

Annual Report 2018

Chair of Business Administration, Production and Operations Management



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Preface

The 2018 annual report from the Chair Business Administration, Production and Operations Management at the Institute for Industrial Production (IIP), Karlsruhe Institute of Technology (KIT) summarizes our activities during the year. The three research groups "Sustainable Value Chains", "Risk Management", and "Project and Resource Management in the Built Environment" have successfully worked on several projects on a regional, national and international level spanning a tremendous variety of topics. The team of the Chair consists of about 20 researchers, 4 administrative staff and a several student assistants. We welcomed new members in our team and, as usual, some team members left us due to completion of their PhDs.



During 2018, we worked on 21 third party funded research projects. We published 11 peer-reviewed journal articles, numerous conference proceedings books and book chapters. A PhD was completed. Teaching activities resulted in around 900 exams and about 70 bachelor and master thesis were supervised. Various international collaborations and international staff exchanges completed our activities.

We hope that this report attracts your interest in our activities. We look forward to future collaboration around our research and teaching activities.

A handwritten signature in blue ink, which appears to be "Frank Schultmann".

Prof. Dr. Frank Schultmann

Chair of Business Administration, Production and Operations Management

Sustainable Value Chains

Head of research group: Dr. Simon Glöser-Chahoud

The research group *Sustainable Value Chains* develops strategies for a more sustainable design of value chains and production systems as well as the affiliated logistical, organisational and information related functions. In this context, sustainability is defined as the parallel consideration of economic, ecological and social aspects. Major areas of research are related to circular economy concepts regarding both material or product cycles (closed-loop supply chains, reverse logistics) and the use of renewable, bio-based resources in industrial value chains (bioeconomy).

To cope with the related manifold problems, different approaches from economics, engineering as well as environmental and social sciences are implemented, adapted and enhanced. Methods and models are developed based on the regarded problems and transferred to specific applications.

A focus task is the development of computational planning models that enable an integrated analysis, assessment and optimization of material streams, complex interconnected plants or complete production networks. Other considered aspects are empirical stakeholder and acceptance analyses and policy advisory.

A further aim of our work is the development of sustainable concepts for material flow management and for decision support at regional, national and global scale. The research focus is currently on industrial plants, products and networks of the

metal, energy, chemical and automotive industry as well as on the utilization of biomass.

Typical methods in use are:

- Investment and production cost estimation, investment decision making
- Operations Research based modelling (optimization and simulation)
- Empirical social studies (especially questionnaire design and statistical methods)
- Life Cycle Assessment (LCA), Life Cycle Costing (LCC), environmental impact assessment



Members of the research group (from t.l. to b.r.): Simon Glöser-Chahoud, Andreas Rudi, Tobias Zimmer, Marina Maier, Carmen Schiel, Kira Schumacher, Sonja Rosenberg.

Risk Management

Head of research group: Dr. Marcus Wiens

The Risk Management Research Group works on scientific research questions and practice-relevant problems in the area of Risk Management with a special focus on systemic risks, behavioral risks, critical infrastructure and supply chains.

In 2018, the risk research group continued its work on two main research lines, the field of applied risk and crisis management on the one hand and the area of behavioral risk analysis on the other. As already in 2017, the behavioral research agenda was partly based on economic lab experiments with a focus on adversarial risks and trust in the course of the SERIOR-project and collective decision-making & negotiations in the research project EXPANDER. Both projects ended in 2018. In the area of applied risk and crisis management, the research in the DFG-ANR-project INCA advanced. Also in 2018 (as already in 2017) the project consortium had the opportunity to present interim project results to the participants of the disaster assistance-working group of the Upper-Rhine conference. In addition to this, two new projects started in 2018, both funded by the Federal Ministry of Education and Research (BMBF): The NOLAN-project which deals with the design & analysis of a public-private partnership for crisis management (public-private emergency collaboration: PPEC) and the PREVIEW-project which deals with a holistic risk management approach for the federal waterway infrastructure. For NOLAN, Markus Lüttenberg joined our team. Markus' focus in the project is the strategic and incentive-based parts of the work such as relational contracts or issues of fair distribution in the aftermath of a crisis. The project kick-off of NOLAN was in April 2018. For the PREVIEW-project, Rebecca Wehrle came aboard at the end of 2018. Rebecca is already familiar with the IIP as she has completed major parts of her studies at our institute. The focus of her work will be on risk management for infrastructure networks. The PREVIEW project kick-off was in September 2018. PREVIEW is essentially a continuation of the research collaboration between

IIP and the Federal Waterways Engineering and Research Institute (Bundesanstalt für Wasserbau, BAW) on a larger scale and with a consortium of three further project partners. The cooperation already started in spring 2017 with a 1-year initiation project, which ended in 2018. A particular success of the risk research group was the admission to the Competence Center for Applied Security Technology (KASTEL) at KIT, which is one of three competence centers for cyber security in Germany – all of them initiated by the Federal Ministry of Education and Research (BMBF) in March 2011 and funded at least until 2020. The participation in this project, which is mainly dominated by computer scientists, expands our risk portfolio to cyber risks, which represents one of the increasing threats worldwide. For KASTEL, Florian Kaiser started his work in our group in September 2018. Florian's focus is on behavioral modeling (in particular game-theoretic defender-attacker models) and on economic risk management for the cyber domain.

The outlook for 2019 indicates a further convergence of research topics of the group, namely the application and modelling of behavioral factors together with logistical and game-theoretical approaches on relevant risk and crisis management contexts.



Members of the research group (from l. to r.): Miriam Klein, Heike Schmidt-Bäumler, Francois Nyobeu Fangué, Rebecca Wehrle, Marcus Wiens, Markus Lüttenberg, Florian Diehlmann, Florian Kaiser, Farnaz Mahdavian.

Project and Resource Management in the Built Environment

Head of research group: Dr. Rebekka Volk

The Project and Resource Management in the Built Environment (PRM) group carries out technical, economic and environmental model-based analysis of energy-efficient, resource-efficient and renewable policies and technologies, as well as their potentials regarding the built environment. Especially in the fields of deconstruction and circular economy, decommissioning and dismantling of nuclear facilities, sustainable urban development, energy efficiency and the use of renewable energies in buildings, research projects are currently being worked on.

To offer decision support for different planning activities on consumer/user perspective, building level, district, regional or national level, several optimization models have been developed and are employed, in particular the AWOHM model framework, the ResourceApp building inventorying tool and robust project planning as well as the MogaMaR model for optimized nuclear decommissioning project planning. AWOHM is a simulation model for the German residential building stock, the building stock's energetic quality and technical equipment as well as its owners and residents. AWOHM is used to identify economically feasible retrofit options and the resulting national greenhouse gas emissions. This is a transferable model for national-scale energy systems, which mainly employs publicly available data and census data.

The ResourceApp and MogaMaR models are linear optimization models for robust project planning under uncertainty, and are employed to analyse time-optimal or cost-optimal project planning. While

the ResourceApp model is focusing on residential and non-residential buildings, MogaMaR is addressing nuclear power plants and facilities. Further models include the stakeholder description, analysis and decision making in the construction sector, the investigation and energetic description of city districts.

The current research foci in the PRM group lie in the identification of potential cost savings of heat and cooling losses, cost-efficient potentials for renewable energies in residential building stocks and municipalities. Furthermore, we work on model-based analyses of material flows, resources and resource efficiency in the construction sector, project management optimization of nuclear dismantling projects and stakeholder analysis in Baden-Württemberg and Germany. Furthermore, we hope for projects with Vietnam, China, Spain and Brazil to further develop and test the application of these methods in the context of real-world case studies.



Members of the research group (from l. to r.): Felix Hübner, Richard Müller, Rebekka Volk, Elias Naber, Anna Kühlen.

Research Projects

An experimental analysis of the negotiations on the allocation of radioactive waste (EXPANDER)

Hanns-Maximilian Schmidt

Partner: -

Funding: Federal Ministry for Economic Affairs and Energy (BMWi)

Supported by:



on the basis of a decision
by the German Bundestag

Duration: 2015 to 2018

The decades-long use of nuclear energy confronts politics, economy and society with the unresolved problem of the final disposal of radioactive waste. The EXPANDER project aims to better understand these challenges and identify approaches to solving this social dilemma. The search for a final repository for radioactive waste in Germany is complex. Due to a high number of involved stakeholders, an extreme planning horizon and technical planning insecurities, it poses an enormous challenge to decision-makers on all levels as well as to our society in general. Although there is a broad set of stakeholders sharing the same interest of finding a solution, their preferences are non-diverging or even contrasting concerning the details. Our research aims for a better understanding of the conflict drivers and the key elements of negotiations like this by using a mixed-methods approach comprising both qualitative and quantitative analyses. Based upon an abstract decision model and corresponding economic experiments, we enriched our analysis with data collected in semi-structured interviews with

representatives of five stakeholder groups, such as power supply companies or citizens' initiatives. Another important stakeholder, the media, was considered by analyzing (print and online) articles that have featured the discussion over the last few years. This data sheds light on the most important issues, the relevant players, the tonality and frequency of media coverage. It also allows for international comparisons.

EXPANDER comprises four data packages: economic experiments, stakeholder interviews, a media data analysis for Germany, France and Switzerland as well as the validation of results in expert discussions. In 2018, the data collection was completed and the evaluation of the media data completed. This sample (N=2,700) of articles from the last 20 years shows that the discussions are conducted differently across countries. Although the tonality is generally rather negative, the content focuses on different aspects or allows other groups to have their say. In Germany, for example, politics is the main speaker in media reports (over 60%). In France, a high proportion of speakers from science and industry (about 39%) is striking, while in Switzerland, citizens reach their peak (20%). The high level of participation that makes up the Swiss process is reflected in the rating. In particular, the transparency of the search process and the level of information and knowledge were rated most positively. These data can be used above all to identify best practices, which can then be evaluated taking into account the country-specific situation. The complete results of the project will be published in the first half of 2019.

BioeconomyBW-Studies: Identification of innovative process chains of a bio-based economy - analysis and integration into a bioeconomic location model for Baden-Wuerttemberg (Algae4BioEcoBW)

Andreas Rudi

Partner: University of Hohenheim

Funding: Ministry of the Environment, Climate Protection and the Energy Sector

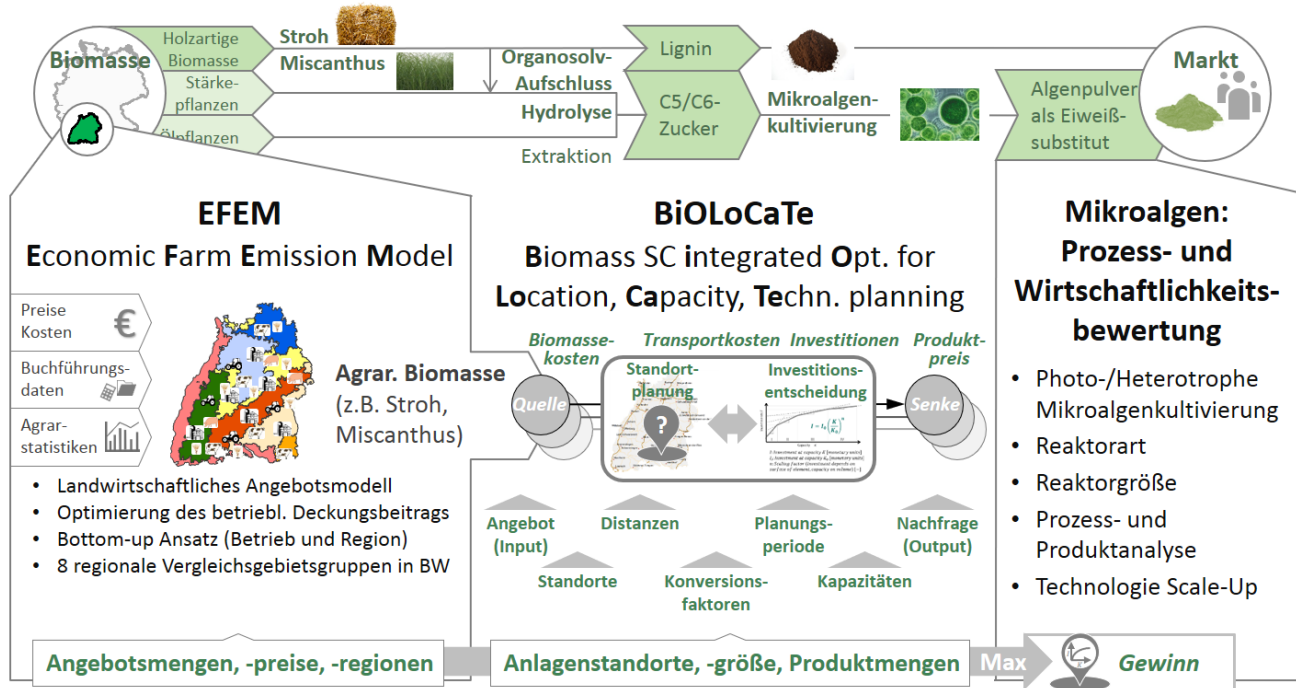
Duration: 12/2017 – 02/2018



Baden-Württemberg

MINISTERIUM FÜR UMWELT, KLIMA UND ENERGIEWIRTSCHAFT
Initial model calculations for the German state of Baden-Wuerttemberg show that many of the already known energetic and material bio-economic process chains are not yet economically viable. In the project, options for the expansion of biomass conversion plants to include processes of microalgae production are investigated. These potential process

extensions increase the economic as well as the ecological sustainability of the process chains in the sense of a closed loop economy. For this purpose, promising methods of algae cultivation are identified within the project based on a literature study. In a next step, selected processes are investigated within a model network. This network has been developed especially for bio-economic issues at the level of Baden-Wuerttemberg and consists of the agricultural supply model EFEM (Economic Farm Emission Model) and the techno-economic location optimization model BiOLOCaTe (Biomass value chain integrated Optimization for Location, Capacity and Technology planning). Based on model scenarios, the considered process paths are evaluated techno-economically and statements on technology selection and location planning are made.



Bioeconomy International: Semi-Mobile Bioenergy from Agricultural and Forest Residues in Chile and Beyond (SeMoBioEnergy)

Kira Schumacher, Tobias Zimmer

Partner: Fraunhofer UMSICHT, Institut für Betriebswirtschaftslehre (IBWL) - Universität Kassel, Unidad de Desarrollo Tecnológico (UDT) - Universidad de Concepción (UdeC), Instituto Bosque y Sociedad (IBOS) - Universidad Austral de Chile (UACh)

Funding: Federal Ministry of Education and Research (BMBF)

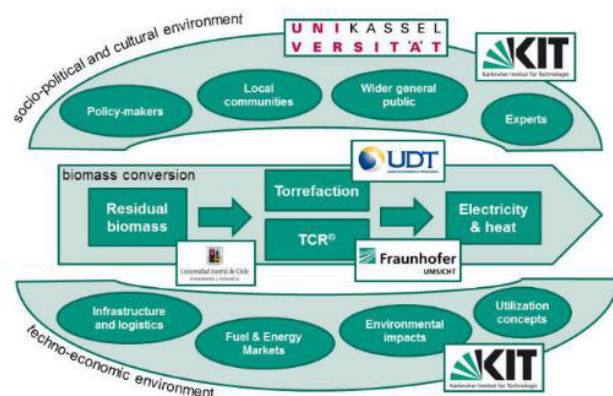
Duration: 2015 to 2018

As Chile is heavily dependent on imports of crude oil and natural gas, there is an increasing interest in renewable sources of energy. Given the importance of forestry and agriculture, particularly in the south of the country, energy from biomass is a promising option to diversify the Chilean energy matrix. However, biomass resources in Chile are highly dispersed along the territory and must be transported over long distances to produce electricity or heat. Given the low calorific value of residual biomass, collection and transportation costs represent a serious challenge.

At the example of Chile, the project SeMoBioEnergy aims at developing and evaluating flexible utilization concepts based on semi-mobile conversion plants. Such plants can be relocated with relatively small effort and allow for a conversion of biomass

feedstock directly at the harvesting site. As a result, transportation costs as well as emissions can be reduced. The utilization concepts are designed around the key technologies torrefaction and thermo-catalytic reforming (TCR). Both technologies produce densified bioenergy carriers which can directly substitute fossil fuels or can be further upgraded to high-quality products.

Within the project, the KIT-IIP focuses on developing utilization concepts which are favourable in terms of economic, ecological and social impacts. This includes the techno-economic assessment of processes and the design of logistical concepts as well as the analysis of different stakeholder groups and their involvement in the project.



Bioeconomy Research Baden-Württemberg - Competence Network Modeling the Bioeconomy: Quantitative assessment of regional biomass-based value chains

Andreas Rudi

Partner: University of Stuttgart, University of Hohenheim, University of Freiburg, Centre for European Economic Research (ZEW)

Funding: Ministry of Science, Research and the Arts Baden-Württemberg

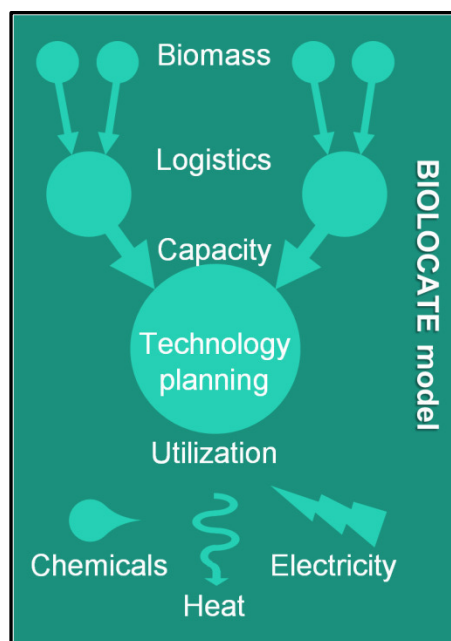


Ministerium für Wissenschaft,
Forschung und Kunst Baden-Württemberg

Duration: 2014 to 2018

Biomass and biomass-based raw materials or residues are largely distributed over a wide area and usually have to be conditioned and processed due to their adverse properties. In many cases, the products are also used on a regional basis. In this way, a variety of interconnected or competing value-added chains exist, involving actors from the agricultural and forestry sectors, industry, science, and society. The

regional context of these value-added chains is a key driver for achieving the goals of a knowledge-based bioeconomy. The promotion of the bioeconomy requires a systemic regional assessment. For technology and product developments, key variables with regard to economic, ecological, and social criteria must be identified and the development of sustainable technologies and products must be supported. Therefore, it is necessary to perform a techno-economic and ecological process evaluation of selected biomass-based pathways for the development of sustainable technologies and products in Baden-Württemberg. In order to fulfil the tasks set, modelling concepts are developed taking into account a Biomass Value Chain Integrated Optimization including logistics, capacity and technology planning for energetic and material utilization (BiOLOCaTe).



CEDIM

Mariana Bartsch

Partner: Geodetic Institute (GIK), Geophysical Institute (GPI), Institute of Applied Geosciences, Institut für Finanzwirtschaft, Banken und Versicherungen (FBV), Institute for Hydromechanics (IfH), Institute for Industrial Production (IIP), Institute for Nuclear and Energy Technologies (IKET), Institute of Concrete Structures and Building Materials - Materials Testing and Research Institute (MPA Karlsruhe), Institute of Meteorology and Climate Research, Institute of Photogrammetry and Remote Sensing (IPF), Institute of Regional Science (IfR), Institute for Technology Assessment and Systems Analysis (ITAS), Institute of Technology and Management in Construction, Institute of Economics (ECON), Institut für Wasser und Gewässerentwicklung

Funding: Karlsruhe Institute of Technology

Duration: since 01/2006 (ongoing)

Facing the increasing probability of extreme events and their tremendous possible impacts on societies,

it is inevitable to investigate their impacts on current and future energy, mobility and information systems. This is also more than valid, facing the aspect that through the network character of those systems, extreme events lead to cascading effects along its system parts. That is why, natural disasters can have also severe impacts far away from their place of origin. The current globalization and strong interconnectedness around the world is also increasing this aspect. To assess the indirect impacts of natural events, two subprojects were implemented, dealing with supply chain vulnerability under consideration of global interconnectedness (IIP) and changed consumer mobility requests in the aftermath of a disaster (ECON).



Development and evaluation of biobased value chains for Baden-Wuerttemberg

Andreas Rudi

Partner: University of Hohenheim, University of Stuttgart

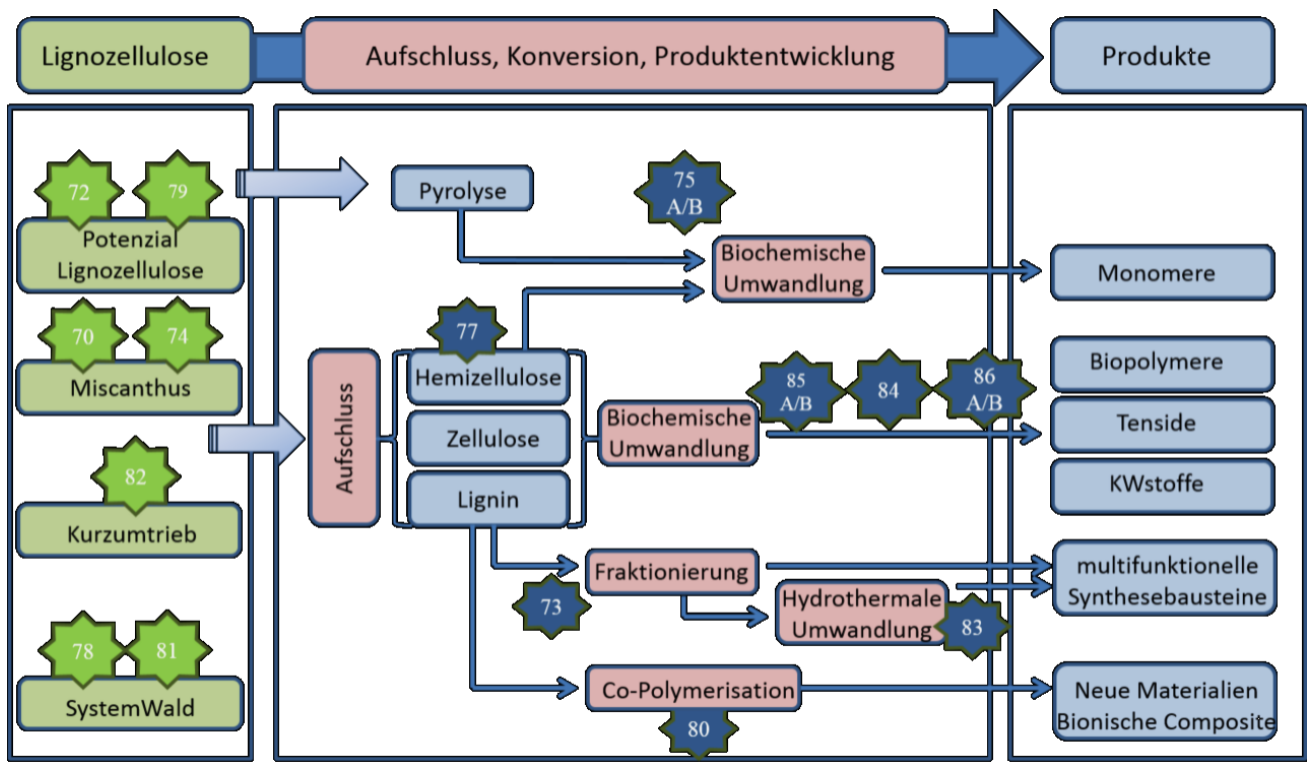
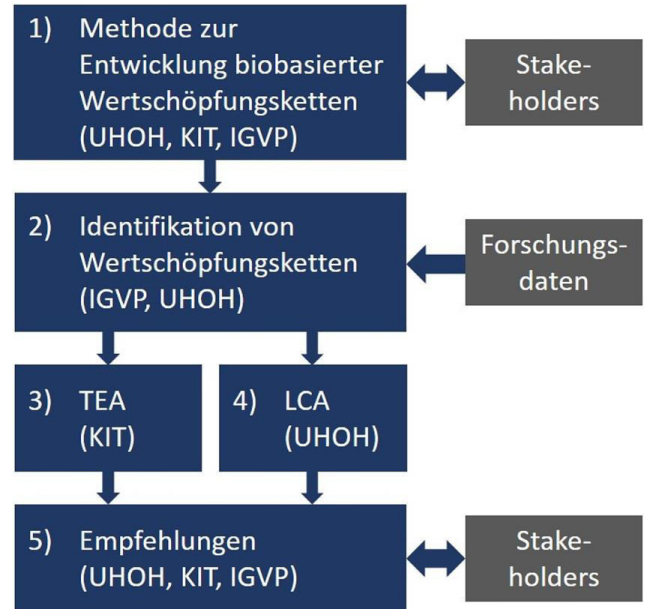
Funding: Ministry of Science, Research and the Arts



Ministerium für Wissenschaft, Forschung und Kunst Baden-Württemberg

Duration: 10/2018 – 09/2020

For the development of new bio-based products, a large number of possible process steps are available. The combination and evaluation of these possibilities is a complex undertaking, especially if process steps are to be taken into account in the trial phase. In addition to the technical feasibility, the ecological evaluation and the economic realization possibilities have to be considered with regard to the overriding goals of the bioeconomy. This project aims to develop a methodological approach that is suitable for creating bio-based value chains and analyzing them from a techno-economic and ecological perspective. Five steps are undertaken:



Development of an economic approach for decision support in a circular economy orientated production

Sonja Rosenberg, Marina Maier

Partners: AUDI AG, UMICORE, Scholz Recycling GmbH

Funding: THINKTANK
Industrial Resource Strategies



Duration: 05/2018 – 03/2019

Up to today, Original Equipment Manufacturers (OEM) have hardly any incentive to invest in recycling and dismantling friendly products. One of many reasons is that expected earnings through recovery in the future cannot be allocated directly to higher costs in the early stages of a products life cycle, such as development and production. Thus, it is common practice for OEM business models to focus solely on producing and selling while achieving

a profit based on a margin. If performed, other companies execute the dismantling and recovery processes and receive the earnings.

With the increasing digitalization and changing consumer behavior OEM rethink their business models and tend to focus more on product service systems. Furthermore, increasing technology allows new forms of cooperation along supply chains and lifecycles of products. These developments create the possibility of new circular economy based business models.

In order to evaluate and identify which circular economy based business models should be chosen for a specific product, decision support is needed.

Thus, the aim of this project is to develop an evaluation tool that allows the economical investigation of alternative business models and recovery options. The developed method is tested for specific use cases in the automotive industry. Afterwards, further use cases in other industries are implemented to show the general applicability.

Emergency Management and Evacuation

Farnaz Mahdavian

Partner: -

Funding: Graduate Funding from the German States

Duration: 2017 to 2020

The first objective of the research project is to gain a deeper understanding of the chain of events during a disaster and to improve human behaviour and reactions particularly regarding evacuation. To this end, extensive research on different natural disasters in several countries has been carried out to outline the key lessons concerning evacuation from various hurricanes and floods in major worldwide events. The analysis revealed both successes and failures in warning and evacuation.

The evacuation process can be viewed from two perspectives. The first is related to government decision-making, to early warning systems and to the relevant authorities' protocols for issuing an evacuation order. The second is whether people in the affected area decide to evacuate or not depending on whether or not they have received an evacuation order. In principle, evacuation needs to be carried out in an immediate and urgent manner, which requires fast decision-making on all levels. However, crises are characterized by a high degree of uncertainty and delay and the need to evacuate is often only realized after the disaster has escalated.

For the government reaction part, a decision model for disaster evacuation was designed using the Bayesian Updating method, which captures government decision-making during the event of a

flash flood. In this scenario, the government receives a noisy signal (a disaster warning) about an upcoming extreme weather event and faces a choice between announcing an evacuation order, either severe or extreme, or keeping silent. The objective of the dynamic model is to analytically compare the outcomes and various costs of different decisions based on different levels of information and identify the optimal decision paths. "Cost" in this context is defined as adverse consequences for life and health as well as a loss of trust or credibility in governmental announcements.

The second part of the research analyses society's perception and attitude towards crisis events based on a questionnaire. To this end, a set of hypotheses about the influence of risk attitude, disaster experience and trust is established. A special focus is on country comparisons.

The target sample includes people who were living or working in the affected area in Germany, Iran, and United Kingdom. Key questions elicitate the levels of risk awareness, knowledge, attitude to disaster and preparedness in different countries as well as the role of trust among people and between people and government in emergency reaction. The objective is to learn which factors influence people's decisions and reactions immediately following a disaster. The insights out of this survey can help the government to improve preparedness, warning and evacuation order.

Energieleitplan Karlsruhe (ELP)

Rebekka Volk, Elias Naber

Partner: Green City Experience GmbH

Funding: Stadt Karlsruhe

Duration: 2018 to 2019



In the course of the new and integrated climate protection concept of the city of Karlsruhe, together with the Green City Experience GmbH we consult the environmental city department and the respective working group in the city. In this project, our work focuses on the data analysis and design of an "Energieleitplan" (energy-use plan) for the whole

city. The "Energieleitplan" is meant to serve as an internal, GIS-based tool to collect and develop all information needed to provide basic information for energetic questions of urban development and energetic solutions on district and city level.

As an internal working tool, the energy-use plan should enable quick orientation, for example, which energy sources are suitable or available for new planning. In addition, it should provide strategic assistance, e.g. by identifying neighborhoods that are considered to be urgent for a rehabilitation initiative ("redevelopment hot spots") or by designating areas that have sufficient potential for connection to a potential district heating network. The energy-use plan should be developed in parallel with the climate protection concept, so that, if possible, initial results can already be used for the planning of measures (for example, to determine further district-specific remediation initiatives).

The project started in May 2018 and results were handed over in November 2018. The consulting will accompany the project until project closing in February 2019.

INCA Project

Miriam Klein and Farnaz Mahdavian

Partner: University of Wuppertal, ARMINES - Mines Paris Tech, University of Paris-Dauphine

Funding: German Research Foundation (DFG), French National Research Agency (ANR).



Duration: 03/2017 to 02/2020

In the INCA project, the crisis scenario of a long-term power failure in the German-French border region is investigated with the objective to enhance cross-border resilience. First, direct and indirect consequences of a power failure for the population are mapped by scenarios. The ensemble of resulting crisis situations represents a stress test for societal resilience as it pushes the emergency procedures to their limits (e.g. energy backup generators are only designed for a short-term usage). Hence, the main aspect is the efficient identification and treatment of casualties by finding an optimal distribution of the available medical resources by efficient integration of cross-border capacities. Hence, a strong focus is on the cross-border cooperation of authorities who are responsible for crisis management as well as the forces involved in crisis management. A second focus of the project is on volunteer management in the cross-border context. During past crises it was observed, that volunteer helpers not just act as members in voluntary aid organizations, but spontaneously come together and offer their know-how. As a result, the usual coordination is limited or even completely eliminated such that this trend requires analysis. One further focus of investigation is the inclusion of voluntary spontaneous helpers into the crisis management procedures since their different backgrounds, experiences and motivations are seen as a huge potential for an improved disaster resilience.

To achieve these goals, an agent-based model is developed, as this method is suitable for mapping the complex interplay of the individuals and the dynamics of their behavior. Agent-based modelling is particularly well-suited for depicting a crisis scenario, as each actor has limited information that he gains by sharing with other agents. Additionally, not all alternative courses of action are known and not all resulting effects are predictable due to the complexity. Nevertheless, decisions must be taken under uncertainty and the project will support this process from a scientific point of view. Here, special features of the cross-border region as culture and language, which may facilitate or complicate crisis cooperation, are considered. Therefore, in the modelling of the communication process, there has been inserted an additional trust variable between sender and receiver of a message. Depending on the relationship of trust between the two agents, the incoming information is evaluated and processed. Using a scenario-based approach, the impact of trust in the dynamic process of crisis management can be measured and compared with other factors of influence such as different languages. Using this approach it is possible to accurately represent the peculiarities of the border region which take into account positive factors of so-called border identity. The solution of the model should be robust despite changes in the scenario, since crises and their course are not known in advance.

In spring 2018, Dr. Anouck Adrot and Dr. Marcus Wiens presented parts of the work to the crisis management working group of the Upper-Rhine-Conference in Colmar. At a mid-term project meeting which took place at the University Paris Dauphine, the INCA-team discussed the current progress of the work with Prof. Louise Lemyre, University of Ottawa und Prof. Stephen Platt, Cambridge Architectural Research Ltd.

Integrated urban district development for climate change challenges in Hanoi (Urban-CCC)

Rebekka Volk

Partner: KIT/IfR, KIT/IESL, KIT/IfV, KIT/AGW, KIT/IWG, KIT/ITAS, Viet Nam Institute for Urban-Rural Planning (VIUP), Ministry of Construction (MOC), Energy Management Faculty, Electric Power University (EPU), Economics and Management Department, Hanoi University of Science and Technology (HUST), National Traffic Safety Committee of Vietnam, Consulting Center for Transport Development, University of Transport and Communications, Hanoi, Department of International Cooperation, Ministry of Natural Resources and Environment, Department of Forest Resources and Environment Management (FREM), Tay Nguyen University (TNU), National Institute of Agriculture Planning and Projection, Ministry of Agriculture and Rural Development

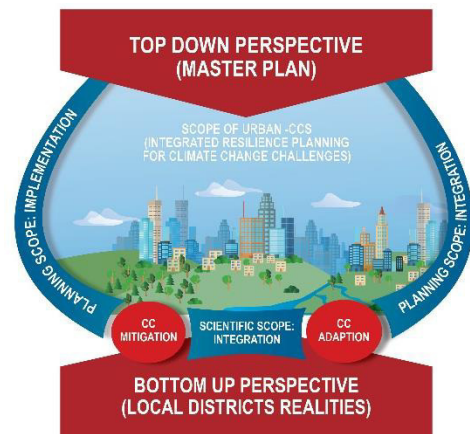
Funding: German Academic Exchange Service - DAAD.

Duration: 10/2017 to 12/2017

URBAN-CCC is a project of a Vietnamese-German project consortium existing since end of 2016. It consists of four partner universities in Vietnam, several partner at Karlsruhe Institute of Technology as well as four ministries/administration offices in Hanoi and the People's Committee.

URBAN-CCC is focusing on dealing with measures of climate change mitigation, adaptation and impact

reduction in city quarters of megacity Hanoi. It combines the regional and cultural expertise of the Vietnamese partners with the perspective of integrative and scientifically based urban and regional planning of the German partners.



In the current status, URBAN-CCC is realising a Fact Finding Mission to Hanoi, during which the project development and conceptualization will be concretized in joint workshops. Furthermore, joint field meetings are held to understand the multiperspective discussion of current problems and local stakeholders outside the scientific field are identified and will be motivated for supporting the project.

KASTEL

Florian Kaiser

Partner: Institute for Applied Computer Science and Formal Description Methods (KIT), Institute for Anthropomatics and Robotics (KIT), Institute for Automation and Applied Computer Science (KIT), Institute for Program Structures and Data Organization (KIT), Institute for Theoretical Computer Science (KIT), Institute for Telematics (KIT), Research Center for Computer Science (KIT), Center for Applied Law (KIT), Institute for Public Law (Goethe University Frankfurt a.M.)

Funding: Federal Ministry of Education and Research (BMBF)

Duration: 05/2018 to 04/2022



In 2018, the risk research group has started its work in the KASTEL project. It will primarily contribute to the objective to make IT security quantifiable and scalable with its approaches from economic risk management. Another focus is the strategic and behavioral analysis of risks in the IT-domain.

The Competence Center for Applied Security Technology is one of three competence centers for cyber security in Germany. KASTEL is addressed to the challenges of the progressive networking of the world. The aim is to develop a holistic approach to ensure IT security instead of isolated sub-solutions. This can only be achieved through interdisciplinary cooperation. This is why KASTEL combines outstanding competencies from various scientific disciplines in the field of IT security in Karlsruhe.

The research group Risk Management started its work in the KASTEL consortium in 2018 and is entrusted with economic risk management. The systematic analysis of internal organizational risks and the development of measures for permanent risk reduction are at the center of its work. The handling and control of IT risks requires not only the control of the necessary technologies and processes, but also the economically sensible use and practical feasibility.

Further tasks include the categorization of attacker profiles and the identification of attack strategies to enable targeted defense against external and internal offenders. This is complemented by the analysis of internal incentives for risk reduction. The description of requirements for an internal security culture as well as the evaluation of material and immaterial damages complete the range of tasks.

Lignocellulose Biorefinery for the Bioeconomy in Baden-Wuerttemberg

Andreas Rudi, Simon Glöser-Chahoud

Partner: Institut für Katalyseforschung und -technologie (IKFT-KIT), University of Hohenheim, BIOPRO GmbH

Funding: Ministry of Science, Research and the Arts



Ministerium für Wissenschaft,
Forschung und Kunst Baden-Württemberg

Duration: 10/2018 – 09/2020

BtB

The aim of the project is to set up and operate a complete lignocellulose utilisation chain in the biorefinery pilot plant "Bioraffinerie-Technikum" on the site of the "Unterer Lindenhof" experimental station at the University of Hohenheim. Within the framework of a modular plant, the complete

recycling of lignocellulosic biomass into platform chemicals will be demonstrated.

Starting from the provision of lignocellulosic biomass, i.e., miscanthus, through the conditioning and logistics processes the biomass will be converted by applying modular processing steps into hydroxymethylfurfural (HMF), furfural and phenol. In order to create an integrated biorefinery concept, new modules for the valorization of will be added in the upcoming project phases. After treatment the nutrient-rich solution, which is obtained as residue in the biorefinery, is returned to a biogas plant which supplies heat and electricity. Two key scenarios will be analyzed: 1. A decentralized biorefinery on a farm level (small scale) and 2. a centralized biorefinery on a local level (regional scale). The IIP is responsible for evaluating these biorefinery concepts from an economic perspective.

Material flow and stakeholder model for an active resource management in the construction industry of Baden-Wuerttemberg (StAR-Bau)

Richard Müller, Rebekka Volk

Partner: ifeu - Institut für Energie- und Umweltforschung Heidelberg GmbH, Karlsruher Institut für Technologie (KIT) – Fachgebiet Immobilienwirtschaft (FIWI)

Funding: Baden-Württemberg Stiftung

Duration: 2015 to 2018

During their life cycle, buildings and infrastructures induce great flows of energy and material, which have in particular regional impacts on society and the environment. Around 40 % of energy demand and around 50 % of the annual generated waste in Germany are assigned to the construction sector. The latter corresponds to average 2.5 t annual generated waste by construction per inhabitant. Demographic change and restricted land use lead to additional building measures made in existing housing in form of renovation or replacement in urban areas.

In a first step, the aim of the project is the elaboration of a detailed, regionally and temporally resolved material flow model of the building and infrastructure stock and its development of Baden-Wuerttemberg. The model displays the current situation and is able to predict possible regional recycling paths under different basic conditions. Material flows generated by new construction, renovation, conversion and demolition as well as the resulting treatment and liquidation processes shall be shown. Furthermore, the model determines the potentials of recycling and of resource protection at a regional level by linking the supply of recycling building material with its demand.

In a second step, relevant actors are questioned and their interests are illustrated and examined in a system-dynamic model considering different

dynamically modified basic conditions. Examples of modifiable basic conditions are several policy instruments and their impacts on decision-makers but also new network structures and technologies for the extraction of construction material from the stock such as construction materials processing facilities and techniques. The individual decisions of actors, which are described by the developed model, collectively form the material recycling paths which are then evaluated with regard to sustainability through economical, ecological and sociocultural indicators. Furthermore, from this evaluation we derived suitable instruments and control options as well as recommendations for action from the state's point of view to implement corresponding recycling economy concepts.

In 2018, the final results of the project were developed and summarized. In March 2018 the project results were presented in Stuttgart in front of the Advisory Council and the representatives of Baden-Württemberg Stiftung. The project report was written and completed in summer 2018. Both project report and an associated academic paper are in the publication process.

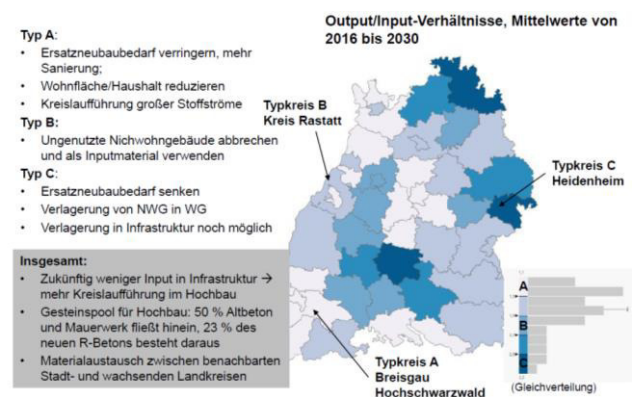


Figure: Result part from the material flow perspective of the StAR-Bau project.

Model development of a holistic project management system for nuclear dismantling projects (MogaMaR)

Felix Hübner

Partner: AREVA NP GmbH; VKTA - Radiation Protection, Analytic & Disposal Inc.; Institut für Technologie und Management im Baubetrieb (TMB), Karlsruher Institut für Technologie (KIT)

Funding: Federal Ministry of Education and Research (BMBF)

Duration: 01/2014 to 03/2017

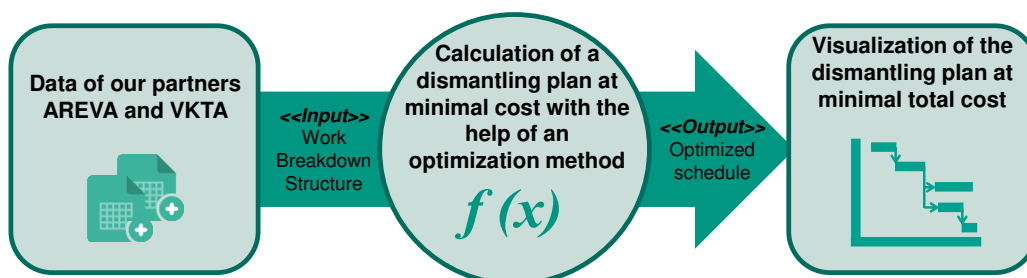
As a result of intensive research and development for the dismantling of nuclear power plants, a variety of technologies and procedures have been developed. Various dismantling projects, that were successfully completed in the past as well as the progress of ongoing dismantling projects show that it is already possible to technically dismantle nuclear facilities safely.

However, besides the safe technical implementation of the dismantling process, it is also very important to consider the holistic and economic view of the planning, execution and monitoring of nuclear dismantling projects. Due to the individual and innovative character, decommissioning and dismantling of nuclear facilities are based on experience. Therefore, the planning and execution underlie various uncertainties. For the same reason, it is difficult to standardize and generalize the processes and procedures in the style of decommissioning projects of civil engineering. Current project management systems have proven that in practice they do not provide sufficient cost and resource efficiency at planning and implementing nuclear dismantling projects.

Especially the various uncertainties are not sufficiently taken into account during the planning process because of missing empirical value. That's why completed or ongoing dismantling projects of nuclear power plants often show significant deviations between expected costs and real costs.

To encounter such deviations, the development of a holistic project management system with an integrated approach is urgently needed. At the same time, this project management system should be able to reflect adequately the complexity of the project, enable a proactive approach to design management processes and stay within current safety standards with regard to time and resources. In this context, considering the uncertainties during the planning process is very important.

The aim of this research project is to analyse the special characteristics of nuclear dismantling projects through project plans, approval documents, approval procedures and other project documentation of completed, ongoing and planned dismantling projects. It conduces to identify current weaknesses in project management which are responsible for unexpected time and cost changes. The results are used for further development of current project management systems used to dismantle nuclear power plants, thereby enhancing it with a holistic approach. This approach shall enable realistic and integrated planning of time, cost and resources while considering the uncertainties due to missing experience at planning and execution.



NOLAN

Florian Diehlmann and Markus Lüttenberg

Partner: 4flow AG, TU Dresden

Funding: Federal Ministry of Education and Research – BMBF.

Duration: 2018-2021

Emergency care falls within the remit of the public sector. Nevertheless, private companies have a large number of resources (including skills) at their disposal, which can be very helpful in providing emergency support to the suffering population in the event of a crisis. In the NOLAN project, the option of a public-private partnership in crisis management is being systematically investigated for the first time.

The project partners are experts in the areas of risk and crisis management, emergency logistics, supply chain management and public law. Together with dialogue partners from the private and public sectors, the partners investigate the possibilities for the effective and practical design of a "Public Private Emergency Collaboration" (PPEC).

The overall objective of the project is to improve the supply security of an urban population with essential goods in crises. The aim is to develop concepts for efficient cooperation between private actors in commercial supply chains (i.e. retail, logistics, CI-operators) and state actors (i.e. public response agencies). For an escalating crisis event in urban areas, a holistic concept of emergency logistics – scalable in escalation stages – is developed which focuses on the cooperation of private actors in commercial supply chains and on state actors in emergency supply, taking into account the findings from humanitarian supply chains.

The focus is on the supply of vital, discrete goods such as food, medicines and bottled drinking water. Methodologically, a distinction can be made between two different approaches. On the one hand, the supply chains of public authorities and private companies are modelled and the interaction of the supply chains simulated and optimized. Parallel to this, a game theoretical analysis of the cooperation takes place, in which among other things fair approaches to the distribution of costs and risks or problems regarding cooperation incentives and information flows are scientifically worked out.

The kick-off of the NOLAN took place on April 11th, 2018 at the IIP in Karlsruhe. Representatives of the project sponsor VDI together with the project partners from TU Dresden, 4flow Research, and IIP balanced their expectations of the project. Furthermore, the first steps in the project were defined at further project meetings in Dresden, Karlsruhe, and Berlin and first interim results were discussed. Some of these interim results were presented by Florian Diehlmann at the OR2018 conference in Brussels. A huge potential for improvements in the area of cooperation during crisis de-escalation was identified and quantified in a simplified model approach.

Furthermore, the first NOLAN expert workshop took place in November 2018. Dialogue partners from the private and public sector reported on their experiences. Together, they defined various possibilities for the effective and practical design of a "Public Private Emergency Collaboration" (PPEC), which will be implemented in the models to be developed in the further course of the project.

**Piloting the native ethanolic extraction of rapeseed; Subprojects 5:
Economic and ecological accompanying research in the joint project (EthaNa)**

Simon Glöser-Chahoud, Andreas Rudi

Partner: Fraunhofer-Zentrum für Chemisch-Biotechnologische Prozesse CBP, Fraunhofer-Institut für Grenzflächen und Bioverfahrenstechnik IGB, Fraunhofer-Institut für Verfahrenstechnik und Verpackung IVV, Forschungsinstitut Futtermitteltechnik IFF, B+B Engineering GmbH, Thywissen GmbH, AVA Anhaltinische Verfahrens- und Anlagentechnik GmbH, Miccra GmbH, VetterTec GmbH, tti Magdeburg GmbH

Funding: German Federal Ministry of Food and Agriculture (BMEL)

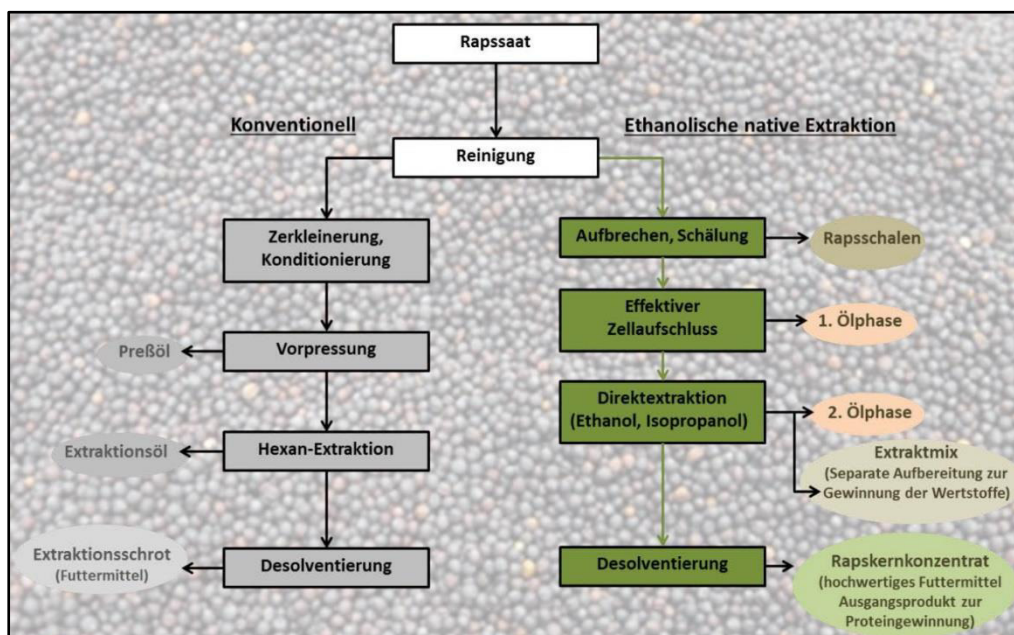


Duration: 09/2017 – 08/2020

The aim of the project is to develop an innovative refining process of canola seed in order to obtain highly efficient, economical, high-quality products. Compared to extraction processes with the solvent hexane, which were customary up to now, the EthaNu-refining processes might enable a significant

qualitative improvement of the products rape oil and rape kernel concentrate. In addition, new highly valuable substances which have not yet been derived from rape seed are isolated. This will open up further sales markets in future and increase overall sales revenues from the oleaginous seed. The EthaNu concept is a fully integrated process for rape seed refining. Direct extraction with alcohol makes it possible to obtain high-quality plant-oil and proteins as primary products. Within the framework of the overall project, the IIP is dedicated to the evaluation of the relevant economic and ecological aspects of the individual sub-processes as well as the overall process. It forms an essential basis for industrial application and marketing of the developed concept. Economic and ecological evaluation models for the concept are used and evaluations are carried out in parallel. For this purpose, methods from material and energy balancing (e. g. process engineering simulation), investment and operating cost estimation as well as life cycle assessment (e. g. Life Cycle Inventory of the entire value-added chain) are applied.

EthaNa Process



PREVIEW

Rebecca Wehrle

Partner: 4flow AG, TU Dresden, Bundesanstalt für Wasserbau (BAW), antwortING

Funding: Federal Ministry of Education and Research – BMBF.

Duration: 2018-2021

Around 2.5 million containers are transported annually on the German waterways. On the one hand, the waterways are of outstanding importance for the functioning of the economy. On the other hand, the infrastructure of the artificial federal waterways, including canals and locks, is outdated. Floods or possible terrorist attacks also pose a threat to the waterway infrastructure. Furthermore, it is not known what consequences the failure of individual critical elements of this system may have for other transport infrastructures, the economy and the population in the affected regions.

The PREVIEW project investigates the possible consequences of the failure of critical water transport infrastructure structures for other transport infrastructures, logistics, neighbouring industries and the population of the regions concerned. The overall objective of the project is thus to increase the resilience of the waterway infrastructure in Germany. To this end, adverse consequences will be analyzed and processed on the basis of three exposure scenarios as natural events, technical or human failure and hostile attacks. For the first time, the entirety of the hazards for the population as well as for transport logistics and the economy will be analysed. The resulting findings will be used to draw up contingency plans in order to effectively counter these hazards.

The results of the project will be incorporated into a simulation model, which illustrates possible hazardous situations using the example of the West German canal network. This enables end users to

visualize the vulnerability of the infrastructure, the local communities and industries. Logistic models also make it possible to assess the economic impact of damage events in canals. The results benefit the end users and can then be transferred to the entire waterway infrastructure.

Work in 2018 and main results:

The PREVIEW project started in September 2018 and the project kick-off of PREVIEW took place on September 10th, 2018 at the IIP in Karlsruhe. Representatives of the project sponsor VDI together with the project partners BAW, Hochschule Karlsruhe, antwortING, 4flow Research, and IIP exchanged their expectations on the project. During the three-year duration of the project, the scientists of the research group risk management of IIP will focus on the scenario development, the assessment of damage consequences and the interdependence of critical infrastructures. A further task is to contribute to an integration of the partial work into a holistic risk framework.

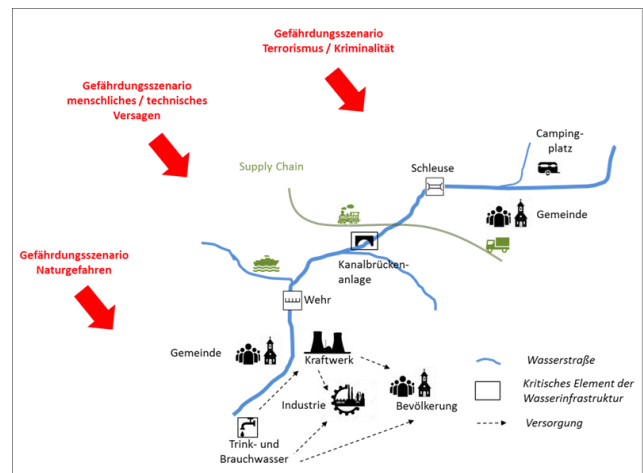


Figure: PREVIEW Risk Map. Holistic risk analysis of waterways as a Critical Infrastructure

Raw materials of strategic economic importance (r⁴)

Innovative technologies for resource efficiency

– Provision of raw material of strategic economic importance

Sonja Rosenberg, Simon Glöser-Chahoud

Partner: Clausthal Research Center for Environmental Technologies (CUTEC), Fraunhofer Institute for Systems and Innovation Research (ISI), Federal Institute for Geosciences and Natural Resources (BGR), Pforzheim University of Applied Sciences (HS PF)

Funding: Federal Ministry of Education and Research (BMBF)

Duration: 2015 to 2019

Raw materials, such as indium, gallium, and rare earth elements are of strategic importance, while being scarce and thus, play a key role in future technologies and in Germany's transition to renewable energy. The started programme aims at increasing supplies for primary and secondary raw materials of strategic economic importance through research and development. Research areas cover primary and secondary resources comprised in 40 joint projects. Initiatives with focus on primary

resource are associated to the exploration or the extraction and processing of raw materials. Meanwhile secondary resource projects deal either with recovery of raw materials or the recycling of end-of-life products.



Innovative Technologien für Ressourceneffizienz

Bereitstellung wirtschafts-strategischer Rohstoffe

The parties of the Germany-wide programme are interlinked by the research-supporting "r⁴-INTRA" integration and transfer project. "r⁴-INTRA" strengthens the innovation power of the projects by interconnecting parties and showing interdisciplinary synergies leading to a possible higher research efficiency. Performed potential analyses and evaluation of ecological and social benefits are used to derive recommended actions for future funding programmes.

Reallabor 131: KIT findet Stadt - Urban Transition Lab 131

Elias Naber

Partner: EIFER (European Institute for Energy Research), KIT-Institute for Building Design and Technology, Building Science Group

Funding: Ministry of Science, Research and the Arts Baden-Württemberg - IQF-Programm „Reallabore, BaWü-Labs, für eine Forschung für Nachhaltigkeit in Baden-Württemberg“

Duration: 10/2015 to 11/2016

The Urban Transition Lab focuses on four topics, identified as the bottom line of two different perspectives: the objectives of Karlsruhe's citizens which were developed in a participatory process on the one hand and the expertise of KIT on the other hand.

- Energy concept in the district Oststadt Karlsruhe
- Mobility and consulting
- Social networks and aspects of urban planning
- Sustainable consumption

Aside of surveys and various analyses of the building stock and the ownership structure, a model to calculate and assess energy demand and material stocks has been designed and applied on the Urban Transition Lab district. The results show that the combination of 3D building data and established methods increase certainty of model outcomes (see figures below). The comparison with other sources yielded good results and confirmed the validity of the model base data.

The project received two awards awarded by the Sustainability Council in 2017. The project closure ceremony of the project and the funding program took place in Karlsruhe on 27.04.2018.



Figure: Spatial distribution of total energy demand of thermal energy. Values in kWh/(m²A_B*a)



Figure: Spatial distribution of total energy demand of electricity. Values in kWh/(m²A_B*a)



Figure: Distribution of steel in the Oststadt Karlsruhe. Values are in Mg/m²A_B



Ausgezeichnet durch den NACHHALTIGKEITSRAT
als besonderer Beitrag zur **TRANSFORMATION**

Resilience of critical waterway infrastructure

Marcus Wiens, Mariana Bartsch, Heike Schmidt-Bäumler

Partner: Federal Waterways Engineering and Research Institute

Funding: Federal Waterways Engineering and Research Institute

Duration: 03/2017 to 02/2018

Hydraulic structures, such as sluices, dams and the like, fulfill important functions for the waterway infrastructure. At the same time, however, risks are becoming increasingly apparent about which infrastructure operators need more information and better preparation. Risks that affect hydraulic structures include natural hazards, the ageing of the building stock in connection with a high maintenance backlog and the generally increasing dependency and susceptibility of socio-technical systems to failure. The subject of the research project is the analysis of the vulnerability and criticality of the infrastructure of the water sector with the aim of deriving a prioritization for the allocation of maintenance investments.

The project was completed in 2018. In the first step of the investigation, the focus was on the exposure of the infrastructure elements. In the course of an intensive case study, a long list of external and internal hazards to water infrastructure elements was compiled, which could be grouped into three categories: natural hazards, terrorist attacks and technical/human failure. The findings show that the hazards to and from (failing) hydraulic structures go back a long way historically and have led to considerable damage, in some cases even to a high number of fatalities. A particular focus of the incidents is understandably in the area of dams and reservoirs and most of the damages are the result of severe flooding.

Criticality was analyzed on the basis of criteria and categorizations that exist for other

(especially network-based) critical infrastructures and that are common both in the scientific literature and in accordance with practical specifications and standards. The energy (supply) system, transport infrastructure and economic networks such as supply chains served as a blueprint for the criticality assessment. In a second step, the developed criticality and resilience criteria were transferred to the specifics of hydraulic engineering infrastructure.

The risk analysis carried out in the third step was mainly based on the dimension of structural vulnerability. Based on a data set provided by the BAW, a risk analysis was carried out for approx. 260 hydraulic structures of the West German canal network using a risk matrix. The results indicate an enormously high risk for most of the structures of the West German canal network. The analysis makes it possible to differentiate between risks that are specific for an entire building category and those that are rather general risks. At the same time, it became clear that the information content of the data which stem from condition inspections of the structures also makes a risk analysis more difficult as the degradation of the structure portfolio increases steadily. In addition to remedying the maintenance backlog, a more differentiated assessment of the infrastructure's condition is therefore advisable.



Sandy - From climate action plans to stakeholder-integrated building retrofitting: strategies, solution approaches and best practices for dynamic communities

Elias Naber and Rebekka Volk

Partner: EIFER (European Institute for Energy Research), KIT-Institute for Building Design and Technology, Building Science Group, cities of Baunatal (HE), Dortmund (NRW), Ebersberg (BY), Hamm (NRW), Hauzenberg (BY), Homberg (Efze) (HE)

Funding: Federal Ministry of Education and Research (BMBF)

Duration: 2014 to 2018

Deep energy retrofit of the German residential building stock is progressing slowly. One reason for this is that environmental policy instruments do not take sufficient account of the diversity and motivation of those who make a decision on the implementation of a refurbishment measure. In this context diversity refers, for example, to the current and future (and perceived) financial situation, the personal living perspective, the level of information and the location and condition of the building. In particular, demographic dynamics, which vary greatly from one area to another, have so far hardly been taken into account, so that the diversity of society and the resulting challenges and opportunities are largely ignored. The primary objective was redesign and improvement of existing instruments of environmental, social and housing market policy towards an effective deep energy retrofit offensive for residential buildings. The targeted offensive incorporates the interests and options of various stakeholders and creates a framework that enables many stakeholders to retrofit the diverse housing stock in Germany. Based on a socio-technical agent based model, the tools and strategies developed at the local level for the target group-oriented stimulation of deep energy retrofits of residential buildings are simulated at the national level in order to develop more effective and efficient instruments coordinated with the local level. The Sandy project was successfully completed in 2018. Results of the project are:

- Identification of seven types of building owners using multivariate statistical analysis and based on data from an online survey in the partner municipalities
- Population scenarios and scenarios for the municipal development in the partner municipalities with consideration of the high immigration to Germany in the year 2015
- Analysis of selected districts and neighbourhoods in the partner municipalities
- Toolbox and instrument collection with 21 instruments for increasing retrofit and support the deep energy retrofit offensive
- Simulation of the development paths for the national building stock with the result that progress in accordance with the status quo would fail to achieve the national targets of 2030 and 2050. A significant increase in the current subsidy rates and/or tax deductibility of the retrofit costs would not achieve the necessary potential exploitation. A stronger differentiation of financial support according to the initial and final condition of the buildings leads to more appropriate support and more activity. Effects caused by changes in actor strategies (behaviour) are large and must be considered as an essential success factor for a deep energy retrofit offensive.

In 2018, the project received an award from the NRW state government. The research project was honoured with admission to KlimaExpo.NRW.



Figure: Awarding ceremony of the project Sandy

SERIOR

Upper Rhine Trinational Graduate Academy SERIOR (Security – Risk – Orientation)

Sascha Meng

Partner: University of Basel, University of Freiburg, University of Koblenz-Landau, University of Upper Alsace, University of Strasbourg, National School for Water and Environmental Engineering, National Center for Scientific Research

Funding: SERIOR is co-financed by the EU through the European Regional Development Fund within the framework of the INTERREG V program Upper Rhine, as well as by the Swiss Confederation and the cantons of Basel-Stadt and Basel-Landschaft.

Duration: 01/2016 to 12/2018

The Upper Rhine Trinational Graduate Academy SERIOR aims to offer a new intercultural, interdisciplinary and practice-oriented training and supervision program for young scientists in the field of risk management in the Upper Rhine region. To this end, innovative programs and instruments for training and knowledge transfer are to be developed, tested and implemented – including summer schools, seminar series and methodological and didactic handbooks on the perception, assessment and communication of risks.

In 2018, KIT was primarily engaged with writing the "Security" handbook. This handbook is one of three handbooks produced within SERIOR and was developed together with project partners from the University of Koblenz-Landau and the Université de Strasbourg. The manual focuses on the description of experimental research methods in psychology (University of Koblenz-Landau, Université de Strasbourg) and economics (KIT). The result is a guideline that provides students and scientists with theoretical basics in this field as well as exemplary procedures for the planning, execution and

evaluation of laboratory experiments and field studies. Furthermore, KIT organized a lecture on "Cooperation in Crisis Management" as part of the SERIOR lecture series at KIT, which was given by Prof. Frank Fiedrich of the University of Wuppertal.



Figure: Prof. Dr. Frank Fiedrich, University of Wuppertal, during his lecture on "Cooperation in Crisis Management" at KIT.

The focus of this lecture was on factors for successful cooperation in crisis and disaster situations, in intra- and inter-organizational environments. Furthermore, Sascha Meng from KIT presented the project together with three other project members at the 27th Annual Conference of the Society for Risk Analysis Europe in Östersund in June 2018.



Sustainable Supply Chain Management. Carbon accounting in the supplier network: A sustainable decision support model.

Richard Müller, Andreas Schiessl

Partner/Funding: Industry

Duration: 10/2016 to 02/2018

While end customers are increasingly demanding sustainable produced products, some manufacturers also expect future regulatory frameworks that contain, for example, explicit specifications on the carbon footprint of a product. For this reason, it is becoming increasingly important to not only understand the internal production processes as well as to control them with regard to environmental impacts, but also to include the upstream supply chain in the considerations.

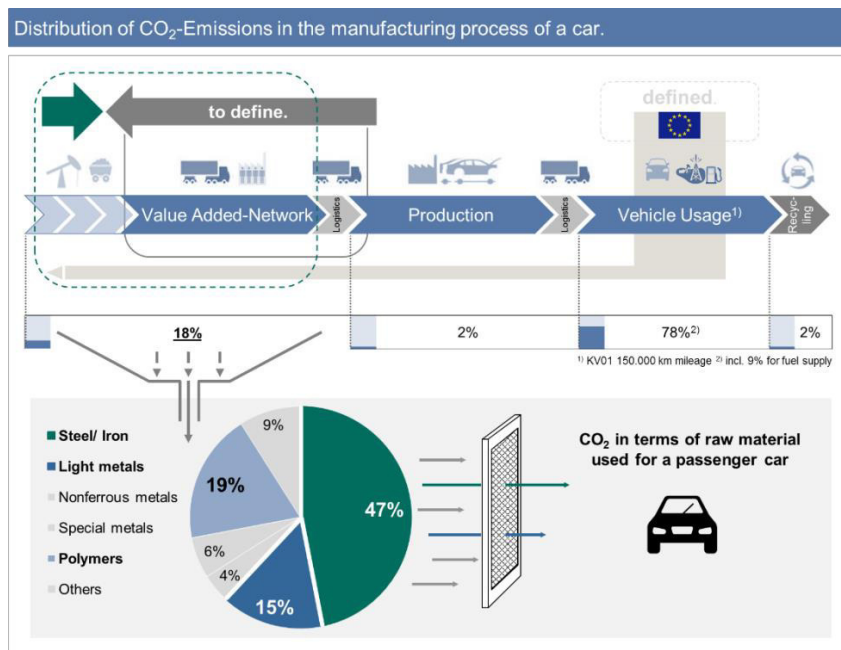
However, the fact that the environmental impact of individual suppliers is not always known to the focal company (OEM) and sometimes more than 100 suppliers are considered for a certain product (e.g. reference product passenger vehicle/car), illustrates a certain difficulty. This lack of transparency and the high number of suppliers require the development of a methodology for a standardized assessment of the environmental impact of individual suppliers and for taking the generated data into account during the sourcing process.

The assessment of CO₂e emissions for individual steel suppliers (integrated iron and steel mills) has

already been successfully demonstrated in a previous project and a standardized method based on the use of publicly available plant-specific data (ECCO₂ Steel - Evaluation Tool to compare CO₂e emissions of the iron and steel industry) has been developed.

Steel was chosen as a reference product, since steel has the largest impact on the selected reference product – passenger vehicle, in terms of the quantity of the material needed and the according carbon emissions generated during the manufacturing process.

In this research project, the methodology of estimating greenhouse gas emissions at specific sites was transferred to other materials and extended in order to be able to record the CO₂ footprint of a product in detail. For the automotive industry, this applies above all to light metals (aluminium) and plastics (e.g. polypropylene), which make up the second and third largest share of the vehicle after steel. With the goal of improving the long-term sustainability performance of companies, the tools developed (ECCO₂ Steel, ECCO₂ Alu and ECCO₂ Plastics) enable CO₂e emissions to be taken into account when selecting suppliers and further control of the environmental impact of a product.



Technical Secretariat of the Task Force on Techno-Economic Issues (TFTEI)

Carmen Schiel, Simon Glöser-Chahoud

Partner: Interprofessional Technical Centre for Studies on Air Pollution (CITEPA), Italian National Agency for New Technologies, Energy and Sustainable Economic Development (ENEA)

Funding: French Environment and Energy Management Agency (ADEME)

Duration: since 2002 (ongoing)

Since 2002, DFIU and CITEPA (France) form the Technical Secretariat of the former Expert Group on Techno-Economic Issues (EGTEI), now Task Force on Techno-Economic Issues (TFTEI). The work is primarily funded by the French environmental agency ADEME under the UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP). Between 2002 and 2008 several sector specific background documents with techno-economic information about air emission abatement techniques have been developed and revised. This information is considered in the Integrated Assessment Models (IAM) RAINS and GAINS, developed by the International Institute for Applied Systems Analysis (IIASA) in Laxenburg, Austria. Both models have been applied for the derivation of emission abatement strategies on UNECE and EU level.



After EGTEI focused on technical background documents for the revision of the Gothenburg Protocol and investment and cost calculation for emission abatement in large combustion plants in recent years, the work has been honoured in December 2014 by promoting the former Expert Group into a Task Force that is a constant part of the Working Group on Strategies and Review (WGSR). The current work focuses on VOC abatement in order to support the revision of the BREF STS and on emission abatement in the aluminium and cement sector. Furthermore, an information platform (the so-called Clearing House on Abatement Techniques) is built up and hosted by TFTEI. The results of the TFTEI activities shall be of use for the convention and its members, but particularly for the EECCA-region, where mission abatement strategies are currently developed.

THINKTANK „Industrial Resource Strategies“

Marina Maier, Sonja Rosenberg, Simon Glöser-Chahoud, Rebekka Volk

Partners: AUDI AG, Badische Stahlwerke GmbH, Carl Zeiss AG, Daimler AG, Robert Bosch GmbH, Scholz Recycling GmbH, SchwörerHaus KG, Umicore AG & Co. KG, German Chemical Industries Association (VCI) Baden Württemberg, Zeller+Gmelin GmbH & Co. KG.

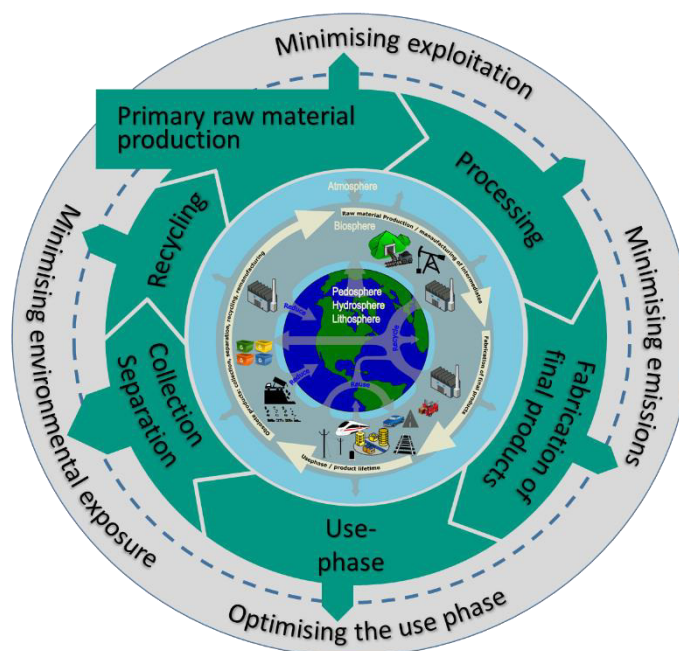
Duration: 01/18-12/21

In February 2018 the THINKTANK “Industrial Resource Strategies” was set up at the Karlsruhe Institute of Technology (KIT). This THINKTANK is a pioneer institution between policy, industry, and science to develop ideas and answers on questions concerning resource and raw material efficiency. The efficient usage, as well as the recycling and reuse of (raw) materials, have a high priority, especially in a Federal State like Baden Württemberg that only has a few natural resources, but is at the other hand a well-developed production location. Therefore, ideas and concepts to reduce its dependency on raw material imports and geopolitical crises should be developed within the THINKTANK.

Four institutes of the KIT are involved in the THINKTANK, among others the Institute for Industrial Production (IIP). Within the THINKTANK, we will work on topics such as

circular economy, resource efficiency alongside the entire supply chain. The circular economy framework will be applied holistically to achieve a more efficient material selection, to increase the collection and recycling rate, and to decrease the resource input. Furthermore, the impacts of important technical and social trends and transformation processes on resource demand and efficiency will be analysed.

Five pilot projects have been defined to set up the work of the THINKTANK. Those projects deal with questions in trending areas such as blockchains and digitalization, closed loops supply chains, circular economy and the 2nd life cycle of products.



Finite resource flow according to the Circular Economy Concept

Upper Rhine Cluster for Sustainability Research (URCforSR)

Jérémy Rimbon, Kira Schumacher, Rebekka Volk

Partner: University of Upper Alsace, University of Basel, University of Freiburg, University of Koblenz-Landau, University of Strasbourg

Funding: European Regional Development Fund (ERDF) under the INTERREG V Upper Rhine program

Duration: 2015 to 2018



The project "URCforSR" aims at strengthening scientific excellence and at the same time intensifying the interactions between science and society in the Upper Rhine region (URR), in particular with regard to the topic "governance of sustainable growth". The goal of the URCforSR is to establish a stable, long-term and efficient governance structure for cross-border cooperation. The funds approved by Interreg V and Swiss partners serve to provide start-up financing for the establishment of a steering structure to stabilize research cooperation in the URR.

In the course of the last three years, the consortium has been working on the following tasks:

- (1) The establishment of a stable and efficient management structure whose task is to provide favorable framework conditions for successful cooperation and to ensure quality of research.
- (2) The establishment of an office with two locations in Freiburg and Basel, which conduct the day-to-day operations of the cluster.

(3) The establishment of research cooperation along five thematic axes:

- Governance in multi-level systems
- Energy, infrastructure and societal change
- Transformation processes and technologies
- Management and development of resources
- Multiculturalism, multilingualism and sustainable development

(4) Networking with other science partners and society: The research cluster aims to collaborate with applied sciences and with politics, business and society.

(5) The research cluster will develop services for the wider public with the aim of promoting the topic of "governance of sustainable growth".

In 2018, the cluster launched several joint publication projects, organized an International Sustainability Conference and prepared a range of thematic workshops and various project proposals. The latter range from smaller binational funds to trinational proposals for the DFG / SNF / ANR cooperation and INTERREG to multinational COST action proposals. More information is available on the project website: <https://www.nachhaltigkeit-oberrhein.info>.

On September 17, 2018, the Trinational Workshop of Axis 2: "Energy, Infrastructure and Societal Change" took place at the Institut für Technikfolgenabschätzung (ITAS) in Karlsruhe. Here, Rebekka Volk presented project results from the project StAR-Bau with the case study region Baden-Württemberg with the title "Stakeholder and policy influence on regional material stocks and flows in the built environment". Subsequently, further project ideas in the area of energy, water and building infrastructures as well as eco-system services were discussed. A joint EU application is planned with partners of the University of Strasbourg and University of Landau-Koblenz, which will be further specified in January 2019.

Awards

In 2018, the project „**Sandy - Vom Klimaschutzkonzept zur zielgruppenorientierten Sanierungsoffensive: Strategien, Lösungsansätze und Modellbeispiele für dynamische Kommunen**“ received an award of the NRW-Government (North Rhine Westphalia). The research project was awarded with the inclusion in KlimaExpo.NRW. The project team received the award at the ceremony on 16.03.2018 in Dortmund.

Completed PhD Dissertations and Habilitations

PhD Dissertation: “Decision Support for Biomass Value Chains for the Production of Biochemicals Considering Uncertainties”

Ann-Kathrin Müller

The scarcity of fossil resources, the resulting geopolitical conflicts and global warming are leading many stakeholders worldwide to search for alternative raw materials. In particular, the chemical industry depends on fossil resources and is due to economic and socio-political reasons increasingly using bio-based raw materials for its production. The transformation to and improvement of a bioeconomy is therefore becoming more and more important. In order to be able to use bioeconomic concepts in the chemical industry, suitable value chains are required for the production of bio-based chemicals. These value chains are very different from petro-based structures because they are usually much more complex and more dependent on risks and uncertainties. These must be taken into account in strategic corporate decisions. Research currently focuses primarily on supply and demand risks in biofuel and bioenergy networks and supply chains. A holistic approach to bioeconomic value chains, starting with the cultivation of biomass containing starch and lignocellulose up to the production of biochemicals and other products for the sales market, has not yet been systematic. Against this background, a generic approach for strategic decision support under uncertainty for bioeconomic site and logistics planning is developed within the scope of this work, which is applied to the production of biochemicals as an example.

The approach developed in this work includes an integrated model and three sub-models. The optimization model optimizes the locations and capacities of pretreatment plants. These convert lignocellulosic biomass into processable intermediates. The model is used to identify suitable suppliers of pre-treated biomass. The technical model describes the conversion processes. Based on flowsheeting simulations, technical and economic evaluations of all considered conversion processes can be carried out. Production yields, utility demand, production costs and investments are the main

results of the technical model. The risk model identifies and evaluates risks and uncertainties that occur along biomass value chains. One result is the modeling of quantifiable risks by risk costs, which are based on probabilities and consequences. The risk costs are taken into account in the objective function of the integrated model. The probabilities are modeled as Monte Carlo simulation. The non-quantifiable risks are described in scenarios. In addition to the results of the three sub-models, other factors such as costs, transport restrictions, existing infrastructures, and suppliers etc. are considered in the integrated model. The integrated model is modeled as mixed integer, linear programming, which represents different biomass types, transport modes, intermediates, and uncertainties. In this work three case studies are considered: two biochemical and one thermochemical processing in the USA. As a result, the model suggests a nearly optimal location and the associated logistics network for the production of biochemicals.

The results are dependent on the biomass price, conversion yields and transport modes. In general, uncertainties have an impact on the structure of the value chain. Non-quantifiable risks in particular have a major impact and should therefore be taken into account in the decision-making process. The choice of raw material, the final product and other by-products are decisive for the feasibility of the value chain. In order to minimize delivery risks, a location close to several suppliers should be chosen. Barge is the preferred mode of transport for long distances. Although this work aims at using real data, the results should be critically questioned. All relevant data were taken from literature without further validation. Historical data on risks cannot generally be projected to the future. The approach assumes fixed capacities for production and storage. Nevertheless, the model offers a first approach to present various problems in complex biomass value-added chains and to solve them.

Staff as of December 2018

Head of the Chair of Business Administration, Production and Operations Management

Prof. Dr. Frank Schultmann

Administrative Staff

Katrin Grauer

Corinna Feiler (also working for the Chair of Energy Economics)

Liana Blecker (also working for the Chair of Energy Economics)

Josiane Folk (also working for the Chair of Energy Economics)

Heads of Research Groups

Dr. Simon Glöser-Chahoud – Sustainable Value Chains

Dr. Rebekka Volk – Project and Resource Management in the built environment

Dr. Marcus Wiens – Risk Management

Postdoctoral Researchers

Dr. Marina Maier

Research Associates and their PhD-topics

Mariana Bartsch: Impacts of natural disaster on supply chain performance

Florian Diehlmann: Public-Private Cooperation in Humanitarian Supply Chains (focus: humanitarian logistics modelling and optimization)

Felix Hübner: Scheduling of complex projects under uncertainty using the example of nuclear facility dismantling

Miriam Klein: Social resilience and cooperation in cross-border crisis management

Markus Lüttenberg: Public-Private Cooperation in Humanitarian Supply Chains (focus: game-theoretic modelling of incentive mechanisms)

Farnaz Mahdavian: Emergency Management and Evacuation Behavior

Carmen Schiel: Real Option Based Investment Strategies for Emission Abatement in Large Combustion Plants

Richard Müller: Planning and modelling of costs and CO₂-emissions along industrial supply chains – using the automotive industry as an example

Sascha Meng: Adversarial risk analysis in the context of uncertainty and social acceptance

Elias Naber: Socio-Technical Modeling and Agent-based Simulation of Deep Energy Retrofits in the German Building Stock - Mitigating Emissions Caused by Cooling and Heating of Buildings

Sonja Rosenberg: Effects of digitalisation in modelling of production

Andreas Rudi: Modelling regional biomass-based value chains

Hanns-Maximilian Schmidt: A mixed-methods approach towards the search for a final repository for nuclear waste

Heike Schmidt-Bäumler*: Risk-Based Maintenance Management System for Waterways Infrastructures

Kira Schumacher: Social acceptance of renewable energy installations in different national contexts – a comparative approach

Tobias Zimmer: Model-based assessment of mobile pre-treatment technologies in bioenergy value chains

*external researcher

International Collaboration and Exchange

Location: Adelaide, Australia

Staff: Richard Müller

Host: Prof. Dr. Noel Lindsay, University of Adelaide, Entrepreneurship, Commercialisation and Innovation Centre (ECIC).

Period: March until May 2018

Short description of stay:

The goal of Richard Müller's stay abroad was the scientific exchange in the field of methods for estimating CO₂ emissions in raw material extraction and processing as well as for the technoeconomic evaluation of "green" technologies and decarbonization.

During his stay, Richard Müller gained valuable experience in the evaluation of green technologies and especially in the methodology of estimating greenhouse gas emissions. Through oral presentations and bilateral discussions, the colleagues of the ECIC and Richard Müller were able to gain valuable insights into each other's current work and PhD projects. Through the intensive exchange, ideas for possible thematic extensions to the work at the KIT and the PhD project could be gained (especially in the field of handling greenhouse gas emissions in the upstream chains, such as the production of iron ore or crude oil).

Through the research stay, very close contacts could be established for further research work and for the work at KIT. Explicit to be mentioned are Dr. Barry Elsey (PhD Advisor and Senior Lecturer), who was always interested in scientific discussions, and Christian Hoyer, a PhD candidate in the field of Industry 4.0, with whom a very good exchange of scientific content has taken place daily.

The knowledge gained during the research stay on CO₂ emissions and costs along the value chain will also be used as examples in the exercise for the lecture "Grundlagen der Produktionswirtschaft" ("Foundations of Production Management") offered at KIT.



Location: Adelaide, Australia

Staff: Felix Hübner

Host: Prof. Dr. Noel Lindsay, University of Adelaide, Entrepreneurship, Commercialisation and Innovation Centre (ECIC).

Period: January until March 2018

Short description of stay: Since the colleagues at ECIC research in the field of project management, Felix Hübner interacted very closely on this topic especially with Assoc. Prof. Indra Gunawan. In particular, Felix shared his knowledge about complex project management in oral presentations and bilateral discussions. Furthermore, he had the opportunity to gain valuable experience and the colleagues' knowledge about complex project management. Some of the learning outcomes and examples of complex projects in Australia are integrated in the lecture "Project Management".

In the field of data collection and data use for complex project planning, the research gap of collecting lessons learned was identified. Therefore, Felix and Dr. Graciela Corral de Zubielqui (Associated Head of the Research at ECIC and Senior Lecturer for Project Management at ECIC) conducted a literature review to further investigate this research gap. Through their literature review, they identified suitable tools and techniques for collecting lessons learned in complex projects.

As an expert in project management, Felix conducted the Career and Research Skills Training (CaRST) in Project Management for students of the University of Adelaide. In total, 14 students attended the intense one-day workshop. After 6 hours of condensed knowledge in project management the students played a business game to apply their project management skills at the real-life project of building the Berlin airport from scratch.

This research stay was funded by the Karlsruhe House of Young Scientists (KHYS).



Figure 1: Group Work playing the business game



Figure 2: Students of the CaRST-workshop together with Prof. Frank Schultmann (seventh from left) and Felix Hübner (first from left)

International Collaboration and Exchange

Location: Los Angeles, USA

Staff: Dr. Rebekka Volk

Host: Prof. Dr. Lucio Soibelman, University of Southern California (USC) Los Angeles, USC Viterbi School of Engineering, Sonny Astani Department of Civil and Environmental Engineering.

Period: March until July 2018

Short description of stay: Between March and July 2018, Dr. Rebekka Volk completed a research visit as a Visiting Scholar at the Sonny Astani Department of Civil and Environmental Engineering at the University of Southern California (USC) in Los Angeles (CA, USA). During that time Rebekka further developed the cooperation and the scientific exchange and collaboration with the employees and PhD students of i-Lab regarding sensors, drone surveys of neighborhoods, automated building detection and data processing, as well as the creation of thermal point clouds and the localization of energy losses.

Together with her host, Prof. Lucio Soibelman, and two PhD students Meida Chen and Yu Hou, Rebekka developed requirements, drone flight procedures and organized and performed field test on USC campus. The data required for research, analysis and publication was recorded on the USC campus on May 31, 2018 using a drone and thermal camera and is currently being processed and evaluated. In addition, additional equipment was procured by the USC in order to collect further data for the joint research project.

The collaboration led to a first joint conference contribution on this topic submitted in October 2018. A second joint work is planned based on the result of a research stay of PhD candidate Yu Hou during Dec 2018/Jan 2019 at the Institute for Industrial Production (IIP), Karlsruhe Institute of Technology (KIT). This research stay, as well as a second stay in summer 2019 will be funded by DAAD grant.



USC Viterbi



Visit of Vietnamese Delegation from Hanoi

Staff: Dr. Rebekka Volk, Phuong Khuong Minh, Prof. Dr. Frank Schultmann

Period: April 2018

Partnering institutions: City of Hanoi, Hanoi Institute of Socio-Economic Development (HISEDs), Hanoi Institute of Urban Planning (HUPI), Hanoi Department of Natural Resources and Environment (HANAT), Vietnam Institute for Urban and Rural Planning (VIUP), University of Science in Hanoi (VNU), Electrical Power University (EPU), University of Transport and Communications (TRANCONCERN)

Short description: In April 2018, a delegation of Hanoi city representatives and university members visited KIT and especially the Institute for Industrial Production (IIP) during their 10 days' stay in Germany. The visit was a return visit to the previous delegation travel of KIT staff members (funded by DAAD) in December 2017 to Hanoi.

Goal of the visit of the Vietnamese delegates to KIT was the establishment of a closer cooperation within the project consortium for the planned project "Urban-CCC – Integrated urban development for climate change challenges in Hanoi". The consortium submitted their project proposal at BMBF in April 2018 to the program "Nachhaltige Entwicklung urbaner Regionen".

List of delegates:

1. Mr. Nguyen Thanh Cong, Vice Director of Institute, Hanoi Institute for Socio-Economic Development Studies (HISEDs), Leader
2. Mr Pham Gia Luong, Head of Division, Division of Planning and Urban Design, Project Quantity Control and Training, Hanoi Urban Planning Institute (HUPI), Member
3. Mrs. Nguyen Thi Khanh Linh, Research, Department of Urban Studies, Hanoi Institute for Socio-Economic Development Studies (HISEDs), Member
4. Mr. Nguyen Ba Phan, Officer, Department of Hydro - Meteorological Forecasting and Climate change, Hanoi Department of Natural Resources and Environment, Member



Figure: Delegation visit at KIT



Figure 1: Delegation visit at KIT

Figure 2: Visit of Mr. Phạm Vũ Thắng (Director of Center for International Training and Education, UEB, VNU)

On November 7th 2018, Mr. Phạm Vũ Thắng (Univeristy of economics and Business, Vietnam National University, Hanoi) also visited KIT to investigate on future collaboration topics such as environmental pollution, environmental city and province governance and education with Rebekka Volk from the Institute for Industrial Production (IIP).

Teaching Activities

The Chair of Business Administration, Production and Operations Management offers several modules in the fields of Production and Operations Management, Risk Management, Project Management, Supply Chain Management and Logistics, and Sustainability. During 2018 more than 900 student exams were conducted and the chair has supervised 70 bachelor and master thesis.

Grundlagen der Produktionswirtschaft / Foundations of Production Management

Prof. Dr. F. Schultmann, Dr. Rebekka Volk, Richard Müller, Elias Naber, Felix Hübner

~180 students

This course aims to make students familiar with basic concepts of industrial production economics and logistics. The main contents are the different strategic, tactical and operational production strategies and layouts, as well as planning and management methods. The terms and tasks of industrial production are defined and described by interdisciplinary and system approaches. Furthermore, warehouse location problems, operational site planning and production design problems as well as decision making are in the focus. Qualification aims are to enable students to describe the field, to reproduce and analyse decisive aspects and decisions in industrial production contexts, to know, model and solve key planning tasks of strategic production management and logistics.

Logistics & Supply Chain Management

Dr. Marcus Wiens, Florian Diehlmann

~100 students

Students learn the central tasks and challenges of modern logistics and supply chain management. They learn and apply methods of risk evaluation and risk management in supply chains like market forecasts, the Bullwhip effect and the difference between a lean and a robust supply chain. Further aspects comprise the analysis and development of efficient incentive-schemes and planning-tools relevant to procurement decisions, optimal location decisions, order management and supplier relationship management.

Produktions- und Logistikmanagement/ Production and Logistics Management

Dr. Simon Glöser-Chahoud

~120 students

This course covers central tasks and challenges of operational production and logistics management. Systems analytically, central planning tasks are discussed. Exemplary solution approaches for these tasks are presented. Further practical approaches are explained. Students get to know the set-up and mode of operation of planning systems such as PPS, ERP and APS to cope with the accompanying planning tasks. Alongside to MRP II, students are introduced to integrated supply chain management approaches in Supply Chain Management.

Anlagenwirtschaft/ Planning and Management of Industrial Plants

Dr. Simon Glöser-Chahoud

~160 students

This course familiarizes students with industrial plant management along the entire life cycle, starting with the initiation and erection up to operating and dismantling. Students learn how to deal with important methods to plan, realize and supervise the supply, start-up, maintenance, optimization and shut-down of industrial plants. A focus is also given to specific characteristics of plant engineering, commissioning and investment.

Project Management

Prof. Dr. F. Schultmann, Dr. Rebekka Volk, Felix Hübner, Kira Schumacher, Marcus Wiens, Carmen Mayer, Sonja Rosenberg

~60 students

This lecture introduces the basics of project management starting with a general introduction on projects and standards in the field. Then, scope management as well as time, cost and resource management principles are addressed and emphasised. Furthermore, aspects of risk, stakeholder and quality management are described and considered and, communication, negotiation, leadership and controlling in the project management context is examined. The lecture is deepened with practical exercises and complemented by a business game. Furthermore, we are happy to have two invited talks this semester from employees of Campana & Schott (<https://www.campana-schott.com/de/de/>), an international management and technology consultancy with more than 300 employees in Europe, the US and Canada. The talks will cover the topics "The role of the project manager" and "Agile Methods of Project Management" from a practical perspective.

Risk Management in Industrial Supply Networks

Dr. Marcus Wiens, Miriam Klein

~50 students

Students learn methods and tools to manage risks in complex and dynamically evolving supply chain networks. Students learn the characteristics of modern logistics and supply chain management and learn to identify and analyse the arising risks. On the basis of this overview on supply chain management, the students gain knowledge about approaches and methods of industrial risk management. Key aspects include the identification of major risks, which provide the basis for the development of robust networks, together with risk reduction techniques like risk diversification, risk pooling and risk transfer. This provides the students profound knowledge for supply chain risk analysis and for the design of strategic and tactic risk prevention and mitigation measures for supply networks.

Supply Chain Management in the Automotive Industry

Prof. Dr. Frank Schultmann, Dr. Tilman Heupel (BMW AG), Hendrik Lang (BMW AG)

~100 students

Students learn concepts, methods and tools on various aspects of automotive supply chain management. Through concrete application examples of a globally operating automobile manufacturer, the students recognize challenges that are connected with the implementation of these solutions. The students learn theoretical concepts as well as their practical implementation in the context of value chains, procurement logistics, risk management, quality engineering, cost engineering and purchasing, and they can identify, analyse, and evaluate problems in these areas as well as design adequate solutions. At the end of the lecture, students are able to identify links in these fields and to classify them into the overall context of the value chain and the product development process of an automobile manufacturer.

Sustainable Production

Prof. Dr. F. Schultmann, Dr. J r my Rimbon

~50 students

This course offers an introduction into the basics of sustainability and the linkage of sustainability to production and logistics. Examples of sustainability assessments and sustainable production systems illustrate actual challenges for the transformation of current production environments into sustainable structures.

Teaching at the Chair for Business Administration, Production and Operations Management

BSc-Module
„Production Management“

- Introduction to Production Management (SS, 5,5 ECTS)
- Sustainable Production (WS, 3,5 ECTS)
- Logistics and Supply Chain Management (SS, 3,5 ECTS)

MSc-Module
“Planning and Management of Industrial Plants“

- Planning and Management of Industrial Plants (WS, 5,5 ECTS)
- Emissions and Environment (WS, 3,5 ECTS)
- Life Cycle Analysis (WS, 3,5 ECTS)
- International Management in Engineering and Production (WS, 3,5 ECTS)

MSc-Module
“Production and Logistics Management“

- Production and Logistics Management (SS, 5,5 ECTS)
- Supply Chain Management with Advanced Planning Systems (SS, 3,5 ECTS)
- Project Management (WS, 3,5 ECTS)
- Supply Chain Management in the Automotive Industry (WS, 3,5 ECTS)
- Risk Management in Industrial Supply Networks (WS, 3,5 ECTS)

Publications

Peer-Reviewed Journals

- Gunawan, I., Zarghami, S. A., Schultmann, F. (2018). Integrating Typological and Hydraulic Attributes for Robustness Analysis of Water Distribution Networks. *Industrial Engineering and Operations Management* (forthcoming)
- Glöser-Chahoud, S., Pfaff, M., Walz, R., Schultmann, F. (2018). Simulating the service lifetimes and storage phases of consumer electronics in Europe with a cascade stock and flow model. *Journal of Cleaner Production*
- Glöser-Chahoud, S.; Schultmann, F. (2018) [article in press]. Potential Contribution of Secondary Materials to Overall Supply – The Example of the European Cobalt Cycle. Special Issue on the International Workshop E-Mobility & Circular Economy, Scientific.Net: Materials Science and Engineering
- Hübner, F.; Volk, R.; Schultmann, F. (2018). Project management standards: strategic success factor for projects. *International journal of management practice*, 11 (4), 372-399. <https://doi:10.1504/IJMP.2018.095145>
- Müller, R.; Loster, M.; Volk, R.; Schultmann, F. (2018): CO₂ -based assessment for sustainable production planning in the metal processing industry. 2018. *Procedia manufacturing*, 21, 289–296. <https://doi:10.1016/j.promfg.2018.02.123>
- Petig, E.; Rudi, A.; Angenendt, E.; Schultmann, F.; Bahrs, E. (2018) Linking a Farm Model and a Location Optimization Model for Evaluating Energetic and Material Straw Valorization Pathways – A Case Study in Baden-Wuerttemberg. *GCB Bioenergy*. [accepted for publication]. doi:10.1111/gcbb.12580
- Pfaff, M.; Glöser-Chahoud, S.; Chrubasik, L.; Walz, R. (2018). Resource efficiency in the German copper cycle: Analysis of stock and flow dynamics resulting from different efficiency measures. *Resources, Conservation and Recycling*. doi: 10.1016/j.resconrec.2018.08.017
- Schiel, C.; Glöser-Chahoud, S.; Schultmann, F. (2018). A real option application for emission control measures. *Journal of business economics*. doi:10.1007/s11573-018-0913-9
- Schumacher K.; Krones F.; McKenna, R.; Schultmann, F. (2018) Public Acceptance of Renewable Energies and Energy Autonomy: A Comparative Study in the French, German and Swiss Upper Rhine Region. *Energy Policy* [accepted for publication].
- Volk, R.; Hübner, F.; Hünlich, T.; Schultmann, F. (2019). The future of nuclear decommissioning – A worldwide market potential study. *Energy policy*, 124, 226–261. <https://doi:10.1016/j.enpol.2018.08.014>
- Volk, R.; Luu, T. H.; Mueller-Roemer, J. S.; Sevilmis, N.; Schultmann, F. (2018): Deconstruction project planning of existing buildings based on automated acquisition and reconstruction of building information. 2018. *Automation in construction*, 91, 226-245. <https://doi:10.1016/j.autcon.2018.03.017>
- Zarghami, S. A., Gunawan, I., Schultmann, F. (2018). System dynamics modelling process in water sector: a review of research literature. *Systems Research and Behavioral Science* 35 (6), 776-790. <https://dx.doi.org/10.1002/sres.2518>

Zarghami, S. A., Gunawan, I., Schultmann, F. (2018). Integrating Entropy Theory and Cospanning Tree Technique for Redundancy Analysis of Water Distribution Networks. *Reliability Engineering and System Safety* 176, 102-112. doi:10.1016/j.res.2018.04.003

Conference Proceedings and Working Papers

Arnold, M.; Rudi, A.; Glöser-Chahoud, S.; Schultmann, F. (2018). Identifying potential biomass conversion sites in Baden-Wuerttemberg – A concept based on Multi Criteria Analysis and Geographic Information System. *International Sustainability Conference, Strasbourg, France, 27.-28.09.2018*

Glöser-Chahoud, S.; Schultmann, F. (2018). Potential Contribution of Secondary Materials to Overall Supply – The Example of the European Cobalt Cycle. *International Workshop E-Mobility & Circular Economy, 06.-08.06.2018 Freiberg, Germany*

Glöser-Chahoud, S. (2018). Simulation von Rohstoff-Kreislaufsystemen mit System Dynamics. 24 STUNDEN FÜR RESSOURCENEFFIZIENZ: Der Ressourceneffizienz-Kongress für Nachwuchsforscherinnen und Nachwuchsforscher 27.– 28.02.2018, HS Pforzheim

Hübner, F.; Möller, S.; Schultmann, F. (2018). Entwicklung eines Expertensystems für die Planung kerntechnischer Rückbauprojekte. *Working Paper, Karlsruhe.*

Klein, M.; Rigaud, E.; Wiens, M.; Adrot, A.; Fiedrich, F.; Kanaan, N.; Lotter, A.; Mahdavian, F.; Schulte, Y.; Schultmann, F. (2018). A Multi-Agent System for Studying Cross-Border Disaster Resilience. *ISCRAM 2018 Conference Proceedings – 15th International Conference on Information Systems for Crisis Response and Management, May 20-23, 2018, Rochester, NY, USA. ISBN: 978-0-692-12760-5.*

Rosenberg, S.; Maier, M.; Glöser-Chahoud, S.; Schultmann, F. (2018). Conceptual economic and ecological evaluation for a Closed-Loop Supply Chain in the Automotive Industry. *VHB Herbsttagung der Wissenschaftlichen Kommission zu Nachhaltigkeitsmanagement, 4.-5.10.2018, Universität Augsburg*

Schiel, C.; Glöser-Chahoud, S.; Schultmann, F. (2018). Real Option Thinking: Policy Implications for Environmental Investments. 28. *International Sustainability Conference of the Upper Rhine Cluster for Sustainability Research, Strasbourg, France, 27.-28.09.2018*

Schiel, C.; Glöser-Chahoud, S.; Schultmann, F. (2018). Assessing emission control techniques in LCP: Techno-economic aspects and investment strategies External Link. 27. *ExPPERTS Europe: Exploring Power Plant Emission Reduction Techniques and Strategies, Wroclaw, Poland, 26.-27.09.2018*

Rudi, A.; Liebscher, C.; Fröhling, M.; Schultmann, F. (2018). Heuristic-based Iterative Optimization for Evaluating Regional Bio-based Value Chains through GIS and OR Model Combination. *OR2018, Brussels, Belgium, 12.-14.09.2018*

Zimmer, T.; Arteaga-Pérez, L.; Segura, C.; Walter, M.; Mayer, C.; Schultmann, F. (2018). Export of regular and torrefied wood pellets from Chile to Europe and Asia. 26th *European Biomass Conference and Exhibition (EUBCE 2018), Copenhagen, Denmark, 14.-17.05.2018.*

Zimmer, T.; Diehlmann, F.; Glöser-Chahoud, S.; Schultmann, F. (2018). A simulation-optimization approach for the assessment of bioenergy supply chains under uncertainty. 7th *International Conference on Sustainable Energy and Environment (SEE2018), Bangkok, Thailand, 28.-30.11.2018.*

Zimmer, T.; Schumacher, K.; Glöser-Chahoud, S.; Schultmann, F. (2018). Modelling the impact of biomass-based value chains on local feedstock prices. *Gemeinsamer Workshop der Arbeitsgruppen "OR im Umweltschutz" und "Supply Chain Management" der Gesellschaft für Operations Research (GOR) e.V. und des Netzwerks Industrial Ecology, Ulm, 20.-21.03.2018.*

Books and Book Chapters

- Adrot, A.; Fiedrich, F.; Lotter, A.; Münzberg, T.; Rigaud, E.; Wiens, M.; Raskob, W.; Schultmann, F. (2018): Challenges in Establishing Cross-Border Resilience. In: Fiedrich, F.; Fekete, A. (Hrsg.): *Urban Disaster Resilience and Security*, Springer, 429-455.
- Fath, K. (2018): *Technical and economic potential for photovoltaic systems on buildings*, Karlsruhe: KIT Scientific Publishing, 283 Seiten, Englisch, ISBN: 978-3-7315-0787-1, Series: *Produktion und Energie*, Band 25, Dissertation, Karlsruher Institut für Technologie (KIT), 2017, Hochschulschrift, <https://publikationen.bibliothek.kit.edu/1000081498/14534279>
- Gentile, M.; Gentile, E.; Loi, A.; Mayer, C.; Rosenberg, S.; Rudi, A.; Schultmann, F. (2018) Report to DG AGRI of the EC: *STUDY ON STORAGE CAPACITIES AND LOGISTICAL INFRASTRUCTURE FOR EU AGRICULTURAL COMMODITIES TRADE* (with a special focus on Cereals, the Oilseed Complex and Protein Crops (COP)). doi: 10.2762/62642
- Hübner, F.; Volk, R.; Secer, O.; Kühn, D.; Sahre, P.; Knappik, R.; Schultmann, F.; Gentes, S.; Both, P. von. (2018). *Modellentwicklung eines ganzheitlichen Projektmanagementsystems für kerntechnische Rückbauprojekte (MogaMaR): Schlussbericht des Forschungsvorhabens*. KIT Scientific Publishing, Karlsruhe. <https://doi:10.5445/KSP/1000080517>
- Kühlen, A.; Stengel, J.; Volk, R.; Schultmann, F.; Reinhardt, M.; Schlick, H.; Haghsheno, S.; Mettke, A.; Asmus, S.; Schmidt, S.; Harzheim, J. (2018): *ISA: Immissionsschutz beim Abbruch - Minimierung von Umweltbelastungen (Lärm, Staub, Erschütterungen) beim Abbruch von Hoch-/Tiefbauten und Schaffung hochwertiger Recyclingmöglichkeiten für Materialien aus Gebäudeabbruch*. 2018. Serie: *Produktion und Energie*, Band 16, KIT Scientific Publishing, Karlsruhe. <https://doi:10.5445/KSP/1000055155>
- Wiens, M.; Schätter, F.; Zobel, C.; Schultmann, F. (2018): *Collaborative Emergency Supply Chains for Essential Goods and Services*. In: Fiedrich, F.; Fekete, A. (Hrsg.): *Urban Disaster Resilience and Security*, Springer, 145-167.
- Wiens, M.; Raskob, W.; Diehlmann, F.; Wandler, S.; Schultmann, F. (2018). *Exposure and vulnerability of the energy system to internal and external effects. Energy as a Sociotechnical Problem*. Ed. by Christian Büscher, Jens Schippl, Patrick Sumpff., 96-122, Routledge, London.

