Seminar – Winter term 2021
“Current Topics in Risk and Crisis Management”

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Preliminary Kick-Off Meeting
09.11.2021 14:00
Online via MS Teams

Final Presentation and Submission of Thesis
Beginning of February (preliminary presentation date: 02.02.2022)

How to apply
Please use the faculty’s online portal for your application.

Preface
Students can work on a variety of risk management aspects in this seminar. The topics are directly integrated into current research projects (https://www.iip.kit.edu/english/3087.php) and the corresponding scientific staff member supervises the thesis. The teaching language is English. Regarding the Corona-situation there will be timely updates regarding the mode of meetings and the form of the presentations.

The final grade for the seminar will be based on the written thesis and an oral presentation in front of the class (with discussion).

The following table presents an overview of the topics, while a detailed description follows on the next pages.

| 1. | AI-based forecasting models in disaster response |
| 2. | How does COVID-19 affect inland waterway transportation |
| 3. | Simulation of gamification |
| 5. | The Use of Mechanism Design as a Solution for Financial Conflicts and a proper Distribution of Goods |
1. Al-based forecasting models in disaster response

Description:
AI is an increasing field of study with a wide range of applications. One of them is disaster forecasting which allows the decision-makers to take prevention measures such as warn or even evacuate the residents. This seminar topic is dedicated to give an overview of AI-based forecasting models for extreme weather events (e.g. estimation of air temperatures to predict heat waves, coastal water level predictions) and to present an application case study in detail.

The thesis includes the following tasks:
- Which type of problems in disaster response are already addressed by AI-based forecasting models?
- Which tools are used to implement the models?
- Which data are taken for training simulations (NOAA-DAT, EM-DAT, …) and how is the training progress evaluated?

Basic programming skills are required.

Supervisor: M. Sc. Miriam Klein

Literature (as a starting point):

2. How does COVID-19 affect inland waterway transportation

Description:
COVID-19 is causing drastic disruptions in global supply chains. Transport on domestic waterways is not spared from this. Inland shipping transports around 230 million tons of goods per year on Germany's rivers and canals. The seminar paper will show how the pandemic has affected both the transported goods (quantities, structure) and the availability of the end products. The focus of the work shall be on the German waterways, but may also consider other countries in case of particularly interesting data or case studies. Furthermore, a focus should be set on goods groups of pharmaceutical products and an analysis about whether this group of goods shows a special significance.

The thesis includes the following tasks:
- Provide a review of statistical documents, reports and scientific journal articles dealing with the quantification of disruptions of waterway transportation (German focus for data; international focus for methodological approaches).
- Resulting from the first task and previous Seminar Thesis: A qualitative/schematic description of the detected cause-effect-chains explaining how / via which channels the pandemic affected waterway-related supply chains.
- Analyze the affectedness and interconnections of pharmaceutical products and show whether this group of goods shows a special significance.
- Provide a statistical account of transported commodities on German inland waterways as well as the respective final goods on a monthly basis of the year 2021.

Due to the type of literature sources, this topic requires a good knowledge of the German language.
3. Simulation of gamification

Description:
As part of a current research project, a game for the analysis of infrastructure development and management was developed. The collaborative board game emulates real-world processes, whereby the interaction of the players especially helps to understand the system, including the role of the players and the effects of the players’ decisions. The game is implemented as a board game, but can lead to extended insights by programming it to automatically simulate different game sequences. A previous work includes the implementation of the game in machine-learning-based python code but has to be finalized since the potential of machine learning has to be enhanced and possible resulting strategies have to be compared to real-world strategies.

The thesis includes the following tasks:
- Short literature review on machine learning algorithms
- Extension of the implemented game towards intelligent players
- Simulation of different game sequences and evaluation of the results
- Comparison to possible real-world strategies

Due to the game manual this topic requires a good knowledge of the German language as well as programming skills (Python).


Description:
Public authorities such as the Federal Office for Civil Protection and Disaster Relief (BBK) recommend that the population stockpile food, drinking water and medicines on its own responsibility in order to be prepared for a supply failure. In view of the still ongoing COVID-19 pandemic, the topic of supply and thus the stockpiling of certain goods is more relevant than ever. For the initiation and control of appropriate measures, a scientifically sound database is indispensable.

The thesis includes the following tasks:
Brief literature review on topics relevant to the work:
- COVID-19 pandemic
- Stockpiling behavior of the population in Germany
- How the population deals with crises

Focus lies on analysis of empirical data that is provided for this work:
- Statistical analysis of the provided survey responses with statistic software (e.g. SPSS)
- Comparison of before COVID-19 answers to during COVID-19 answers
- Critical discussion of the results

A good knowledge of statistics and the use of statistical software, or the willingness to acquire these skills, are prerequisites for the preparation of this work.

**Supervisor:** M.Sc. Markus Lüttenberg

**Literature (as a starting point):**

### 5. The Use of Mechanism Design as a Solution for Financial Conflicts and a proper Distribution of Goods

**Description:**
Financial crises happen often around the world and have a major impact on economies affected as well as the individuals who lose their jobs or suffer from rising prices because of the crashes. In times of globalisation, the financial instability of a limited number of players can have high impact on many others. Mechanism design as a subfield of game theory can help to look at the causes of such financial problems from a new perspective and to find solutions for such problems.

**The thesis includes the following tasks:**
Literature review on topics relevant to the work:
- Overview of Financial Conflicts in Germany (+ Europe & US if necessary)
- The meaning of mechanism design & the purpose of it

Analysis of:
- How to make use of mechanism design methods in order to overcome financial conflicts
- Show potential and limitations of mechanism design to create a more stable financial system
- Critical discussion of the results

**Supervisor:** M.Sc. Markus Lüttenberg

**Literature (as a starting point):**