained and ensured.

**Keywords:** decision-making process; digital twin; Monte Carlo simulation; risk management; stochastical scenario analysis