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

Florian Diehlmann, Florian Kaiser, Miriam Klein, Markus Lüttenberg, Rebecca Wehrle, Dr. Marcus Wiens

Preliminary Kick-Off Meeting
13.04.2021 14:00

Final Presentation and Submission of Thesis
July (preliminary presentation date: 06.07.2021)

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.

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 list presents an overview of the topics, while a detailed description follows on the next pages:

1. Risk perception, trust and compliance during COVID-19
2. How does COVID-19 affect inland waterway transportation?
3. Simulation of gamification
4. Cascading effects of cyberattacks in the automotive value system
5. Evaluation of German Authorities’ Interventions during the COVID-19 pandemic
6. AI in disaster response
1. Risk perception, trust and compliance during COVID-19

The COVID-19 pandemic has resulted in some drastic political decisions and engraving social challenges. Particularly in times of great uncertainty, the willingness of the population to support measures and endure restrictions depends both on their own perception of risk and on trust. In terms of trust, a distinction must be made between trust among citizens and trust in the state and in politics.

In particular, the thesis should deal with the following tasks:

- Provide a concise account on established empirical measures of risk perception, trust, acceptance and compliance. A special focus lies on measures and instruments already used by research institutes for longitudinal studies.
- Conduct a literature research on risk perception for pandemic risks compared to other risks like natural disasters, nuclear fallout or financial market crash.
- Conduct a literature review on current studies on risk perception and trust (as well as trust related aspects, such as acceptance and compliance) related to the Covid-19 pandemic.
- Report (at least) one of the current studies in depth with a focus on the applied statistical methods and the conclusions, which can be drawn with respect to social-psychological factors during an ongoing pandemic.

Supervisor: Dr. Marcus Wiens

Literature (as a starting point):
- COSMO — COVID-19 Snapshot Monitoring: https://projekte.uni-erfurt.de/cosmo2020/web/

2. How does COVID-19 affect inland waterway transportation?

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.

In particular, the thesis should deal with the following tasks:

- Provide a review of statistical documents, reports and scientific journal articles dealing with the quantification of disruptions of inland waterway transportation (German focus for data; international focus for methodological approaches).
- Resulting from the first task: A qualitative/schematic description of the detected cause-effect-chains explaining how / via which channels the pandemic affected waterway-related supply chains.
- Provide a statistical account of transported commodities on German inland waterways as well as the respective final goods on a monthly basis, starting from April 2017 to March 2021.

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

Supervisor: M.Sc. Rebecca Wehrle

Literature (as a starting point):
- https://www.verkehrsrundschau.de/nachrichten/corona-krise-binnenschiffer-spueren-flaute-2595905.html
3. Simulation of gamification

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 object-based python code.

The resulting work should include the following points:

- 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

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

**Supervisor:**
M.Sc. Rebecca Wehrle

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

- Internal game manual – the game is based on the commercial game “PANDEMIC”
- Previous Work on Github: [https://github.com/EUB-LE/logistics_boardgame](https://github.com/EUB-LE/logistics_boardgame)

4. Cascading effects of cyberattacks in the automotive value system

Cyberattacks are considered one of the main risks to modern economy. Cyberattacks could cause disruptions leading to higher economic damage than biological pandemics. Those “cyber pandemics” (as called by the world economic forum) are fed by increasing connectivity and digitalization. For example, interruptions of industrial production in one firm may cause cascading effects along the value system e.g. shortages in inputs to downstream firms. Likewise, the interruptions may cause backlogs and thus fluctuations in demand. Hence, effective cyber risk management needs to be set in place. However, cyber risks are yet not well understood and especially cascading and ripple effects are hard to quantify. The objective of this seminar thesis is to tackle this question by applying industry economic modelling. As an exemplary branch the automotive industry is selected.

In particular, the thesis should contain the following elements:

- Give a short overview on scientific literature dealing with disruption in automotive supply chains caused by cyberattacks and their dynamics
- Generate a simplified model of the automotive value system
- Simulate the effects of interruptions within a particular value chain and the spreading across the value system (e.g. analogous to the logic of the beer game)

**Supervisor:**
M.Sc. Florian Kaiser

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

5. Evaluation of German Authorities’ Interventions during the COVID-19 pandemic

The COVID-19 pandemic shows how easily supply chains can be disrupted in a globalized world. During the first wave of the pandemic, there was a massive demand for medical supplies such as respirators and medical products, which means that supply chains must be adapted to the new challenges. In order to support companies, public authorities such as the German Federal Agency for Technical Relief (THW) and the German Federal Armed Forces (Bundeswehr) have been partially involved in the procurement and distribution of medical and non-medical products.

Extending already existing work that focused on the period from the start of the pandemic until December 2020 (you will be provided with this information to reduce your workload), the thesis should include the following topics:

- A literature review on approaches to evaluate disaster interventions (for example, in response to Hurricane Katrina or the Indian Ocean Tsunami)
- An overview of the activities of German and selected international actors during the COVID-19 pandemic (from January 2021 until the end of May 2021)
- An application of one of the evaluation measures towards the German interventions during the mentioned period.

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

Supervisor:
M.Sc. Markus Lüttenberg

Literature (as a starting point):
- https://www.bundesregierung.de/breg-de/themen/coronavirus/corona-massnahmen-1734724

6. AI in disaster response

AI is an increasing field of study with a wide range of applications. One of them is disaster response as in such a situation, a huge set of information has to be processed correctly and quickly by decision makers to get a valid and precise overview about the current circumstances. This seminar topic is dedicated to give an overview of AI (especially neural networks’) applications in disaster response and to present an application case study in detail. In particular, the following questions should be answered:

- Which type of problems in disaster response are already addressed by neural networks?
- Which tools are used to implement the neural network?
- Which data are taken for training simulations and how is the training progress evaluated?

Basic programming skills are required.

Supervisor:
M.Sc. Miriam Klein

Literature

Literature (as a starting point):

During the outbreak of the COVID-19 pandemic, the government's goal of protecting the population is prevalent in the media, while companies strive in particular to be able to maintain their supply chains. At the same time, it became clear that an extreme course of the crisis can also lead to other motivations for companies to be involved in a cooperative effort with governmental institutions. The COVID-19 pandemic hit many companies with a force that threatened their very existence. Under such extreme pressure, companies showed unusually flexible reactions (e.g., production conversions for the manufacture of disinfectants or respiratory protection masks) and a predominantly public welfare-oriented motivation.

During the COVID-19 pandemic, also new forms of public-private cooperation were observed: Cooperations between the public sector and the pharmaceutical industry, the chemical industry and the transport sector (in the form of the so-called "Transport Pact" (see "Gütertransportpakt") were concluded relatively spontaneously.

The focus of this seminar thesis is on the examination of this specific “Transport Pact”.

Your tasks include:
- A concise overview on the spread of COVID-19 in Germany with a focus on the transportation bottlenecks of supply chains
- Description and analysis of the “Transport Pact”, with a focus on:
  - Who is involved?
  - What are the goals of the actors involved?
  - Which arrangements were made?
  - Is the “Transport Pact” just planned as a transient, exceptional arrangement or could it be a model for a long-term and cross-sectoral arrangement?
  - Are there any comparable arrangements in other countries?
  - What is the current status of the “Transport Pact” (to what extent was it used, what was the experience so far etc.)?
- You should also draw a focus to any legal restrictions that came up

Due to the German focus of the topic, a good knowledge of this language is necessary.

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

**Links and literature (as a starting point):**