Karlsruhe Institute of Technology

Institute for Industrial Production

Annual Report 2017

Chair of Business Administration, Production and Operations Management




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Preface

This first annual report from the Chair Business Administration, Production and Operations Management at the Institute for Industrial Production (IIP), Karlsruhe Institute of Technology (KIT) sketches our main activities during the year 2017. Our three research groups "Sustainable Value Chains", "Risk Management", and "Project and Resource Management in the Built Environment" have conducted several projects on a regional, national and international level covering a broad range of topics. The team of the Chair consists of about 20 researchers, 4 administrative staff and a several student assistants.

During 2017, we worked on 21 third party funded research projects. We published 11 peer-reviewed journal articles, numerous conference proceedings books and book chapters and 2 PhDs were completed. Teaching activities resulted in around 900 exams and about 80 bachelor and master theses were supervised. Various international collaborations and international staff exchanges completed our activities

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

Prof. Dr. Frank Schultmann,

Chair of Business Administration, Production and Operations Management

Sustainable Value Chains

*Head of research group: Dr. Simon Glöser-Chahoud (as of December 2017)**

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, technological, ecological and social aspects.

To cope with the related manifold problems, different approaches from economics, engineering as well as environmental and social sciences are successfully 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 flow, 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 stream management and for the decision support on 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 costs estimation
- investment decision making
- Operations Research based modelling
- empirical social studies (especially questionnaire design and statistical methods)
- Life Cycle Assessment

Members of the research group (from t.l. to b.r.): Ann-Kathrin Müller (until 07/2017), Sophia Radloff (until 05/2017), Sonja Rosenberg, Carmen Mayer, Andreas Rudi, Tobias Zimmermann, Kira Schumacher. Not on the picture: Dr. Simon Glöser-Chahoud

*interim heads of the research group were also S. Radloff, A.K. Müller and Carmen Mayer

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, critical infrastructure, industrial value chains and behavioural risks.

In 2017, the *Risk Management* 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 behavioural risk analysis on the other. As already in 2016, the behavioural research agenda was based on economic lab experiments with a focus on adversarial risks and trust in the course of the SERIOR-project and collective decision making and negotiations in the research project EXPANDER. In the area of applied risk and crisis management the work on our sub-topic on "effects of extreme events on supply chains" as part of the KIT risk network CEDIM advanced. At the beginning of the year 2017 a new research collaboration between IIP and the Federal Waterways Engineering and Research Institute (Bundesanstalt für Wasserbau, BAW) was established and already in spring 2017, BAW and the risk research group drafted a joint 1-year project on Critical Infrastructure interdependencies with a special focus on waterway infrastructure. A particular success of the risk research group was the acquision of the DFG-ANR-project INCA which is conducted by a French-German consortium and which deals with the topic of cross-border resilience. In this project, IIP – as a coordinator – collaborates with the University of Wuppertal and with two French universities, Paris Dauphine and Paris MINES Tech. The project kick-off was in March 2017 at the IIP, the project duration is three years. For INCA, our new research associate, M.Sc. Miriam Klein, strengthens our team and works on this project for the coming years. In 2017, our group gained two further members: M.Sc. Farnaz Mahdavian and M.Sc. Florian Diehlmann. Farnaz holds a KHYS grant and is working for her Ph.D. on the topic of evacuation behaviour during natural disasters. Florian strengthens our logistics and supply chain competence and works on the research topic of a public private emergency collaboration (PPEC), for the time being in the context of the Supply Chain Lab. The outlook for 2018 indicates a further convergence of research topics of the group, namely the application of behavioural aspects together with logistical and game-theoretical approaches on concrete risk and crisis management contexts.

Members of the research group (from l. to r.): Sascha Meng, Farnaz Mahdavian, Hanns-Maximilian Schmidt, Mariana Bartsch, Thomas Münzberg, Marcus Wiens, Miriam Klein (not on the picture: Florian Diehlmann)

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.

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, its energetic quality and technical equipment as well as its owners and residents; it 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.

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. 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 development of cost-potential methods for renewable energies in residential building stocks and municipalities, the model-based analysis of material flows, resources and resource efficiency in the construction sector, optimization in project management of nuclear decommissioning projects and stakeholder analysis in Baden-Württemberg and Germany as well as the of the application of these methods in southeast Asian countries (Vietnam) and 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 (graduated in 2017).

Research Projects

Bio-Energy System Analysis (BESA) – Establishment of a working group for bio-energy system analysis

Tobias Zimmer, Sophia Radloff, Florian Diehlmann

Partner: Joint Graduate School of Energy and Environment (JGSEE) - King Mongkut's University of Technology Thonburi (KMUTT), Technical University of Hamburg-Harburg (TUHH), Trier University of Applied Science, CUTEC Institut GmbH, Clausthal-Zellerfeld

Funding: Federal Ministry of Education and Research (BMBF)

Duration: 2015 to 2017

During the project, a Thai-German working group on bioenergy system analysis was initiated and established. Aim of this network is to carry out system analyses with focus on renewable raw materials and energies in Thailand. This includes the estimation of sustainable biomass potentials as well as techno-economic utilization strategies for the available biomass resources. It is reflected if and how the set of political targets can be achieved or need revision. The results therefore serve as decision support for science, industry and politics. Moreover, current research topics in Thailand are connected and the application process for subsequent research activities is facilitated.

In the first part of the project, the biomass potential in Central Thailand was analysed by scientists at the JGSEE in Bangkok. The supply was estimated to be more than 125 million tons of agricultural residues per year, mainly from the cultivation of rice and sugarcane. Residues with good fuel properties, such as sugarcane bagasse, are mostly utilized as fuel in sugar mills. As a result, the remaining energetic potential is mainly based on rice straw. However, rice straw is considered a challenging feedstock with high ash content and various logistical obstacles during collection and transport. In order to account for these uncertainties, a simulation model for the economic assessment of the entire rice straw value chain was developed during the second stage of the project. The results indicate that the utilization of rice straw in conventional combustion plants as well as more efficient gasification plants is generally not profitable. However, rice straw pellets for small-scale heating applications and upgraded pyrolysis oil as a substitute for diesel fuel were identified as promising utilization paths.

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 2006 (ongoing)

The *Center for Disaster Management and Risk Reduction Technology (CEDIM)* is an interdisciplinary research center of KIT in the field of disaster management. 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 under the roof of CEDIM, dealing with supply chain vulnerability under consideration of global interconnectedness (IIP) and changed consumer mobility requests in the aftermath of a disaster (ECON).

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)

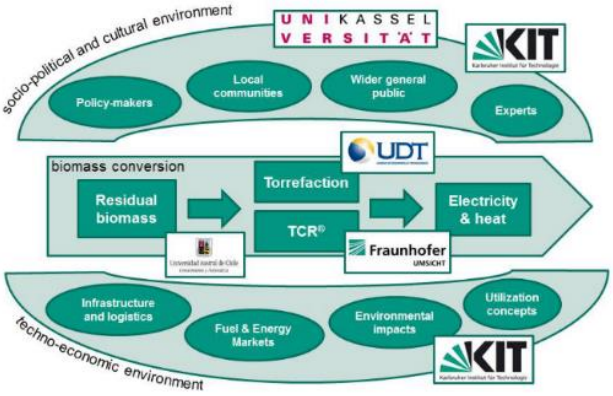
Funding: Federal Ministry of Education and Research (BMBF)

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.



Raw materials of strategic economic importance (r^4)

Innovative technologies for resource efficiency – Provision of raw material of strategic economic importance

Sonja Rosenberg, Sophia Radloff

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 (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.

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

Carmen Mayer

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 Environment and Energy Management Agency ADEME under the United Nations Economic Commission for Europe (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 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 focusses on VOC abatement in order to support the revision of the BREF STS (Best Available Techniques Reference Document for Surface Treatment using Organic Solvents).

The TFTEI Technical Secretariat developed two Emission Reduction Investment and Cost Calculation (ERICCa) tools. These tools enable cost calculations for emission reduction measures in large combustion plants (ERICCa_LCP) and for VOC reduction measures in the automotive and packaging printing industry (ERICCa_VOC). The ERICCa tools are free of use and publicly available on tftei.citepa.org. The results of the TFTEI activities shall be of use for the convention and its members, but particularly for the EECCA (Eastern Europe, Caucasus and Central Asia)-region, where emission abatement strategies are currently being developed.

**This initiative is primarily hosted by the French-German Institute for Environmental Research (DFIU)*

Upper Rhine Cluster for Sustainability Research (URCforSR)*

Jérémy Rimbon, Kira Schumacher, Johannes Schäuble (Chair of Energy Economics)

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, 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 Upper Rhine.

To achieve this, the following sub-goals have been defined:

(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 2017, the cluster launched several joint publication projects and prepared a rage of thematic workshops and various project proposals. The latter range from smaller binational funds between scientists from Freiburg and Strasbourg to trinational proposals for the DFG / SNF / ANR cooperation and INTERREG to multinational COST action proposals.

**This initiative is primarily hosted by the French-German Institute for Environmental Research (DFIU)*

Resilience of critical waterway infrastructure

Mariana Bartsch, Heike Schmidt-Bäumler

Partner: Federal Waterways Engineering and Research Institute

Funding: Federal Waterways Engineering and Research Institute

Duration: 2017 to 2018

The current conditions and aging of the waterway infrastructure elements in Germany reveal the need for an appropriate maintenance and construction strategy. For most of the elements measures have to be implemented very fast, but are e.g. limited to the available resources. Beside this it can be assumed that the elements themselves are risks, as they could fail due to the aforementioned circumstances. That is why a risk orientation has to be integrated to the current maintenance and construction strategy.

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

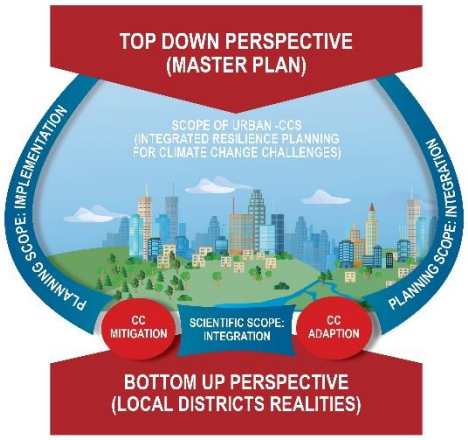
Rebekka Volk

Partner: KIT-Institute or Regional Science, KIT-Regional Planning and Building in Rural Areas, KIT-Institute for Transport Studies, KIT-Institute of Applied Geosciences, KIT-Institute for Water and River Basin Management, KIT-Institute for Technology Assessment and Systems Analysis, 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: 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 2017, URBAN-CCC has conducted a Fact Finding Mission to Hanoi, during which the project development and conceptualization has been concretized in joint workshops. Furthermore, joint field meetings were held to understand the multiperspective discussion of current problems and local stakeholders outside the scientific field were identified and motivated for supporting the 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)

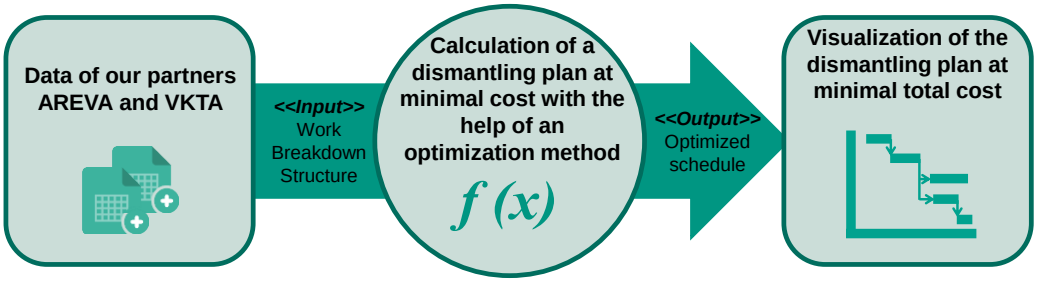
Duration: 2014 to 2017

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.



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

Richard Müller

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

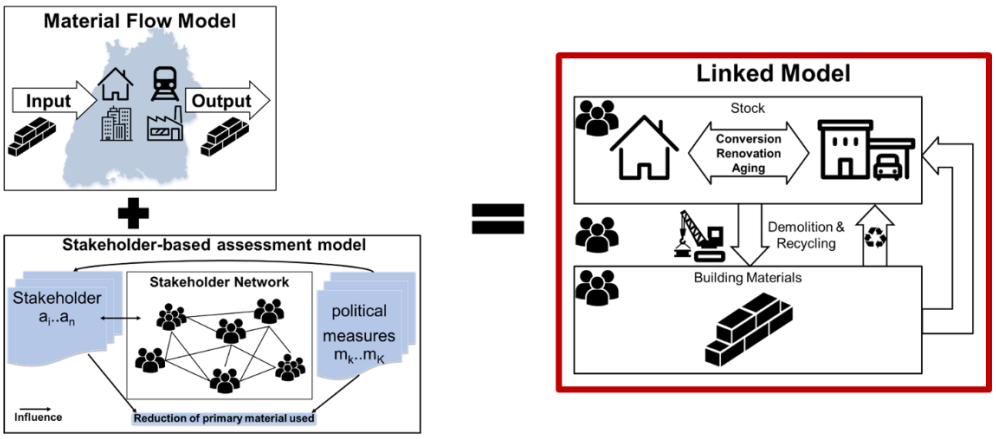
Funding: Baden-Württemberg Stiftung

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, it is planned to derive from this evaluation suitable instruments and control options as well as recommendations for action from the state's point of view to implement corresponding recycling economy concepts.



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

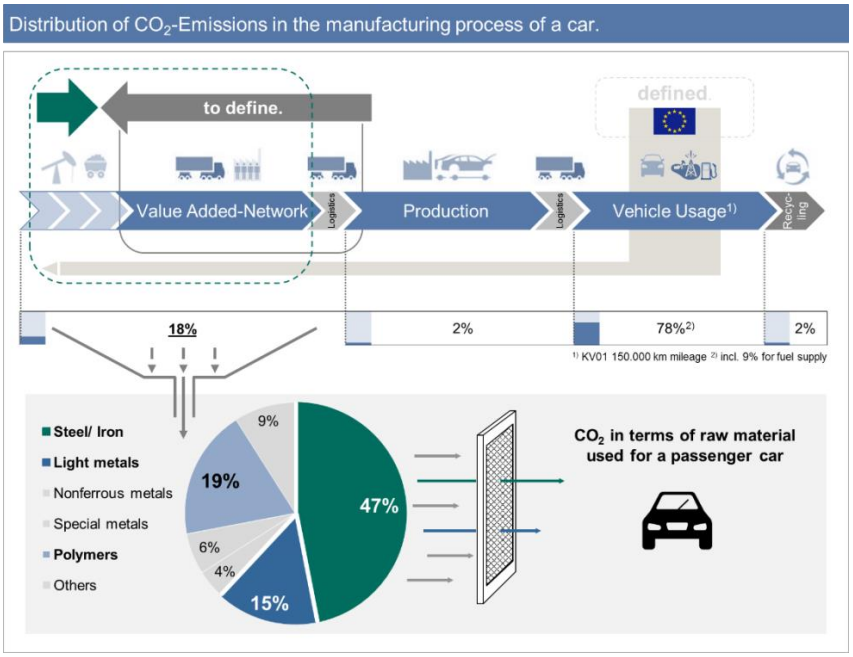
Richard Müller, Andreas Schiessl

Partner/Funding: Industry

Duration: 2016 to 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 CO_2 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 ($ECCO_2$ Steel - Evaluation Tool to compare CO_2 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, further materials are to be integrated into the existing tool in order to be able to record the carbon footprint of a product in detail. For the automotive industry, this applies primarily to light metals and plastics, which account for the second and third largest share of the vehicle after steel.
Against the background of improving a company's long-term sustainability performance the new developed tool allows CO_2 emissions into account when selecting suppliers and to further control the environmental impact of a product.



Reallabor 131 ("The Urban Transition Lab 131"): KIT findet Stadt

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: 2015 to 2016

The way we organize our life in the cities is a crucial determinant of the success of sustainable development. Against this background, the Karlsruhe Institute of Technology (KIT) establishes the "Urban Transition Lab 131" (R131) to integrate science, innovation, and urban development into a transdisciplinary process with citizens and other local actors (cf. WBGU 2011). This process addresses the district level which is especially suited since the residents identify themselves with their neighbourhood and are thus more committed. The common societal objective of the actors of the Urban Transition Lab is to initiate and consolidate a comprehensive sustainable development of Karlsruhe's Oststadt, including a targeted advancement of the adjacent KIT itself. Its scientific goals are the generation, provision, and testing of the respective knowledge of systems, targets, and actions required for a sustainable transformation of existing cities and districts. Therefore, practical goals together with research and educational aims represent the triangle of objectives of the Urban Transition Lab 131.
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
- Mobility and consulting
- Social networks and aspects of urban planning
- Sustainable consumption

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

The IIP is involved in the basal (inter-)disciplinary tasks. In the subproject data collection, data aggregation is the main objective. Furthermore, in a secondary data analysis, residential buildings and the respective stakeholders are analysed concerning energy efficiency and modernization potentials.
The goal on the one hand is a high detail GIS based depiction of the building stock and on the other hand an analysis of players and constellation of players concerning energy efficiency in residential buildings.
Additionally, technical, content-related and legal questions of such a complex data collection, data processing and problem-oriented data evaluation shall be examined and solved.

Sandy - Vom Klimaschutzkonzept zur ziel-gruppenorientierten Sanierungsoffensive: Strategien, Lösungsansätze und Modellbeispiele für dynamische Kommunen / From climate action plans to stakeholder-integrated building retrofitting: strategies, solution approaches and best practices for dynamic communities

Elias Naber

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: 2015 to 2017

The energetic retrofitting of residential buildings is on a constant low level in the past years and also projected for the future. One reason is the plenitude of stakeholders and their motivations and regulatory instruments that do not fit well on the current situation of those that face the decision and implementation of retrofitting measures. Especially, demographic dynamics are not considered yet that impact small and local district structures. Also, the cultural diversity and the related chances and risks are not considered yet. The overarching goal is the identification and enhancement of existing instruments of environmental, social and housing market policy in order to enable an effective remediation offensive of residential buildings. The project is not limited to the technical level and integrates the agents perspective such as decision makers, particularly their motivation and their scope of action but also other stakeholder such as the role of the respective municipality.
The project follows an integrated approach of surveys, interviews and case studies with transdisciplinary character. Furthermore, a model is utilized to depict development path of the national building stock. Following elements are investigated in the project:

- An empirically grounded analysis of the living situation of the stakeholders/agents and their values and motives
- Analysis of the technical an economical remediation potential of the residential buildings
- Analysis of the local frame (demographic development, migration and interactions with the real estate industry, housing finance, craft, etc.)
- An agent-based household and residential building model in order to reflect the results onto the national level

For the realization of the case study the cities Baunatal (HE), Dortmund (NRW), Ebersberg (BY), Hamm (NRW), Hauzenberg (BY), Homberg (Efze) (HE) are partner municipalities. Corresponding to the transdisciplinary character of the project the partners are integrated into the research process and shape it within their possibilities.

Sandy Workshop and Stakeholdermeeting at IIP Karlsruhe, 10 October 2017

One of the most recent activities (autumn 2017) were expert meetings and exchanges on different levels and in different regions (Nordrhein-Westfalia, Hessia and Baden-Württemberg). The figure shows the workshop taking place at IIP Karlsruhe on 10 October 2017. In this series of regional workshops and stakeholder meeting with communities and communal experts, the participants presented and discussed on effectivity and practical implementation of regulatory instruments to foster and stimulate the "Energiewende" (energy transition) in the building stock on communal and local level. The insights of these workshops complement the scientific findings based on surveys, research and simulations. First reactions on the presented set of tools for communities („Werkzeugkoffer" für Kommunen) were very positive and confirm the need for viable solution approaches.

SERIOR

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: Co-financed by the European Union through the European Regional Development Fund within the framework of the INTERREG V program Upper Rhine, Swiss Confederation and the cantons of Basel-Stadt and Basel-Landschaft.

Duration: 2016 to 2018

The objective of SERIOR is to develop a concept for a trinational Graduate Academy in the field of risk management in the Upper Rhine region.

SERIOR has three core areas: "security", "risk" and "orientation", which highlight the complex interplay of: understanding cultural differences in subjective perceptions of security and risk, objectifying risk assessments through the methods of natural sciences, and gaining orientation with a view to multifaceted risk communications and in the face of differing conceptions of risks and securities.

INCA

Miriam Klein, 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: 2017 to 2020

In the INCA project, the crisis scenario of a long-term power failure in the German-French border region is investigated. First, direct and indirect consequences of a power failure for the population are collected by scenarios. The selected situation represents a stress test for the supply system and brings the emergency program to its limits, as 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 remaining medical resources. In past crisis it was observed, that volunteers no longer 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 completely eliminated such that this trend requires analysis. It will be investigated in coordination processes for the inclusion of voluntary spontaneous helpers to act in a structured way since their different backgrounds, experiences and motivations are seen as a huge potential for strengthen the resilience in a disaster. Another important aspect in crisis management is the minimization of cascading effects, especially in so-called Critical Infrastructures. These organizations as food and water distributors, the transportation, finance and health sector, energy suppliers, information and communication service providers as well as state, administrative and cultural institutions have to be protected particularly since they are essential for the maintenance of important social functions. One of the major points in the project is the communication and coordination of authorities who are responsible for crisis management as well as the forces involved in crisis management and the affected population. Since there is no complete information available in a crisis situation, 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.

To achieve these goals, an agent-based model will be developed, since this method is suitable for mapping the complex interplay of the individuals and the dynamics of their behaviour. In the whole project, it is important to model not only optimized actions of the people, but rather to take into account inefficient panic reactions. The solution of the model should be robust despite changes in the scenario, since crises and their course are not known in advance. Furthermore, the elaborated approaches will be verified in experiments and their applicability will be checked in stakeholder workshops.

The research objective of the INCA project is to provide a holistic approach for decision support under uncertainty in order to increase the crisis resilience of the population in the cross-border region.

Emergency Management and Evacuation

Farnaz Mahdavian

Partner: -

Funding: Graduate Funding from the German States

Duration: 2017 to 2020

The primary aim of the research is to understand the reasons behind different reactions to natural disaster or man-made disaster focusing, in particular, on evacuation behaviour during a critical event, and secondly to study the authorities' behaviour and decision making processes in times of emergency to understand how their response might be enhanced. Analysing societal risk perception and awareness, the expectations of government emergency response and people's reactions and evacuation behaviour will help us find ways of increasing safety and resilience and reducing delays and catastrophic decisions.

One of the key methods adopted by the research is scenario planning. By designing a scenario planning exercise with an expert group of stakeholders and by putting them in a created disaster situation allows to examine in detail the decision making process and their need for and use of information. It can be examined how fast, precise and reliable they need the information and it can be estimated how expensive it might be to provide. Furthermore, it can be studied how well they communicate with each other and with other emergency managers in cross border disaster and how they deal with cascading events coming after the initial event and how they adapt and make new decisions. This will help to identify gaps in risk management organizational departments and pin-point some of the important issues in major emergency situations.

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 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. The 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, the analysis is enriched 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, is to be considered by analyzing (print and online) articles that have featured the discussion over the last few years. This data sheds a light on the most important issues, the relevant players, the tonality and frequency of media coverage. It also allows for international comparisons. In the end, we hope to bring up reference points for an efficient design of the renewed decision-making procedure.

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

Andreas Rudi

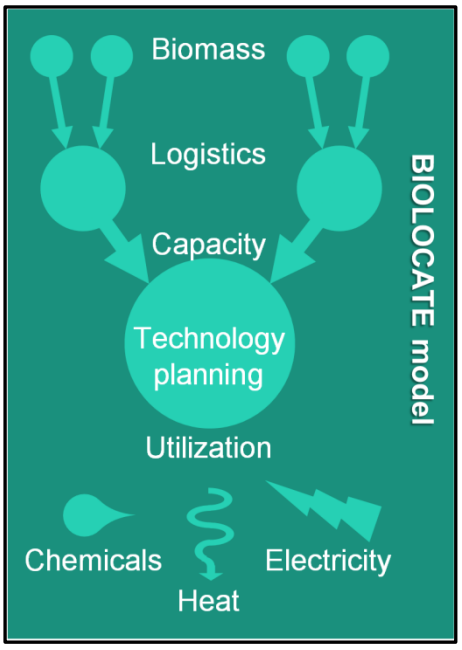
Partner: University of Stuttgart, University of Hohenheim, University of Freiburg, Centre for European Economic Research (ZEW)

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).



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))

Andreas Rudi, Sonja Rosenberg

Partner: Areté

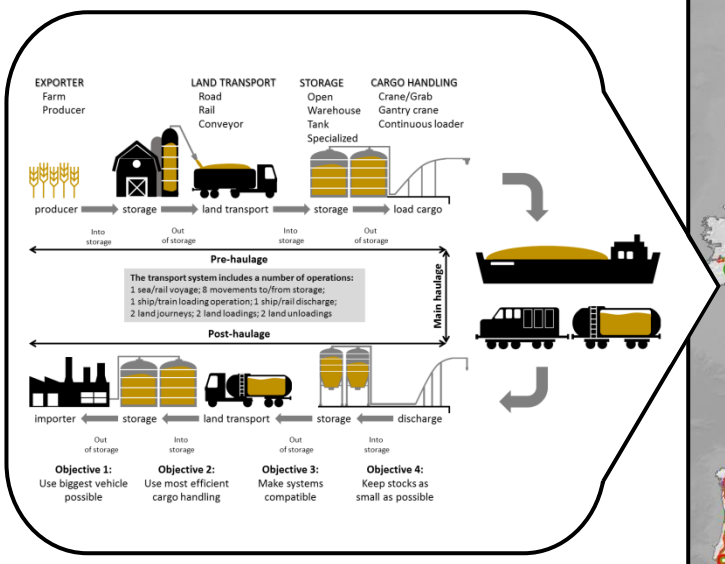
Funding: European Commission (DG AGRI)

European Commission

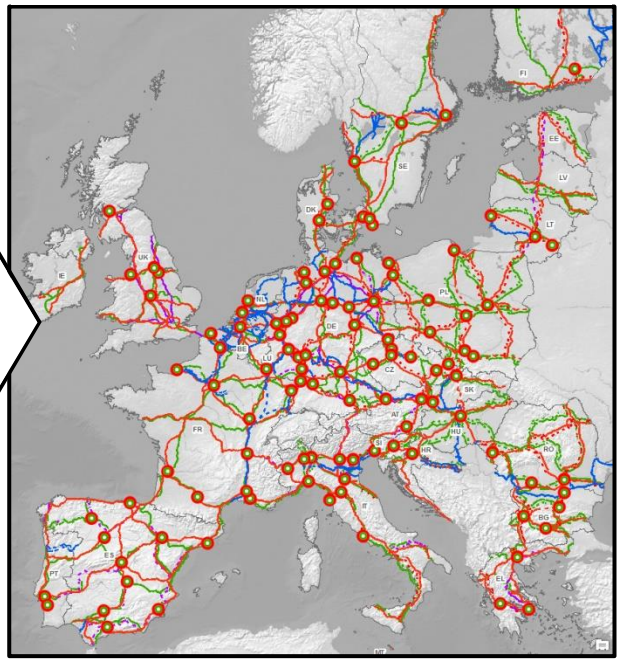
Duration: 2017

The aim of the study is the analysis of the storage capacities and the logistical infrastructure for EU agricultural commodities trade (COP crops). The storage capacities are obtained and GIS-mapped for all EU28 Member States to provide a picture for future investments in storage capacities. In addition, the European logistical infrastructure is GIS-mapped and analyzed in terms of existing and potential bottlenecks. In order to perform an in-depth analysis of bottlenecks, critical EU Member States are reviewed and the main COP crops transport routes are observed and compared with the main TEN-T corridors. The main EU transport corridors for COP crops are identified on the basis of quantitative and qualitative elements sourced from i) official reports about the key EU transport corridors and ii) transportation statistics describing the flow of COP crops between EU Member States. The identified corridors were then illustrated in a set of GIS maps, together with the related transport infrastructure: road, rail, and inland waterways network, and the related interconnections and transhipment points (road-to-rail terminals; inland waterway ports; seaports). The analysis was carried out in a way that facilitated the identification of bottlenecks directly resulting from the structure of the transport corridors (e.g. missing or not yet built connections; tunnels; crossings), or arising from the interaction between long-haul and short-haul transportation and limited infrastructural and/or storage capacities.

COP Crops Supply Chain Analysis



Logistical Infrastructure of the EU28



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

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

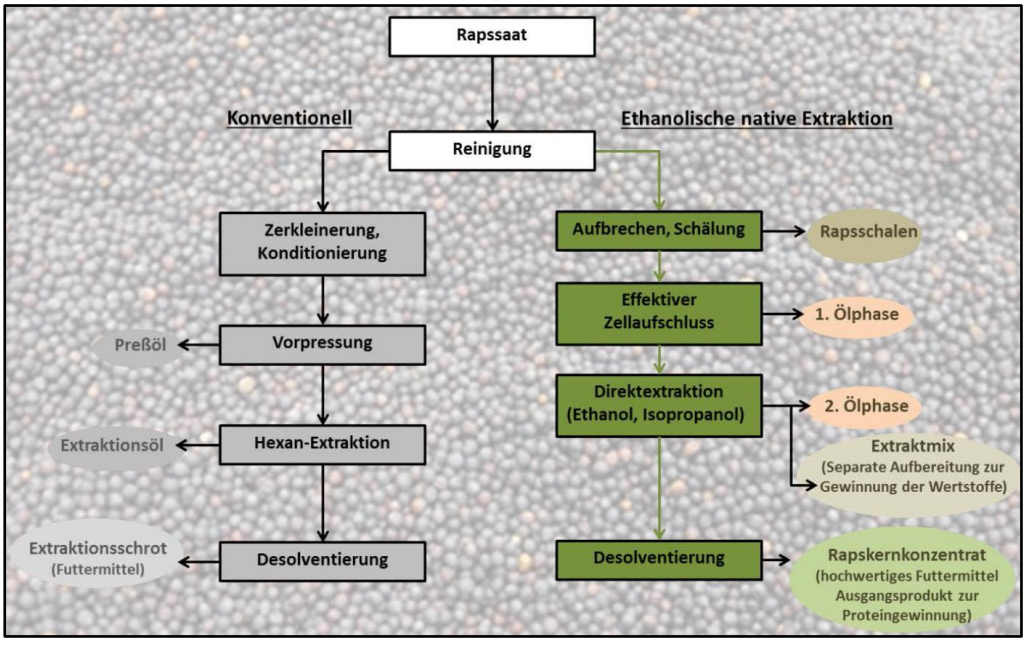
Funding: German Federal Ministry of Food and Agriculture (BMEL)

Federal Ministry of Food and Agriculture

Duration: 2017 to 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 EthaNa-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 EthaNa 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, 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



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

Ministry of the Environment, Climate Protection and the Energy Sector Baden-Württemberg

Duration: 2017 to 2018

Many technologies and possible sales channels of a developing bioeconomy are not yet known, simulation models can show development paths, potentials, opportunities, and risks. Initial model calculations for Baden-Wuerttemberg show that many of the already known energetic and material bioeconomic process chains are not yet economical. Within the framework of the project, options for the expansion of biomass conversion plants in order to investigate microalgae production processes are investigated. Through these potential process extensions, both the economic and ecological sustainability of the process chains can be increased in the sense of a closed-loop economy. To this end, promising methods of microalgae cultivation are identified in a literature review. In a next step, selected methods are investigated with a model combination. This model group has been developed specifically for bioeconomic issues at the level of Baden-Württemberg 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). On the basis of model scenarios, the process paths considered are evaluated in terms of technology and economics, and statements are made on technology selection and location planning. Thanks to the preliminary work in the Bioeconomy Research Program of Baden-Wuerttemberg, it is now possible to generate results in a comparatively short project period that demonstrate innovative process chains in the field of bioconversion plants and microalgae production for the food and feed industry.

Awards

The Research Project "The Urban Transition Lab 131" funded by the Ministry of Science, Research and Arts Baden-Württemberg - IQF-Programm „Reallabore, BaWü-Labs, für eine Forschung für Nachhaltigkeit in Baden-Württemberg" was awarded by the Rat für Nachhaltige Entwicklung (RNE) /German Council for Sustainable Development of the Bundesregierung with the prize „Projekt Nachhaltigkeit 2017" and „Transformationsprojekt".

Dr. Rebekka Volk was awarded with the Science Award 2017 of the Department of Economics and Management of the Karlsruhe Institute of Technology (KIT) in the category best dissertation in „Business Administration" (Wissenschaftspreis 2017 der wirtschaftswissenschaftlichen Fakultät in der Kategorie für „Betriebswirtschaftslehre").

Completed PhD Dissertations and Habilitations

PhD Dissertation: "Technical and economic potential for photovoltaic systems on buildings"

Karoline Fath

The finity of fossile resources and the negative effects of their consumption on global climate result in a necessity for the exploitation of alternative energy sources like photovoltaics. In this thesis, a methodology for the calculation of the photovoltaic potential in 2015 and a prognosis for the potential development until 2050 based on detailed solar irradiation and electricity generation simulations on three-dimensional building and urban district models has been developed.

This methodology extends the scope of existing photovoltaic potential studies in multiple ways: On the one hand, the increase in computing power has enabled the researcher in this thesis to perform small- and medium-scale irradiation simulations on an individual building and urban district level with an hourly resolution as basis for equally-detailed electrical simulations. In this way, reliable conclusions on the influence of shading and reflections from the surrounding on photovoltaic electricity generation can be drawn. Most importantly, for the first time the so far often neglected or roughly estimated potential on building facades has been included in the analysis and due to the detailed simulation methodology, results are sufficiently reliable to provide a basis for large-scale estimates.

On the other hand, photovoltaic installations have experienced an unprecedented price decline since the millennium. Therefore for the first time as an extension of the so-called theoretical or technical potential (i.e. the sum of available surface areas and the potential electricity generation) it was possible to calculate an economic potential considering the investment and the cash-inflow from the generated electricity.

In this thesis the developed methodology has been applied to the German building stock. As a result, for 2015 a theoretical potential of 37,700km2, a location potential of 22,855 TWh, an electricity generation potential of 2923 TWh and an economic potential ranging from 1158 TWh to 2482 TWh has been calculated. Eventually, based on prognoses for the population development and technological improvements in the photovoltaic industry a prognosis for the potential development until 2050 has been derived ranging from 3015 TWh to 4210 TWh generated electricity.

The methodology developed in this thesis can be easily transferred to other countries where a similar database is available. Results can also be further refined when more detailed geographic information on the actual building stock in Germany exists.

PhD Dissertation: "Techno-Economic and Environmentally Conscious Deconstruction Project Planning and Decision Support (TEE-D-Plan)"

Anna Kühlen

For operational deconstruction project planning the principal, the engineering consultant, the deconstruction company and/or authorities are supported by a deconstruction plan of the specific project based on single activities. Usually, so called 'multi-mode resource-constrained project scheduling problems' (MRCPSP) are used to identify and define such a project plan. In this regard, alternative activity-related deconstruction techniques are displayed as modes. Decisions are regularly made due to quantitative economic objectives, such as minimisation of direct costs or the duration of the overall project. Project constraints due to economic parameters, such as maximum budget and maximum duration, and technical parameters, such as available resources, are modelled as renewable and non-renewable resources. Emissions and impacts on the local environment in general, in particular their mitigation and impact-influencing characteristics of the surrounding / neighbourhood are unconsidered in these models and in decision making to date.
In the dissertation a model for technical, economic and environmental deconstruction project planning and decision support (TEE-D-Plan) is developed and exemplarily applied. With this modular model for operational deconstruction project planning for the first time, local environmental impacts in the form of noise, dust and vibrations are integrated as objectives of decision making. The assessment of the deconstruction technique feasibility is completed with parameters, such as the deconstruction height above ground, which have an influence on the resulting local impacts as well. Economic assessment of the single deconstruction techniques is updated and enhanced by data from current literature, an expert survey and consultations. The economic assessment is validated by two realised deconstruction projects. For the first time, average human-sense-related emission and impact levels of noise, dust and vibrations of deconstruction activities can be quantitatively proposed with the help of a newly developed environmental assessment approach and newly collected primary data of experiments and expert survey and consultations.

With the help of TEE-D-Plan, project plans with activity-related deconstruction techniques for a specific building to be deconstructed are provided due to the preferences of the decision maker related to the mitigation of local environmental impacts and while considering the overall project duration and costs.

Staff as of December 2017

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. Marcus Wiens – Risk Management

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

Dr. Simon Glöser-Chahoud – Sustainable Value Chains

Research Associates and their PhD-topics

Andreas Rudi: Modelling biomass-based value chains

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

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

Farnaz Mahdavian: Emergency Management and Evacuation Behavior

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

Florian Diehlmann: Public-Private Cooperation in humanitarian supply 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

Mariana Bartsch: Impacts of natural disaster on supply chain performance

Miriam Klein: An agent-based model to analyse cross-border collaboration and people's behaviour in a crisis situation.

Richard Müller: Planning and modelling of costs and CO_2-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

Sonja Rosenberg: Effects of digitalisation in modelling of production

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

*external researcher

International Collaboration and Exchange

Location: Concepción and Valdivia, Chile
Staff: Kira Schumacher
Host: Dr. Alex Berg, Universidad de Concepción (UdeC), Unidad de Desarrollo Tecnológico (UDT); Patricio Carey Briones, Universidad Austral de Chile (UACh), Facultad de Ciencias Forestales y Recursos Naturales, Instituto de Manejo Forestal
Period: September to December 2017
Short description of stay: Kira Schumacher spent a total of three months at the two Chilean Universities UdeC in Concepción and UACh in Valdivia. Both institutes are partners in the project "SeMoBioEnergy", which is coordinated by the IIP. During her stay she conducted a representative study on the social acceptance of renewable energies of the Chilean population. Moreover, she organized and took part in several meetings on sustainable use of biomass in Chile. Another focus of her stay was to identify possibilities for further cooperation with Chilean partners. In this context she organized a stakeholder workshop and participated in the Fact-Finding-Mission of the KIT-Chile Cluster.

Location: Concepción and Valdivia, Chile
Staff: Tobias Zimmer
Host: Unidad de Desarrollo Tecnológico (UDT) - Universidad de Concepción (UdeC), Instituto Bosque y Sociedad (IBOS) - Universidad Austral de Chile (UACh)
Period: September to December 2017
Short description of stay: From September to December 2017, Tobias Zimmer visited two universities in Chile which are project partners in the current Chilean-German project SeMoBioEnergy. He first spent two months with the bioenergy research group of the UDT, an application-oriented institute at the University of Concepción (UdeC) focusing on forest biorefineries. During his stay, he learnt more about the extensive work conducted at the UDT on the torrefaction of woody biomass, including process simulations as well as pilot-scale experiments. Together with the chemical engineers at the UDT, he worked on a techno-economic assessment of co-firing torrefied biomass with coal in Chile. He then spent one month at the IBOS, a forestry institute at the university of Valdivia (UACh). During his visit, the forest engineers at the IBOS provided him with detailed geographical information about the biomass potential of mixed native forests in Chile. He also learnt more about harvesting processes and logistics in forestry and the importance of firewood in the Chilean energy matrix.

Location: Blacksburg, USA
Staff: Dr. Marcus Wiens
Host: Prof. Dr. Christopher Zobel, Virginia Polytechnic Institute and State University (Virginia, USA), Department of Business and Information Technology, Pamplin College of Business.
Period: July and August 2017
Short description of stay: In July and August 2017, Dr. Marcus Wiens completed a research visit as a Research Fellow at the Pamplin College of Business and Information Technology at the Virginia Tech Polytechnic Institute and State University in Blacksburg (VA, USA). During that time Marcus further developed the model-based framework of a Public Private Emergency Cooperation (PPEC) which transfers the logic of a Public Private Partnership to the context of crisis management. He established the baseline concept of a PPEC already in 2016 and extended the application to the US case together with his host, Prof. Christopher Zobel, during his visit in Blacksburg. The collaboration led to a first joint publication on this topic in 2017. A second joint work was conducted on the challenging topic of quantifying disaster resilience – a research field Chris Zobel is specialized on. During his stay,

Marcus was invited to give a faculty presentation. His talk "Risk decisions in a complex environment – the network disruption game" was about an economic lab experiment designed to analyse the trade-off between risk and complexity which is common to decisions in logistics and operations management. Within this experimental setting it is possible to analyse the effect of complexity on risk behaviour, the action-inaction bias for investment in risk mitigating measures and the gap between true and perceived value of decision support. Marcus gratefully acknowledges the cordial hospitality and the productive scientific cooperation during his time at the Department of Business Information Technology and in particular the close cooperation with his host, Prof. Christopher Zobel, and his team. The risk research group is looking forward to intensify this valuable cooperation with our partners from Virigina Tech in the next year.

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 2017 more than 900 student exams were conducted and the chair has supervised 83 bachelor and master theses.

Introduction to Production Management / Grundlagen der Produktionswirtschaft

Prof. Dr. F. Schultmann, Dr. Rebekka Volk

~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

~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.

Production and Logistics Management / Produktions- und Logistikmanagement

Dr. Frank Schätter

~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.

Planning and Management of Industrial Plants / Anlagenwirtschaft

Prof. Dr. F. Schultmann

~120 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

~40 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.

Risk Management in Industrial Supply Networks

Dr. Marcus Wiens

~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. Jérémy Rimbon

~50 students

This course offers and 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.

Emissions into the Environment

Apl. Prof. Dr. rer. nat. U. Karl

~50 students

The course provides an overview of sources of air pollution, waste and municipal waste. Methods to monitor and to reduce and/or manage pollutant flows and the corresponding regulatory framework on national and international level are introcduced.

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 into the 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

Breun, P.; Fröhling, M.; Zimmer, K.; Schultmann, F. (2017): Analyzing investment strategies under changing energy and climate policies: an interdisciplinary bottom-up approach regarding German metal industries. Journal of Business Economics 87 (1), 5-39. http://dx.10.1007/s11573-016-0829-1

Hübner, F.; Volk, R.; Kühlen, A.; Schultmann, F. (2017). Review of project planning methods for deconstruction projects of buildings. Built environment project and asset management, 7 (2), 212-226. https://doi.org/10.1108/BEPAM-11-2016-0075

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Müller, R.; Loster, M.; Volk, R., Schultmann, F. (2017): CO2-based assessment for sustainable production planning in the metal processing industry, Procedia Manufacturing (accepted, in publication)

Münzberg, T.; Wiens, M.; Schultmann, F. (2017). A Spatial-Temporal Vulnerability Assessment to Support the Building of Community Resilience against Power Outage Impacts. Technological Forecasting and Social Change 121, 99-118. https://doi.org/10.1016/j.techfore.2016.11.027

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Rudi, A.; Müller, A.-K.; Fröhling, M.; Schultmann, F. (2017) Biomass Value Chain Design: A Case Study of the Upper Rhine Region. Waste Biomass Valorization 8 (7), 2313-2327. doi: 10.1007/s12649-016-9820-x

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Zarghami, S. A.; Gunawan, I.; Schultmann, F. (2017): The Four Rs Performance Indicators of Water Distribution Networks: A Review of Research Literature. International Journal of Quality and Reliability Management 34 (5), 720-732. https://dx.doi.org/10.1108/IJQRM-11-2016-0203.

Zimmer, T.; Rudi, A.; Müller, A.-K.; Fröhling, M; Schultmann, F. (2017): Modeling the impact of competing utilization paths on biomass-to-liquid (BtL) supply chains. Applied Energy 208, 954–971. doi: 10.1016/j.apenergy.2017.09.056.

Zimmer, K; Fröhling, M.; Breun, P.; Schultmann, F. (2017): Assessing social risks of global supply chains: a quantitative analytical approach and its application to supplier selection in the German automotive industry. Journal of Cleaner Production 149, 96-109. http://dx.doi.org/10.1016/j.jclepro.2017.02.041.

Conference Proceedings and Working Papers

Hübner, F.; Schellenbaum, U.; Stürck, C.; Gerhards, P.; Schultmann, F. (2017). Evaluation von Schedulingproblemen für die Projektplanung von Großprojekten am Beispiel des kerntechnischen Rückbaus. Karlsruhe. https://publikationen.bibliothek.kit.edu/1000069932/4168011

Hübner, F.; Jung, J. J.; Schultmann, F. (2017). Auswirkungen nuklearer Unfälle auf den Menschen und die Umwelt. Karlsruhe. https://publikationen.bibliothek.kit.edu/1000068411/4093397

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Müller, R. C.; Loster, M.; Volk, R.; Schultmann, F. (2017): CO2-based Assessment Model for Sustainable Production Planning in the Metal Processing Industry. 15th Global Conference on Sustainable Manufacturing (GCSM), Haifa, 25-27 September 2017 (peer-reviewed)

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Mutter, K.; Mayer, C.; Müller, A.-K.; Schultmann, F.; Allemand, N. (2017): ECO PHYSICS' NOx Detectors. AWE International, (51), 58-59

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