

Urban Research at KIT: A Contribution to Sustainable Urban Development

More than half of the world's population is currently living in urban areas and this proportion is increasing continuously. In the 21st century, cities are challenged by globalization, increasing complexity and interlinkage of infrastructures, scarcity of resources, environmental pollution, climate change, and demographic change.

Research at KIT contributes to the investigation, development, and design of the city of the future in all essential aspects. With a unique combination of expertise in natural sciences, engineering, social sciences, humanities as well as planning and design, KIT researchers investigate all functional and life areas of a city using a holistic approach. KIT provides knowledge for sustainable urban development to stakeholders and policy makers on a local, regional, national, and international level. KIT researchers have identified six challenges for urban areas, to the solution of which contributions are made.

AMBITION

- Integrated urban governance: Combine perspectives of different stakeholders
- Holistic and interdisciplinary scenarios for districts, cities and regions

KIT APPROACH

- Technology assessment and systems analysis: Embedding **technologies in a social context**
- Analysis of **governance** structures and mechanisms
- Sustainability** analysis and assessment
- Development of eligible operational **strategies**
- Moderation of **participation** processes
- New **cooperation and financing** models



Workshop with Citizens and Stakeholders



District Future: sustainability transformation of an urban district

AMBITION

- Development of a sustainable city: Adapting structure and image
- Holistic and integrative planning and design

KIT APPROACH

- Architecture**, urban planning and development
- Integral consideration of **technological, economic, social, usage and design** aspects
- Development, application and evaluation of **planning** methods and planning devices
- Virtual engineering** – virtual city models
- Cooperation** with urban planning authorities
- Connecting **participation** processes and planning procedures



Urban Voids: Cities offer many idle capacities to use for the development of a sustainable city



HafenCity Hamburg: Revision of the master plan of the eastern HafenCity



Virtual Engineering: Virtual objects are integrated to real scenarios with augmented reality applications



Simulation tools for flood forecasting & risk management



Air quality in the megacity of Beijing needs to be improved

AMBITION

- Measuring and improving the quality of life
- Better understanding of ecologic, economic and social complexity and dynamics
- Protection against hazardous environmental pollution

KIT APPROACH

- Investigating **urban ecology** and assessing **ecosystem services**
- Measuring, modeling and analyzing **environmental pollution** (air quality, water quality and soil quality)
- Determination of **well-being** and desiderata
- Investigating **demographic change**, migration and multi-locality



Aerodynamics and distribution of pollutants in urban areas

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Multi-local living: the interplay between situatedness and movement



Energy efficiency assessment in Tokyo with an infrared camera



Shadow analysis of Karlsruhe: Estimating the efficiency of solar energy (photovoltaic)



Phosphor recycling from waste water



crystallisation reactor

Cleaned water

Cleaned water

P-contaminating product

solar drying

phosphate industry

agriculture

AMBITION

- Efficient urban material and energy flows
- Resource-efficient buildings
- Integrated Water Resources Management

KIT APPROACH

- Modeling, simulation, monitoring, balance study and analysis of **material and energy flow**
- Integral concepts for **resource efficiency** in urban areas and usage of **renewable energies** in buildings
- Development of efficient **building materials**
- Building **Lifecycle Management**
- Integrated urban **water management**



V2X- Communication: Increased Traffic Safety and Flow Optimization

AMBITION

- "Smart City" - Scrutinizing, crosslinking and improving infrastructures
- Adaptive infrastructures

KIT APPROACH

- Monitoring, simulation, regulation and **optimization of infrastructures**
- Mobility systems** analysis and development
- Travel behavior** analysis and traffic simulation
- Smart Grids, Smart Home, Smart Traffic, Smart Data**
- Electricity, gas, and **ICT networks and security**



Dependencies of Critical Infrastructures



Earthquake in Christchurch



Microscopic multimodal modeling of transport processes



URBAN RESEARCH at KIT

QUALITY OF LIFE
Assess, preserve and ameliorate

RESOURCES
Efficient and sustainable use

INFRA-STRUCTURES
Developing and connecting

RISKS
Strengthen the city in handling

PLAN and DESIGN
the city

URBAN SYSTEM
Analyze, finance and control