Seminar – Winter term 2020
“Current Topics in Risk and Crisis Management”

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Preliminary Kick-Off Meeting
03.11.2020 14:00
Online via MS Teams

Final Presentation and Submission of Thesis
Beginning of February (preliminary presentation date: 03.02.2021)

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. 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.

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1. On the Role of German Authorities in the Supply of the Population During a 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 mid May (you will be provided with this information to reduce your workload), the thesis should include the following topics:

- An overview of the activities of German and selected international actors during the COVID-Pandemic (from mid May until the end of December)
- A discussion of key success factors of the different intervention strategies.

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

Supervisor:
M.Sc. Florian Diehlmann

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

2. Trends in Vaccine Distribution Networks

Researchers all over the world try to develop a vaccine against the new Coronavirus. At the same time, it is important to prepare possible distribution strategies. The thesis should include:

- an overview on vaccine distribution networks for selected vaccines (e.g. HIV, Polio, …)
- a discussion on new trends in the distribution (e.g. drones, blockchain, …)
- recommendations/conceptualization of a potential distribution network for the Coronavirus vaccine for a selected case study

Supervisor:
M.Sc. Florian Diehlmann

Literature (as a starting point):

3. Incentives of smart health providers to provide secure and private services

An existing game theoretical model (e.g. the one provided by Steinbrück et al., n.d.) should be modified for describing incentives of smart health providers to provide services that are secure and ensure their users privacy. Thereby a differentiation between the ability of providers to guarantee security and privacy and their willingness to do so shall be modelled as well. This can be based on the provided model of two-sided markets. Such a two-sided market exists if one business area (the generation and provision of smart health applications) is substituted by another (resale/usage of data e.g. for advertisements). In modeling, two-sidedness is to be controlled by a data usage parameter of the company. A data usage of 0 would then result in a one-sided
market (no substitution between the business areas). Network effects (social components of smart health applications based on e.g. peer-to-peer groups or fitness communities) should be taken into account in the modeling as well as degrees of belief of the user (reputation of the smart health application provider, user awareness) and their sensitivity to data use.

The analysis of this model should focus on awareness as well as on security and privacy as sales-critical attributes (security and privacy as differentiation features/attributes that are demand-ed/appreciated by the customer).

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

**Literature (as a starting point):**
- Steinbrück et al. (forthcoming) Ein neues „Datenkartellrecht“ zum Schutz der informationellen Selbstbestimmung im Markt der sozialen Plattformen? In: Datenschutz und Datensicherheit (DuD) (will be provided by the supervisor)

4. Digital Twins for process simulation

The vision of a Digital Twin refers to a comprehensive physical and functional description of a component, product or system, which includes more or less all information which could be useful in all — the current and subsequent — lifecycle phases.

The task of this seminar thesis is to present an overview of different methodologies to model Digital Twins by finding a suitable categorizing system. In particular, the following questions should be addressed:

- How can Digital Twins be classified within the landscape of different simulation models?
- Compare strengths and weaknesses of the different process simulation models for themselves and with regard to their applications
- What are Digital Twins predominantly used for?
- Compare strength and weaknesses of the different methodologies to model Digital Twins for themselves and with regard to their applications
- The problem assessment and model review should be based on a systematic literature search

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

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

5. Agent-Based Models for the COVID-19 response

In order to find adequate response strategies for the current Covid-19 pandemic, there were designed different agent-based models. This seminar thesis should provide an overview of such models and their application to the current Covid-19 pandemic, in detail following questions should be investigated:

- Provide a background on characteristics of Covid-19 pandemic
- Which aspects of the pandemic are addressed by agent-based models?
- Which data are used in the models?
- How do the models deal with uncertainties/dynamics?
- Which results were provided?
Literature (as a starting point):


6. Reputational earnings of private companies from disaster management

In Germany, the management of crises, be they natural disasters or terrorist attacks, lies in the responsibility of state bodies such as the Bundeswehr or the THW. Nevertheless, there are always examples of companies that at first glance seem to be selflessly involved in humanitarian support during a crisis. These firms, for example, give away their products free of charge (particularly relevant in the food industry), provide their infrastructure and resources (trucks, distribution centres etc.) and share their knowledge/data with the state. For such measures, a positive external image can be a driving motivational factor.

The focus of this thesis is on the reputational gain of private companies, which they can acquire by humanitarian contributions in case of a crisis.

The short literature research of this thesis should include:

- An overview on how companies "cultivate their image"?

The main focus of this seminar thesis is on the realization of around 5 company interviews, which you should conduct via phone. Your tasks include:

- Acquire knowledge on how to conduct a telephone-interview
- Search for relevant private companies in the area of food production, food distribution, retail or related consultancy firms.
- Get in contact and set-up the telephone-interview (the questions will be given)
- Conduct the interviews
- Evaluate the answers

As the interviews need to be conducted in German, knowledge of this language is necessary.

Supervisor:
M.Sc. Markus Lüttenberg

Literature (as a starting point):

7. Sustainability in transport infrastructure planning

Transport infrastructures form the backbone of today's interconnected society. Since they represent so-called ultra-long investments, their planning influence lasts for generations. Therefore, their planning must be appropriately sustainable, among other requirements to mitigate environmental impacts from transportation. For this reason, decision-makers must consider a reasonable amount of environmental factors within their decision models.

The resulting work should include the following points:

- Short literature review about sustainability in transport infrastructure planning
- Analysis of the planning modalities in Germany
- Elaboration of sustainability aspects in German transport infrastructure planning – address shortcomings and proposal of further integration

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

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

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


8. 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.

The resulting work should include the following points:

- Short depiction of the developed board game
- Transfer of the game to a programmable environment (e.g. NetLogo, Python or Java)
- 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.

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

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

- Internal game manual – the game is based on the commercial game “PANDEMIC”
9. Prioritization decisions in the context of (medical) emergency

In extreme crises, medical care can reach its limits in terms of equipment and time. The classic example is the so-called mass casualty incidence. However, the current corona pandemic also led to a situation that over-stretched the health care system in terms of its capacities. In these cases, it is necessary to prioritize the allocation of medical services to those in need.

The thesis should include the following aspects:

- Provide a conceptual overview of variants of and criteria for prioritization of medical supply to people in urgent need.
- Collection of examples of prioritization decisions during the corona pandemic and their public reception in the public.
- An in-depth description of one modelling approach of operational prioritization in the context of emergency. The picked model must be taken from the literature (upon consultation with supervisor).

Supervisor:
Dr. Marcus Wiens

Literature (as a starting point):