

MORGENSTADT PORTFOLIO

INNOVATION NETWORK "MORGENSTADT: CITY INSIGHTS"
JANUARY 2020



INTRODUCTION AND OVERVIEW

The Fraunhofer innovation network "Morgenstadt: City Insights" (m:ci) is a platform of high-level first movers from cities and industry, run by the German Fraunhofer-Society. The Fraunhofer Society was founded in 1949 and constitutes Europe's leading application-oriented research organisation. Out of its 72 institutes the innovation network comprises 10 institutes, which develop and implement socio-technical innovations.

The fundamental goal of the Morgenstadt Network is to accelerate development that helps to create sustainable and future-proof cities. In our understanding, future-proofness comprises four aspects:

- The reduction of energy and resource consumption aiming at CO₂-neutrality
- Resilience towards societal, man-made and naturally caused hazards
- Liveability concerning social well-being and health
- Innovation excellence based on a respective infrastructure

To address these four aspects comprehensively and to be able to develop the most efficient solutions for a future-proof city, we promote a systemic perspective on urban development. We therefore embed socio-technical solutions in a systemic urban context and include value models. Instead of thinking in sectors, our perspective lies on innovation fields, which combine several issue areas and aspects of urban development. This portfolio gives you an overview of the expertise our 10 Morgenstadt partner institutes command. We have defined 11 innovation fields, in which our partner institutes offer their expertise.

Consequently, the innovation fields guide you through this portfolio. An explanatory overview of the innovation field icons is provided on page 3. They give you a quick overview of each institute's field of expertise, which is listed on their individual page. On the last pages, we present three of our collaborative projects to demonstrate how we work together on different topics. Thereby, special emphasis is put on the City Lab, the Morgenstadt Network central methodology to analyse a city and develop solutions for its specific demands.

We hope to have caught your interest, enjoy your read!

MORGENSTADT PARTNER INSTITUTES

- Fraunhofer Institute for Building Physics IBP, Stuttgart
www.ibp.fraunhofer.de
- Fraunhofer Institute for Energy Economics and Energy Systems Technology IEE, Kassel
www.iee.fraunhofer.de
- Fraunhofer Institute for Solar Energy Systems ISE, Freiburg
www.ise.fraunhofer.de
- Fraunhofer Fraunhofer Center for International Management and Knowledge Economy IMW, Leipzig
www.imw.fraunhofer.de
- Fraunhofer Institute for Systems and Innovation Research ISI, Karlsruhe
www.isi.fraunhofer.de
- Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB, Stuttgart
www.igb.fraunhofer.de
- Fraunhofer Institute for Open Communication Systems FOKUS, Berlin
www.fokus.fraunhofer.de
- Fraunhofer Institute of Optronics, System Technologies and Image Exploitation IOSB
Industrial Automation Branch, Lemgo
www.iosb-ina.fraunhofer.de
- Fraunhofer Institute for Material Flow and Logistics IML, Dortmund
www.iml.fraunhofer.de
- Fraunhofer Institute for Industrial Engineering IAO, Stuttgart
www.iao.fraunhofer.de

INNOVATION FIELDS



Smart Energy Homes



Hybrid Energy Systems



Urban Governance and Planning



Connected Public Spaces



Integrated Water Systems



Sustainable Wastewater Management



Green Infrastructure and Nature-based Solutions



Smart Financing



Urban Logistics



Mobility as a Service



Urban Data Platform

FRAUNHOFER INSTITUTE FOR BUILDING PHYSICS **IBP**

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Reference project

Duration: 09/2019-08/2024

Funding: Fraunhofer Society

In the project "Urban Physics Modeling", IBP develops models that enable the estimation of at least three target urban characteristics: outdoor thermal conditions, energy use in buildings and air pollution. The approach considers the urban microclimate and its dynamic interactions with the target variables. Not only the buildings and their form/layout/properties, but also paved surfaces and other urban features, such as shading structures, water surfaces, vegetation, are primary influencers. Anthropogenic activity in general and transportation in particular are of interest as they affect the urban microclimate.

By enabling early involvement of and collaboration among the stakeholders in the design and planning of sustainable cities, it is expected to help bridge the gap between architects, urban planners, engineers and construction companies. Another foreseen application is to support energy policy decision-making in existing cities via a priori assessment of the impact of: large-scale retrofits, new minimum energy performance standards, demand-side management, district energy systems, tariff changes, etc.



The Fraunhofer Institute for Building Physics IBP was founded in 1929 and conducts research on classical building physics topics such as acoustics, energy efficiency, indoor climate, hygiene and sensor technology, recycling of building materials and hygrothermics. In addition, it addresses new topics such as how to integrally design schools or workspaces, how to make flying more environmentally friendly or how to sound out the energy potential of entire cities. Further focal points are the analysis of products, processes and services from an ecological, economic, social and technical point of view and their holistic balancing. IBP has laboratories and testing facilities as well as the largest known open-air test site at the Holzkirchen branch, making investigations in model rooms, in the test field and at the completed object possible. It is a "building authority recognized body" for testing, monitoring and certification of construction products and types in Germany and Europe. Four testing laboratories of the institute have the flexible accreditation according to DIN EN/ISO/IEC 17025 of the Deutsche Akkreditierungsstelle GmbH (DAkkS).

Competences regarding M:CI

Energy efficiency and city climate

- Concepts for high efficiency buildings
- Redevelopment concepts for buildings
- Innovative housing development concepts
- Buildings systems solutions

Holistic accounting

- Sustainable district development
- Evaluation and certification of sustainable buildings
- Holistic assessment of building materials



FRAUNHOFER INSTITUTE FOR ENERGY ECONOMICS AND ENERGY SYSTEM TECHNOLOGY **IEE**

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Reference project

Duration: 2012 – 2017

Funding: German Federal Ministry for Research and Education

The main goal of the project "Wolfhagen 100%RES" was to develop and implement the transformation process to an energy-efficient city. Central tasks therefore comprised the lowering of the energy demand in the building sector, refurbishment initiatives, to increase renewable electricity production from wind, solar and biomass in a holistic energy system approach, to implement demand-side-management and client information systems, to provide a potential study on e-mobility, information and pilot cases, and to represent the energy system development scenarios in a holistic way.

The owners and tenants of the central historic district of Wolfhagen, a small municipality in northern Hesse were asked to develop their future urban environment in close cooperation with the city, giving participation and communication aspects much room. To make better use of the fluctuating energy supply from wind and solar plants the local utilities were carrying out a field test on the feasibility of real-time-pricing and end-user acceptance. Best-practice refurbishments were supported by building and energy experts and the experiences were shared with other interested building owners. A long-term monitoring was providing the necessary information for future decision-making and continuous improvement of the project.



The Fraunhofer Institute for Energy Economics and Energy System Technology IEE in Kassel was established in 2018 from the energy system technology branch of Fraunhofer IWES. Fraunhofer IEE researches for the national and international transformation of energy supply systems, addressing current and future challenges faced by the energy industry and energy system technology issues. It thus develops solutions for technical and economic challenges to further reduce the costs of using renewable energies, to secure the supply despite volatile generation, to ensure grid stability at the usual high level and to make the business model of the energy transition a success. In cooperation with IBP and ISE it cover all energy sectors.

With 6 locations in Kassel, Bad Hersfeld and Fuldathal-Rothwesten, Fraunhofer IEE examines economic and technical problems in an interconnected manner. Thus, it is able to actively and competently support industrial and political clients and partners.

Competences regarding M:CI

Energy economics

- Analysis and consulting for energy economics
- Energy meteorology information systems
- Energy informatics
- Virtual power plants
- Wind resource assessment with LiDAR
- Training and knowledge transfer

Energy systems technology

- Grid planning and operation
- Power electronics and device technology
- Hardware in the loop systems
- Decentralised energy management
- Systems engineering
- Measuring and testing



FRAUNHOFER INSTITUTE FOR SOLAR ENERGY SYSTEMS ISE

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Reference project

Duration: 10/2017 – 09/2020

Funding: German Federal Ministry for Economy and Energy, German Federal Ministry for Education and Research

At the lighthouse project "EnStadt:Pfaff" in Kaiserslautern, Germany, 9 partners are cooperating to develop the former production site of the Pfaff sewing machine manufacturer to become a sustainable neighborhood for technology, health and residence. New technologies will be developed, demonstrated, monitored and evaluated. The area therefore serves as a living lab for energy supply, buildings, electro mobility and digitalization. For these sectors, the project develops long-term concepts while innovative solutions such as an online district platform, electric smart grids and an agent-based energy management systems will be implemented. The technological development will be accompanied by sociological investigations.

Fraunhofer ISE is responsible for the scientific management of the project.



Founded in 1981, the Fraunhofer Institute for Solar Energy Systems ISE is the largest solar research institute in Europe with a staff of over 1200. ISE creates the technological foundations for supplying energy efficiently and on an environmentally sound basis in industrialised, threshold and developing countries. With its research focusing on energy conversion, energy efficiency, energy distribution and energy storage, it contributes to the broad application of new technology. It develops materials, components, systems and processes and offers testing and certification procedures. Furthermore, it features an excellent laboratory infrastructure and is certified according to the quality management standard, DIN EN ISO 9001:2015. Apart from its location in Freiburg, it comprises 5 branches in Gelsenkirchen, Freiberg (Saxony), Halle/Saale, as well as Albuquerque, New Mexico and Santiago de Chile.

Competences regarding M:CI

Energy technologies and transformation strategies

- Development of smart city technology in living labs
- Energy systems modelling
- Development of master plans for the transformation of local energy systems
- Local energy distribution systems
- Smart grids
- Sector coupling
- Integration of electric vehicles in the energy system
- Analysis of consumption behaviour
- Communication of new technologies
- Solar energy potential analysis
- Integrated photovoltaics
- Urban photovoltaics



FRAUNHOFER CENTER FOR INTERNATIONAL MANAGEMENT AND KNOWLEDGE ECONOMY **IMW**



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Reference project

Duration: 07/2019 – 12/2020

Funding: German Federal Ministry of Education and Research

Chiang Mai is the largest city in northern Thailand and a destination for around 7 million tourists a year. The resulting development dynamics are changing the traditional socio-economic structures in the city. Large sections of the local population and the municipal administration are uncertain about how to deal with the effects of this development on the material and immaterial cultural heritage.

In the project YoU2 "Liveable historic urban districts in Chiang Mai, Thailand" Fraunhofer IMW and Fraunhofer IEE work together with the School of Public Policy SPP of the University of Chiang Mai in order to sense, mobilize and leverage knowledge to establish sustainable paths of development at the intersection of cultural heritage protection, energy management and development towards a "Smart City" in Chiang Mai. In doing so, YoU2 places particular value on the qualitative modeling of the local context, the identification of established solutions from other regions in Thailand and Germany, and the systematic adaptation and transfer of these solutions.



The Fraunhofer Center for International Management and Knowledge Economy IMW focuses on the fundamental change processes in a globalised world. Founded as the Center for Central and Eastern Europe MOEZ in 2006, it consolidated its expertise and range of services in internationalisation and the knowledge economy under its new name in 2015. The center addresses the worldwide development towards a knowledge economy, the global shift in generating value creation and the growing realisation of the need to promote sustainable development at a regional and international level as the challenges of the future. With its 79 staff, the center compiles analyses and develops recommended procedures for customers from the economy, science and politics to meet these challenges successfully. It examines political structures, economic systems, and structural conditions – such as the infrastructure and human capital – regarding the extent to which they can stand their ground in the competition for internationalised value creation processes. Thereby special emphasis is put on the ability to absorb innovations and the development and realisation of economic sustainability strategies.

Competences regarding M:CI

Innovation acceptance

- Context-specific tools to promote innovation acceptance
- Adapting existing solutions to application contexts



FRAUNHOFER INSTITUTE FOR SYSTEMS AND INNOVATION RESEARCH **ISI**

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Reference project

Duration: 2017 – 2020

Funding: Stiftung Zukunft NRW

The realization of sustainable and resilient cities requires new approaches at many levels, including infrastructure. Infrastructures ensure the basic supply of a society and have an impact on resource consumption as well as on the environment and thus on the quality of life. As a result of major change processes such as climate and demography as well as technological and social change, infrastructures are subject to high pressure to adapt. This leads to major technical and economic challenges, particularly in the case of long-lasting, grid-bound systems such as water infrastructures. The transition of water infrastructures to resilient, resource-conserving systems that can react more flexibly to adaptation needs requires concepts that can be successively integrated into the existing systems and that are compatible with conventional system components that remain in place or are adapted. With this in mind, the Fraunhofer Institute for Systems and Innovation Research ISI developed the integrated WaterEnergyTransition Concept "i.WET" and investigated it in the BMBF project TWIST++. i.WET is a practical concept for heat and water reuse that promotes a near-natural urban water cycle and is characterized by an improved energy balance compared to a conventional water infrastructure.

In the i.WET concept, less polluted partial streams such as greywater and rainwater are separated from the municipal wastewater. Water that is not reused in the household flows into the so-called energy alley, a green area designed as a soil filter, which also serves as a roadside green and absorbance of road runoff. In this way i.WET promotes a near-natural urban water cycle, serves as a barrier to nutrients and pollutants, improves resource efficiency and offers further ecosystem services to enhance the urban landscape. To support the stepwise implementation of new concepts and their elements, to allow the engagement of different stakeholders from the different sectors and disciplines, and to increase their understanding, planning support systems and a serious game for simulating possible scenarios were developed.



The Fraunhofer Institute for Systems and Innovation Research ISI was founded in 1972 and expands the range of Fraunhofer by working at the intersection between technology, economy, politics and society. Fraunhofer ISI deals with issues of transition to sustainable development by investigating the scientific, economic, ecological, social, organizational, legal and political framework conditions for generating innovations and their implications. For this, technical, economic and political options for action are developed and analyzed as well as interdisciplinary decision bases are provided for companies, associations and politics in various fields of work. In its work staff applies not only a broad spectrum of advanced scientific models, methods and social-science measurement instruments, but continually develops them further, utilizing the empirical findings from the research projects conducted. Its assessments of the potentials and limitations of technical, organizational or institutional innovations help decision-makers from industry, academia and politics in making strategic decisions and thus assist them in creating a favorable environment for innovations. Fraunhofer ISI is one of the leading innovation research institutes in Europe.

Competences regarding M:CI

Sustainability and infrastructure systems

- Sustainability of water infrastructure systems
- Assessment of competitiveness of future sustainability technologies
- Assessment of systemic risks and design of adaptation measures
- Mobility concepts and impact-assessment of logistic systems

Energy policy and energy markets

- Evaluation of the contribution of renewable energies to climate protection
- Assessment of security and competitiveness of supply
- Design of energy policy instruments



FRAUNHOFER INSTITUTE FOR INTERFACIAL ENGINEERING AND BIOTECHNOLOGY **IGB**

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Reference project

Duration: 09/2016 – 12/2019

Funding: German Federal Ministry for Education and Research

In order to avoid regional competition for water resources, new processes for water treatment and water reuse are needed. In the project "New Pathways Towards Wastewater Re-Use in Agriculture" (HypoWave), a water-saving concept for agriculture was investigated: hydroponic plant production where the irrigation water is obtained from municipal wastewater. An interdisciplinary team operated pilot plants at the Hattorf wastewater treatment plant near Wolfsburg to investigate how the efficiency of this hydroponic plant production could be further increased by using treated municipal wastewater for irrigation. The adapted wastewater treatment should guarantee high-quality products that are largely free of heavy metals, organic trace substances or pathogenic germs.

In addition, the potential and marketability of such a concept was investigated using case studies in Germany, in the border region between Belgium and Germany and in southern Portugal. In the course of the research work, the potential actors of such systems were involved in the research project via a stakeholder dialogue. This provided information on the market potential for hydroponic agriculture using treated wastewater.



The Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB develops and optimizes processes, products, and technologies in the business areas of health, chemistry and process industry, as well as environment and energy. IGB combines the highest scientific standards with professional know-how in its competence areas – always with a view to economic efficiency and sustainability. Its strengths are offering complete solutions from the laboratory to the pilot scale. Customers also benefit from the cooperation between its R&D departments in Stuttgart and the institute branches located in Leuna and Straubing. The constructive interplay of the various disciplines at our institute opens up new approaches in areas such as medical engineering, nanotechnology, industrial biotechnology, and environmental technology.

Competences regarding M:CI

Water management

- Semi-decentralised urban water management
- Biological wastewater purification processes and reactor concepts
- Municipal and industrial wastewater treatment plans
- Utilisation and recovery of resources

Bioenergy

- Sludge management of sewage treatment plants
- Efficient treatment of organic wastes
- Nutrient removal or recovery from process waters and fermentation residues
- Biogas and biomethane production



FRAUNHOFER INSTITUTE FOR OPEN COMMUNICATION SYSTEMS **FOKUS**

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Reference project

Duration: 09/2017 – 04/2018

Funding: German Federal Ministry for Research and Education

The study "Urban Data Spaces – Data Exchange and Cooperation in an Urban Context" analyzed the situation, potentials and needs with regard to urban data platforms. Fraunhofer FOKUS in cooperation with Fraunhofer IML formulated general, strategic, technical and organisational recommendations for the development of urban data spaces. The focus here was on the design of data use, especially at the local level.

As part of the study, inventory analyses were carried out to record the data situations in selected municipalities (Bonn, Dortmund, Emden and Cologne). Among other things, data management, data protection and the rights and situation of spatial, structural and functional data separation in various sectors were examined and the observations then generalised. The study argues that with the help of cross-departmental data sets, decisions could be made that cover short and long-term perspectives and adequately represent social concerns. Digital services thus contribute to sustainability and quality of life through monitoring and control. In addition, their use enables the comprehensive and profitable participation of all municipal actors and civil society in the shaping of municipal goals, services and urban planning processes.



Fraunhofer FOKUS has developed a number of concepts, prototypes and pre-products in the area of smart cities, Internet of Things, urban data platforms and open data. Especially, Fraunhofer FOKUS has initially developed the open data portal of the city of Berlin, as well as the official Open Governmental Data portal for Germany (GovData.DE). Furthermore, Fraunhofer FOKUS is currently developing the European Open Data portal and is also involved in various research and industrial projects, e.g. for realising the interplay between (open) urban data, Internet of Things and the energy sector in Smart Cities. Furthermore, Fraunhofer FOKUS is co-developing and supporting different standardisation activities for Smart Cities (e.g. EIP SCC Towards Open Urban Platforms for Smart Cities and Communities and DIN SPEC 91357 Open Urban Platforms), which are of relevance for areas such as Internet of Things, cyber physical systems, and digital connectivity in general. Fraunhofer FOKUS is actively participating in a large number of projects (of industrial and research nature) including projects related to security testing as well as the certification of critical infrastructures, e.g. "Common Criteria Certification and Testing" for key national and European ICT infrastructures.

Competences regarding M:CI

System quality

- Optimisation of development processes
- System architecture
- System design
- Testing
- Verification
- Model-driven engineering
- Model-driven testing
- Certification
- Open data platforms



FRAUNHOFER INSTITUTE OF OPTRONICS, SYSTEM TECHNOLOGIES AND IMAGE EXPLOITATION, INDUSTRIAL AUTOMATION BRANCH **IOSB-INA**

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Reference project

Duration: 04/2018 – 03/2021

Funding: Ministry of Economy, Innovation, Digitisation and Energy of the State of North Rhine-Westphalia

Fraunhofer IOSB-INA is implementing the IoT Living Lab "LEMGO DIGITAL" as an open innovation platform for medium-sized towns and cities. The Fraunhofer scientists are supported by the Technische Hochschule Ostwestfalen-Lippe (TH OWL) and other partners as well as by the federal state of North Rhine-Westphalia. Companies, IoT startups, municipalities and research institutes have joined the initiative working together with citizens to design new solutions and data-based services in the areas of mobility, environment, attractiveness of town centers and digital infrastructure. Innovations have already been implemented and tested for example in the fields of smart parking systems, digitalization for public transport, urban data platforms, LoRa-WAN and the installation of sensors for traffic and pedestrian census. The Old Hansa Town Lemgo with about 41.000 inhabitants is the blueprint for more than 180 medium-sized cities in North Rhine-Westphalia, where half of all people of the most populous federal state in Germany live.



The mission of Fraunhofer IOSB-INA is to empower its partners for the digital age. It offers living labs for the digital transformation of both, industry and cities. Building on its core competencies in applying knowledge of industrial automation – like network analysis and monitoring as well as the user-friendly design of technical systems, the goal of IOSB-INA is to support the knowledge transfer from research into real-life applications. Regarding the digital transformation of cities and medium-sized towns, IOSB-INA provides local authorities with tools to successfully plan and implement digitalization projects in line with their overall strategic goals.

Fraunhofer IOSB-INA is a leading research institution in the network Intelligent Technical Systems in Ostwestfalen-Lippe "it's OWL" and core partner in the Competence Center for Mittelstand Digital in NRW. Its partners are numerous and reach from municipalities to operators of automated technical systems. In close cooperation with the Institute for Industrial Information Technology (inIT) at Technische Hochschule Ostwestfalen-Lippe (TH OWL) and other partners, Fraunhofer IOSB-INA is a main contact for intelligent automation and industrial information technology in the Ostwestfalen-Lippe region.

Competences regarding M:CI

Digital transformation of medium-sized towns and cities



Urban data, connectivity and sensor technology

- Training courses for municipalities
- Pilot urban data platform for training, development of competences and decision making skills, testing and piloting
- Improvement of public transport through digital solutions
- Data-based traffic flow optimization
- IoT sensor box measuring traffic volume



Co-creation

- IoT Living Lab (providing test environments for innovative solutions)
- Citizen science
- Identification of use cases
- Foster the attractiveness of the public space



FRAUNHOFER INSTITUTE FOR MATERIAL FLOW AND LOGISTICS IML

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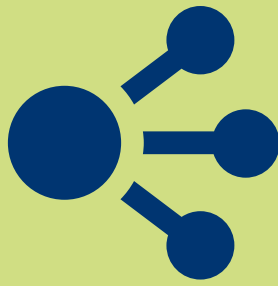
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Reference project

Duration: 01/2018 – 07/2018

Funding: German Federal Ministry of Transport and Digital Infrastructure

On behalf of the city of Düsseldorf, the Fraunhofer Institute for Material Flow and Logistics IML developed a master plan in the first half of 2018, which presents strategies and measures for planned investments in the city's transport system. The relevance and priority of individual measures and strategy modules results from the potential to reduce NO₂ and NO_x pollution in the extended inner city ring as quickly as possible. The "[Masterplan Green-City Mobility](#)" specifies the measures listed with regard to implementation duration, the necessary costs and a chronological classification of effectiveness. Concrete solutions for a new urban mobility in Düsseldorf therefore aim at an improvement in the quality of life and stay in the core city area and in the city districts, better mobility offers in the city and region, a reduction in traffic-related pollutant emissions and the promotion of the city Düsseldorf as an innovative metropolis. The master plan developed perspectives for the thematic areas of flexible mobility, digital networked infrastructure, powerful public transport, attractive cycle paths, low-emission drives, urban logistics, mobility in quarters. The Master Plan has shown a way to move the time of achievement forward by 2 to 3 years.



The Fraunhofer Institute of Material Flow and Logistics IML mainly works in fields of logistics optimization and automation. However, a steadily growing business area deals with urban mobility, urban infrastructure and urban logistics. The institute was founded in 1981 and currently employs around 300 full-time scientists. It has its headquarter in Dortmund and runs several project offices e.g. in Frankfurt, Hamburg and Prien. The main competences of the IML engineers working on smart city solutions cover the fields of digitalization, alternative fuels and transport concepts as well as decarbonisation strategies. The institute has implemented several "enterprise labs" with partners such as Deutsche Telekom, Sick, Würth, Dachser or Schenker to facilitate collaborative working on data-driven solutions and innovations. Last but not least, IML is paving the way to future logistics with innovations in the context of cyber-physical systems and the Internet of Things.

Competences regarding M:CI

Urban logistics and mobility

- Alternative drives
- Night-time logistics
- Urban consolidation centers and cargo bike deliveries
- Urban data space
- Autonomous driving
- Resilience in urban spaces
- Urban production strategies and 3D-printing
- Underground transport systems
- Dynamic tour planning
- Smart infrastructures and traffic management



FRAUNHOFER INSTITUTE FOR INDUSTRIAL ENGINEERING **IAO**

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Reference project

Duration: 10/2019 – 09/2024

Funding: European Union Horizon 2020 research and innovation programme

The smart city project "SPARCS" is one of 17 European Smart Cities and Communities Lighthouse Projects focusing on the urban transformation process towards citizen-centric positive energy districts. The lighthouse cities Leipzig (DE) and Espoo (FI) will implement multiple integrated technical solutions for CO₂ neutral neighbourhoods. The project consortium combines interdisciplinary experience and expertise of 31 partners from industry, research and municipalities who share the same objective and commitment to develop and implement smart solutions in order to replicate them in the five follower cities Kifissia (GR), Kladno (CZ), Reykjavik (IS), Maia (PT) and Lviv (UKR). The overall budget of Sparcs is 23 million Euros (2019-2024). The European Commission funding (Horizon 2020) totals 19 million Euros. The project is coordinated by VTT in Finland and both Fraunhofer IAO and IMW are part of the consortium. Fraunhofer IAO is responsible for city characterization for solution adaptation through the Morgenstadt framework, solution packaging and use case inventorisation for easy implementation in fellow and other cities, production of replication roadmaps, advising project development, providing guidance for joint cross border procurement, facilitating knowledge transfer between participating cities, smart city training for city representatives and supporting business model development for Positive Energy District solutions. Besides, the institute supports Leipzig regarding integration of electric public transport solutions. Fraunhofer IMW co-produces the methodology for cities to develop a city vision for 2050 and it supports Leipzig in empowering its citizens.



The Fraunhofer Institute for Industrial Engineering IAO develops strategies, business models and solutions for digital transformation. Working together with large corporations as well as SMEs, Fraunhofer IAO taps into the potential of new technologies such as cognitive computing, blockchain, autonomous driving and IoT platforms and applies it to product innovations, process improvements and new business models. Together with its partner institute, the Institute for Human Factors and Technology Management (IAT) at the University of Stuttgart, it has a staff of over 600 experts who work in interdisciplinary teams to develop holistic approaches to work design and organisation and corporate cultures, solutions for human-machine interaction, the application of virtual and augmented reality, cognitive systems and artificial intelligence, sustainable solutions for tomorrow's mobility and system innovations for livable and adaptable cities. Combined, Fraunhofer IAO and the IAT have a total of 15,000 m2 of office space, demonstration centers, and development and test laboratories in Stuttgart, Berlin and Garmisch-Partenkirchen.

Competences regarding M:CI

Urban systems engineering

- Municipal digitalisation strategies and processes
- Intelligent urban districts and surroundings
- Co-creative innovation partnerships and strategies
- Data-based business models and processes in urban systems
- Green infrastructure and nature-based solutions



Mobility and innovation systems

- Mobility concepts and integrated energy solutions for cities
- Technology- and innovation management
- Simulation, planning and co-creation of urban mobility futures
- Mobility-as-a-Service cooperation models
- AI-Based technology and trend forecasting
- Demand-driven future vehicle concepts
- Research on user acceptance of mobility innovation

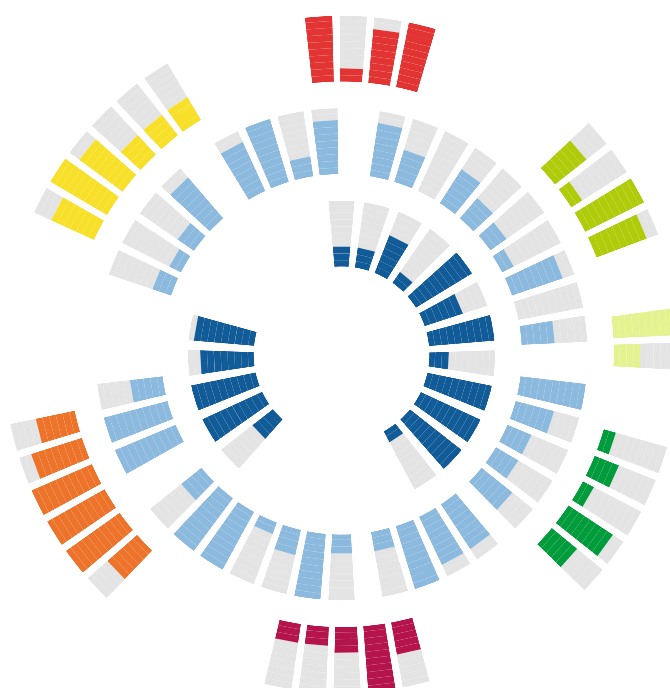


COLLABORATIVE PROJECTS

CITY LABS

A City Lab is a concrete form of cooperation between Fraunhofer researchers and partner cities. A City Lab includes an in-depth analysis of the city based on the Fraunhofer Morgenstadt system approach. Multiple City Labs have already been implemented in several cities, both in Germany and abroad. While most urban studies are based on macroeconomic data such as population growth, economic growth and real-estate prices, City Labs have a different approach. The analysis is based on the Morgenstadt assessment framework for sustainable urban development. This framework is structured into three main levels of analysis, which in sum are designed to understand the current sustainability performance of cities and result in coherent strategies and an integrated roadmap for development. A mixture of quantitative benchmarks and qualitative data analyses certifies that an objective performance profile of the city can be generated, while at the same time respecting the individual factors of the city that make a direct comparison with other cities difficult. This leads towards an individual strategy for each city and the formulation of a list of tailor-made solutions to identified problems. Thereby, the process of data analysis and solution identification is highly participative and integrates representatives from industry, politics as well as civil society.

Morgenstadt Assessment Framework



Urban leadership

- Strategy and planning
- Local policies (regulations and incentives)
- Finance and procurement
- Organization and structure

Enabling strategies

- Data governance and IoT
- Local Innovation ecosystems
- Urban planning
- Socio-economic development model
- Citizen engagement and participation

Technologies and infrastructures

- Energy systems
- Waste and resource cycles
- Water solutions
- Mobility and transport solutions
- Urban production and logistics
- Sustainable buildings and refurbishment
- Green infrastructure and ecosystem service
- Resilience engineering

COLLABORATIVE PROJECTS

MORGENSTADT GLOBAL SMART CITY INITIATIVE

The "Morgenstadt Global Initiative" (MGI) addresses the specific challenges cities in the Global South are facing in climate change adaptation and mitigation. The project aims at reducing CO₂ emissions and applies the method of City Labs in three cities, Piura (Chile), Saltillo (Mexico) and Kochi (India) to identify challenges and develop solutions in sectors defined by city representatives. The project focuses on the technical and financial assessment of projects and measures in cooperation with the Frankfurt School of Finance and includes the implementation of one pilot project per city. It is funded by the International Climate Initiative of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and runs for three years from May 2019 until April 2022.

Fraunhofer IGB

Fraunhofer IAO

Fraunhofer ISE

Fraunhofer IBP

Fraunhofer ISI

According to the sectors identified as relevant in each city, the Fraunhofer institute with the best expertise in this field leads the City Lab and monitors the identification and implementation of the most efficient solution.

The City Lab Approach in MGI

1. Understanding		2. Co-Creation		3. Transformation
Preparation	Desktop research and analysis	On-site assessment	Design	Implementation
Constitution of the city team and Fraunhofer team	Analysis of existing planning documents	High level and expert Interviews	Processing on-site assessment results	Implementation of selected projects (depending on funding)
Definition of the sectors of focus	Scheduling interviews and site visits	Co-ideation of project ideas	Further elaboration of project ideas	
Adaptation of morgenstadt methodology to the local context	Data collection and preliminary analysis	Innovation Lab with local stakeholders	Elaboration of pre-feasibility studies	
	Preparation of the on-site assessment	Project ideas development workshop	Transfer of the project ideas into a roadmap	
		Project ideas filtering	Consolidation of all results into a final report	

COLLABORATIVE PROJECTS

URBAN DATA PARTNERSHIP

Fraunhofer IOSB-INA The "Urban Data Partnership" Programme aims at preparing cities for the governance and value creation of their data. While constantly collecting data, most cities lack the expertise, tools and personnel to deal with it efficiently. At the same time, this data commands great value creation potential that needs to be balanced with citizens' interests and existing regulations – a source of great insecurity among stakeholders on the city-level. In this collaborative RnD Programme, Fraunhofer IAO, FOKUS and IOSB-INA therefore offer support to cities in taking decisions about how to create value with data within the framework of existing regulations. The second aspect is the training city of digital officers on municipal level to embed data governance in the city administration in the long-term. Thirdly, the programme includes the creation of an innovation network in which cities can exchange experiences and consult each other on issues of data governance.

Fraunhofer IAO

Fraunhofer FOKUS

URBAN DATA PARTNERSHIP

1. Project development

Development of common projects and grant applications in the thematic area of digital transformation of cities and municipalities.

2. Transfer of knowledge

Trainings for personnel of city administrations and municipal utilities in the context of the urban agenda.

3. Moderated dialogue

Exchange and dialogue concerning central challenges, ideas and best practices in the thematic area of Urban Data Governance.

4. Expert-support

Individual support for smart city and digitalisation strategies. Easy access to a huge community of experts and consultants.

5. Policy-making

Summary of requirements and results in strategy papers for political decision makers. Dialogue with EU-councils and initiatives.

6. Innovation network

Regular meetings for participants' direct exchange. Dialogue with multipliers and research institutions.

