

PROJECT DESCRIPTION

MORGENSTADT: CITY INSIGHTS-PHASE II



MORGENSTADT / CITY OF THE FUTURE: CITY INSIGHTS-PHASE II

»M:CI - Urban Transitions«

Shaping future markets for systems innovations
towards smart and sustainable cities

Fraunhofer Partners:

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Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V.

Additional Partners:

Economic Transformations Group (ETG)

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1 Why Cities?

By 2030 the number of people living in cities will rise from three to five billion. Scarce resources, climate change, and the sheer number of people will create great challenges to urban infrastructure, economic development, and quality of life. In the 21st century the majority of people in the world live in cities for the first time in human history, making this the first urban century.

“There is a backlog in providing decent housing and infrastructure to one billion urban dwellers, while the global urban population will increase by another three billion over the next 40 years. The logical conclusion is that within the next 40 years the same urban infrastructural capacity will have to be built as that over the last 4.000 years. (...) It is clear that this development cannot be realized with current levels of resource and energy wastage.”

Simpson 2013: “The Economy of Green Cities”

“The political and economic foundations of cities will determine whether four billion new urban houses in the next 40 years can be built, whether global warming can be limited to 2°C and whether the state and quality of our ecosystems and resources can be sustainably maintained”

Zimmermann 2013: “The Economy of Green Cities”

“150 of the world’s most significant metropolitan economies produce 46% of global GDP with only 12% of the global population”.

Berube et al. 2010: “Global Metro Monitor”

The environmental performance of cities is dependent on a combination of effective green strategies and physical infrastructure – urban form, size, density and configuration. They can be designed, planned and managed to limit resource consumption and carbon emissions. Or they can be allowed to become voracious, land hungry, all-consuming systems that ultimately damage the delicate global energy equation.

Philipp Rode 2013: Executive Director of LSE Cities

Both creating and responding to “the city of tomorrow” will require new ways of thinking. Conventional products and solutions oriented to single consumers or single markets must be replaced by integrated approaches that relate to entire urban systems. Future cities must master an innovation loop based upon new relationships between information, resources, products, natural systems, and users.

2 »Morgenstadt/ City of the Future: City Insights – »M:CI«

2.1 Introducing City Insights

The Fraunhofer City Insights Network aims to accelerate the global transition to sustainable urban systems. Members of the Network share three important convictions:

■ **Sustainable cities are the key to a sustainable future.**

To create a livable future on our planet, we must create intelligent, CO₂-neutral cities that effectively make use of energy and resources and provide a high quality living for everyone.

■ **Technical, organizational, and financial innovations are key to creating sustainable cities.**

Effective, transformational solutions for clean, efficient, and livable cities emerge where innovative technologies are combined with mindset shifts, new management and organizational structures, and sound creative business models.

■ **Interdisciplinary collaboration lies at the heart of urban innovation.**

Sustainable, change innovations must be rooted in collaborative processes that facilitate out-of-the-box thinking and enable active work at interface points between sectors and disciplines.

Based on these convictions the City Insights Network developed a radical new approach to urban systems research. In order to more deeply understand the underlying forces influencing and shaping sustainable urban development and the future of cities worldwide, in 2012 twelve Fraunhofer research institutes joined forces with a network of high-profile industry and city partners

Driven by a new interdisciplinary research approach, more than one hundred global best practices in the sectors of energy, mobility, ICT, buildings, production & logistics, security, governance, and urban water infrastructure were analyzed between January and August 2013. In-depth research and analysis was conducted largely on-site in six leading-edge cities: Singapore, Freiburg, Copenhagen, Berlin, New York and Tokyo.

The results of these insights were brought together in one action-oriented model for sustainable urban development. The City of the Future Model gives City Insights Network members a tool to systemically analyze the sustainability performance of any given city system and derive context-based strategies to accelerate sustainable development.

Starting from this point, the City Insights Network is now preparing the next phase of project engagement. Phase II will focus on a) strategic long-term collaborations with selected cities aimed at accelerating their transition towards sustainable urban systems (technologies, infrastructure and governance) and b) implementing transformational projects and solutions developed by consortia in the City Insights Network.

2.2 Outcomes Phase I

The first phase of »Morgenstadt / City of the Future: City Insights« took place from June 2012 until October 2013. Over 50 researchers from 12 Fraunhofer-Institutes conducted a rigorous on-site analysis of six leading global cities: Freiburg, Copenhagen, New York, Berlin, Singapore and Tokyo.

Over 100 best practices in eight urban sectors were analyzed with a trans-disciplinary approach. Fraunhofer researchers systematically derived insights regarding key factors that create conditions for cities to successfully transition towards urban systems that make effective use of energy and resources while maximizing the quality of life for residents. The research identified requirements for the urban markets of the future and enabled new collaborations between private sector industry partners, research institutes, community groups, and city administrations.

The aim of phase I was to identify the leading-edge global status quo of sustainable city systems and to create a starting point for the research and development of innovations in future urban systems. The »M:CI« researchers went one step further and aligned and synchronized insights from all cities in one action-oriented model for sustainable urban development – called the City of the Future Model for Sustainable Urban Development.

■ Methodology

The »M:CI« consortium has developed the »City Insights Methodology«: a multidisciplinary methodology for analyzing complex urban systems and transferring this knowledge into integrated concepts and innovative solutions for future cities.

■ Best Practices

The in depth analysis of over 100 best practices from eight urban key sectors gives valuable insights into successful structures, processes, technologies and business models for sustainable urban solutions.

■ Database

All information is fed into a City Insights Database that tracks the relationships between indicators (over 200 per city), success indicators for each best practice case, and factors that impact sustainable urban development in general. Profiling and benchmarking of cities becomes possible.

■ Impact Factors for sustainable urban development

During the first phase over 600 impact factors for sustainable development were distilled and processed within the database. The categorization process and tracking relationships between the impact factors allowed »M:CI« researchers to identify the key factors that enable sustainable urban systems.

■ City of the Future Model for Sustainable Urban Development*

85 key application fields for sustainable urban development were identified in phase I and integrated to create a generic action-oriented model for sustainable urban development.

■ Project Development

Over 50 ideas and concepts for urban development projects have already been generated out of the insights from the analysis of the reference cities and the first projects are in the process of implementation or are 'shovel ready'.

*Distinguishing the terms - all these 3 levels are represented within the model:

1. **Indicators = What**

The indicators enable »M:CI« to assess the current state of the city. Examples include numbers and figures that show the performance of the city (cars per 1000 people, / CO₂ emissions per capita, / total road length / water use per capita etc.)

2. **Application fields = How**

The application fields allow »M:CI« to assess how the city is addressing its challenges and potentials. These include 85 fields for action that we identified within these six cities on 3 basic categories: urban leadership (policy, planning, management & structuring of sustainable development), levers (urban planning, business tactics, incentives, regulations, R&D tactics, information & education etc.), points of action (smart grids, resilience engineering, urban big data systems, electronic ticketing, renewable energies, district heating, energetic refurbishment, storm water management etc.). These are the foundational basis for the model.

3. **Impact Factors = Why**

An analysis of the impact factors uncovers why certain progress happens (or does not happen) in a particular way in a specific urban system. These are general factors that push or hinder the process of sustainable development (active leaders, access to funding, geographic parameters, tolerance of citizens, existence of informal networks, etc.)

Starting in January 2014, »M:CI« will be transformed into an ongoing alliance of industry, cities, and research partners that will join forces for the purpose of accelerating innovation throughout the various research sectors and for creating both international and German showcases for transformative urban projects. The focus of Phase II will be on developing detailed, innovative cross-sectoral urban sustainability projects and on implementation within context-specific complex city systems.

3.1 Scope of the platform

The primary mission of the City Insights Network is to **identify, conceive, initiate and implement pilot and demonstration projects for sustainable urban solutions** in cities in Germany and around the world. Projects will be developed in variable consortia made up of industry, city, and research partners.

Throughout phase I of »M:CI« researchers witnessed several challenges that industry and businesses face in working together with cities:

- No single company can meet the needs of a city nor can it implement innovative solutions without partners from the city and businesses from other sectors.
- Companies find it difficult to engage cities directly as a customer. Procurement regulations can complicate the ability of companies to develop a reliable relationship with city clients.
- Public contract directives usually lead to large and inefficient bidding processes. They produce high upfront costs on both sides and often do not result in the best solution.
- Good solutions to pressing problems are often not implemented because evidence based long-term planning and sound analysis of consequences are not being applied or because investors fear the risk that goes along with innovative technologies.

The City Insights Network is designed to address these challenges with a new collaborative approach.

The aim of »M:CI« Phase II is to **initiate and accelerate the long-term transitions of selected cities towards sustainable urban systems** and to thereby create both international and Germany based reference projects on the level of entire cities.

»M:CI« aims to become the first global alliance for planning and implementing large-scale sustainable urban solutions in a range of cities around the world.

3.2 Project Structure

In January 2013 »M:CI« project partners inaugurated an R&D platform and put forward 50 ideas for innovative solutions for cities and pilot projects in different sectors. A more formalized »City Insights R&D Platform« will build upon this existing structure in the coming years.

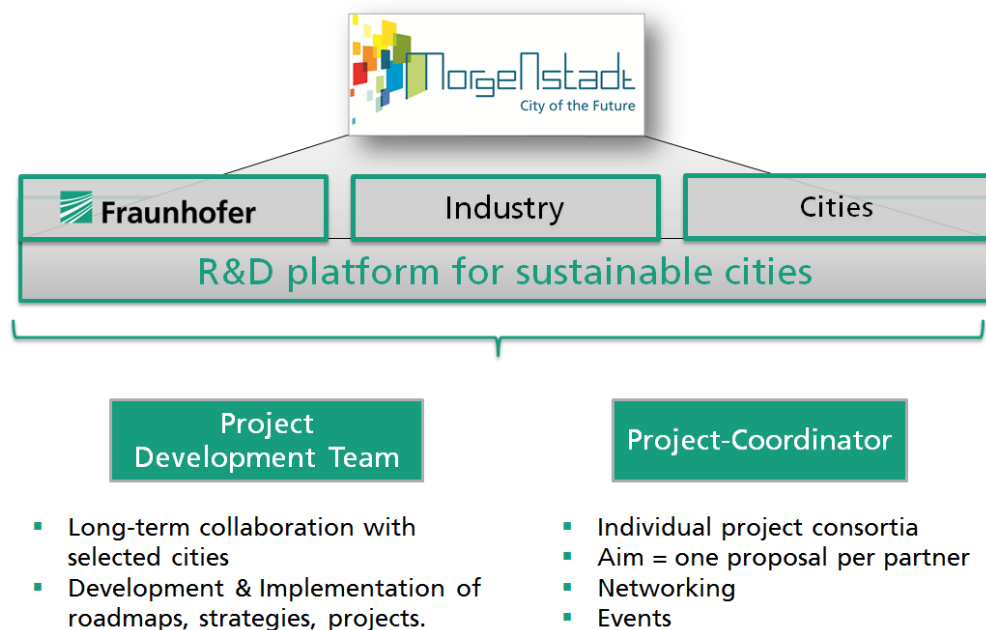
The »City Insights R&D-Platform« consists of the three main actor groups: cities partners, industry partners and Fraunhofer-Institutes.

All actors will meet regularly in **workshops and conferences** for engaging with specific research topics and for building smaller consortia around specific projects that will be developed through to implementation.

A **project coordinator** will actively engage all actors by supporting and developing promising proposals, by searching for project financing and by coordinating the application process.

A **project development team** serves as a research and business development unit for initiating long-term collaborations with selected cities, for conducting on-site systems analyses, and for coordinating the development and implementation of adapted roadmaps and strategies towards sustainable urban systems.

Figure 1
Project Framework



3.3 Project stakeholders

Currently, the City Insights Network is comprised of 21 industry partners, 12 German cities and 12 Fraunhofer-Institutes.

Industry partners

badenova, Bosch, Cadfem, Daimler, Dorsch Gruppe, Drees & Sommer, EnBW, EWE, Fichtner, Finmeccanica, IBM, Ill Taiwan, RTI, Qingdao Sino German Ecopark, SBA, Schüco, Siemens, TÜV Süd, Vattenfall, Volkswagen, Züblin

Cities

Berlin, Ingolstadt, Düsseldorf, Norderstedt, Karlsruhe, badenova-RegionalCluster: Freiburg, Offenburg, Baden-Baden, Lörrach, Neuenburg, Breisach, Waldshut-Tiengen

All associated **Fraunhofer Institutes** can be found on page 20.

Unique to the City Insights Network is its heterogeneous base of partners. Phase I has impressively demonstrated the potential of combining multiple backgrounds and approaches to shaping sustainable cities. From 2014 on »M:CI« will harness the full potential of the network by actively combining the ideas and solutions of diverse suppliers in joint city projects.

Project partners all pursue multiple aims and have multiple reasons for becoming active members of the »M:CI« Network.

The following table gives an overview on benefits and results project partners can expect from joining the City Insights Network for the second phase of »M:CI« starting in 2014:

| | |
|--------------------------|---|
| Cities | Use the City Insights Network as platform for ... <ul style="list-style-type: none">▪ learning about leading-edge technologies and applicable solutions from industry, research, and other cities▪ Identifying strategic partners and form collaborations for the implementation of specific projects▪ conducting a sustainability quick check that allows cities to compare themselves in relation to others and assess relative strengths and weaknesses▪ gaining access to project funding from the public and private sector▪ exchanging and discussing experiences and promising practices▪ promoting city brand and attracting international attention |
| Industry Partners | Use the City Insights Network as platform for... <ul style="list-style-type: none">▪ Learning how products relate to cities and how to maximize market position▪ Partnering with business, research, and cities to generate pilot |

projects

- Accessing selected German and international city markets with a comprehensive and systemic approach
- Co-creating roadmaps and urban development strategies in selected cities
- Influencing scope and content of smart/sustainable city projects in early project development stages
- Gaining access to regional and international funding
- Promoting global brand
- Informing product development and logistics processes based on future city scenarios

3.4 Fields of R&D for »M:CI«

The City Insights Network focuses on seven key technology sectors with a systemic, integrated approach. Governance structures and the economic dynamics within urban systems facilitate progress in these technical sectors and thus represent additional arenas for analysis and implementation.



Mobility

Electric vehicles, innovative charging technologies, infrastructures for bicycles, highly efficient mass transport systems, e-ticketing, real-time information and steering of traffic, urban cable cars, transport oriented development, city of short distances, sub-a-vehicles and urban mobility on demand are examples for R&D topics in future cities.



Energy

Renewable energies, energy efficient technologies, and communicating energy grids will become the drivers of tomorrow's cities. But where will the energy be produced? Energy-plus-houses already produce more green energy than they need. Integrated community energy solutions that link houses, wind and solar parks, biomass sites and electric vehicles or micro smart grids can be a starting point for an integrated urban energy system of the future.



Communications

Technologies already exist that enable communication between devices, buildings, vehicles and people. Geographic information processing, wireless internet, and smart-phone technology possess almost infinite potential for the development of smart solutions for urban systems.



Buildings

Several groundbreaking technologies allow buildings to communicate with their environment, to produce more energy than they consume, and to work with light, biomass, and air from the local environment. Future city development will rely on these technologies and integrate them into systems that allow groups of buildings to create closed cycles of energy and material flows and to shape urban micro-climates.



Production and Logistics

Smart and sustainable use of resources is a key challenge for all cities. Full integration of advanced recycling, recovery and reuse techniques into urban material flows and the holistic use of cradle-to-cradle systems for production, services and consumption will be imperative for the sustainable megacity of tomorrow. This also implies innovations in product design that maximize biodegradable materials and recyclable product concepts. Smart city logistics complete a resource efficient production chain for sustainable distribution of goods in urban areas.



Governance & Planning

Effective organizational structures, management strategies, and the integration of essential actors are essential for multilevel governance of urban processes. Leading cities have developed systems that integrate citizens into decision structures and create smart collaborations between city administration, local businesses, community organizations, and research institutes. Urban planning and governance structures are foundational to the success of sustainable solutions.



Economic Development and Business Innovation

Healthy local businesses and a functioning economy are key to the sustainable development of cities. Strategies to attract businesses and develop economic clusters must be aligned with the implementation of urban sustainability projects. At the same time new technologies and innovative solutions need sound business models and secure financing. These issues are addressed together for a functioning real-world approach.



Security

The resilient city of the future will integrate security concepts and systems at the design stage of urban planning and policy implementation, therefore ensuring the capability to identify and

overcome emerging risks as well as to effectively manage catastrophic situations and quickly return to normal status. New smart and multifunctional protection technologies and materials complemented by sophisticated planning tools, integration of natural systems, capacity building and training, and citizen participation will maximize security while at the same time protecting the civil liberties of its citizens.



Urban Water Infrastructure

Full integration of advanced water treatment, recovery, and reuse techniques into urban systems is imperative for the city of tomorrow. The water infrastructure should integrate with the natural watershed of the area. Innovations in the water supply and sanitation sector must maximize recovery of energy, water and nutrients and must link to other sectors for the most effective reuse of resources.

4 Approach and work streams

4.1 Expected results of the projects

- **15 – 20 projects sector level projects initiated and carried out in smaller consortia.**

Projects can be pilot or demonstration projects or can consist of the development or testing of new solutions in collaboration with cities, research, and industry. They are developed around leading Fraunhofer-Institutes within the specific sectors.

- **Long-term collaboration with at least 3 cities (international and German)**

The visible outcomes of »M:CI's« close and ongoing partnership with selected cities will include a series of joint workshops, the institutionalization of the local counterpart teams, an in-depth systemic city profiles, and detailed roadmaps for sustainable development including several key projects ready for implementation.

The overall goals include initiating projects, showcasing the potential of the City Insights approach, generating international visibility and creating reference projects with the scaling potential.

- **5- 10 integrated city systems projects in the pipeline**

The primary outcome of the joint development of city roadmaps will be a set of implementation-ready key urban development projects that are strategically connected and build on each other.

4.2 Project Approach

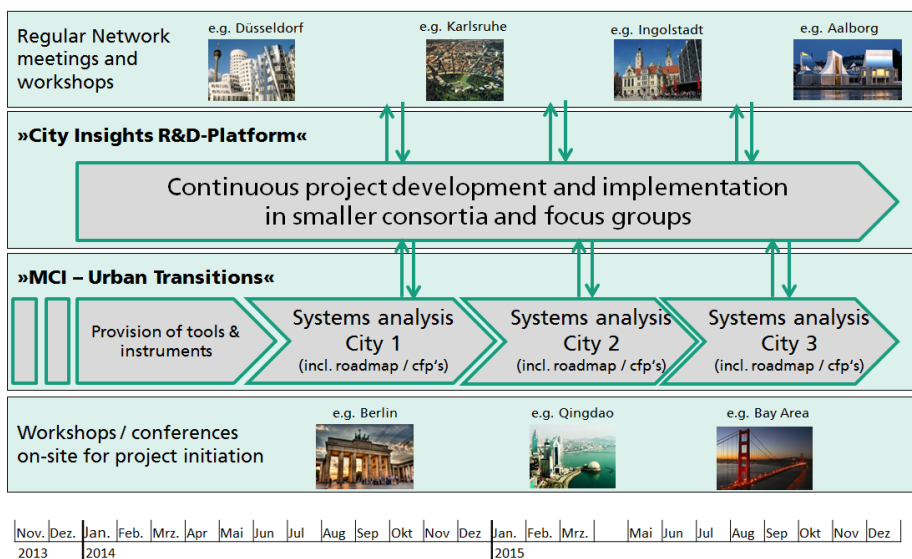


Figure 2 Project Approach

The City Insights Network aims to generate and implement innovative solutions and pilot projects with one or more key sectors involved. At the same time it aims to address the systems level of cities and to demonstrate the long-term transformation of cities across multiple sectors. With these goals in mind, the project approach has been designed as follows (depicted in graph above):

4.2.1 »City Insights R&D-Platform«

Connected by a collaborative online platform, members of the City Insights Network will self-organize in different focus groups for addressing sector specific research questions and for developing and implementing innovative solutions together with our city partners. Coordination of these projects will be managed by the responsible Fraunhofer-Institute(s) representing each sector.

Supported by a City Insights Project Coordinator and the City Insights Management Team, the project consortia can actively link to public funding on state, national and international levels. Options for private funding, institutional investments, and business innovation are being promoted by the City Insights Network.

Regular network meetings bring together all network members and allow for exchange of ideas and creation of new project ideas.

»City Insights R&D -Platform«

| | |
|------------------|---|
| Goal | Initiation of project ideas, proposals, and applications for the implementation of development / technology projects in smaller consortia |
| Structure | <p>Projects are proposed and initiated systematically by the »City Insights Project Development Team«.</p> <p>Additional projects are proposed and initiated by any member of the City Insights Network.</p> <p>Coordination of workshops, best practice visits, ideas and proposals (by research coordinator).</p> |
| Procedure | Sustainability Quick Check for all member cities. Benchmarking of municipalities, based on systemic analysis tools derived from »M:CI« phase 1. |
| Financing | 50% of »M:CI« funds are used for the creation and initiation of technology concepts and joint city projects. |

4.2.2 »M:CI – Urban Transitions «

Approach and work streams

»M:CI – Urban Transitions« consists of a lean team of three to five Fraunhofer researchers. It is coordinated by Fraunhofer IAO and comprises members of one or two other Institutes.

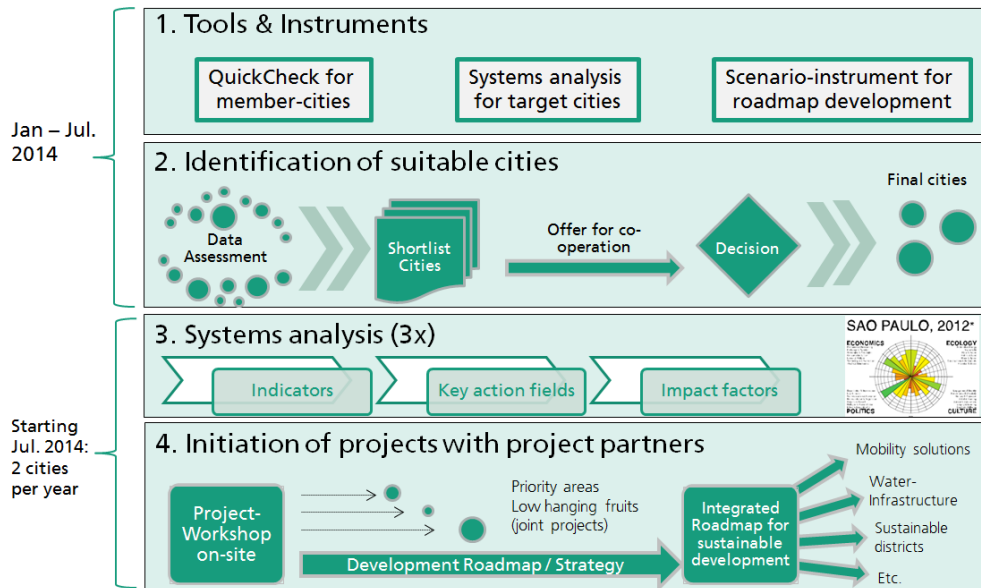


Figure 3
Morgenstadt:
Project Development

»M:CI – Urban Transitions«

Goal Create international showcases for systemic urban development by initiating and implementing long-term transformation processes in selected cities in Germany and internationally.

Structure A central »Project Development Team« has operational responsibility for initiating the collaboration between the City Insights Network and selected cities.

Promising cities will be nominated by all project members. Nominated cities must meet basic criteria such as:

- Strong demand and potential for sustainable development.
- Attractive to City Insights Partners (international showcase with high transferability and high-potential market).
- Demonstrated capacity for change and implementation of high-level projects.
- Commitment to long-term collaboration - financial contribution and strong support of local counterpart team.

-
- Procedure**
- Development of appropriate tools and instruments on the basis of the results of Phase 1.
 - Active identification of suitable cities (national and international) that respond to the above named criteria.
 - Systems analysis of the identified cities using the City Insights tools (indicators, key fields, impact factors).
 - Targeted integration of project partners and Fraunhofer-Institutes for initiating joint technology-projects and for the development of strategies, roadmaps and concepts for the transformation of the selected cities towards higher sustainability.
 - Promoting access to funding for proposed projects by referring to national and international finance institutions (development banks) and public funding programs.
- Financing** 30% of total project funds are channeled into supporting the tasks of the project development team.
-

4.3 Project Management

Overall the coordination of the City Insights Network lies with the Fraunhofer IAO. Project management tasks include:

- Coordinating the flow of information between all parties involved
- Administration of the City Insights Online Platform
- Organization of events and workshops
- Coordination of contractors and third parties within the project framework
- Public relations and communication

Communication between project members and project management will take place primarily in the form of regular e-mails, newsletters and compressed reports, and briefings on ongoing projects and developments.

4.3.1 Newsletter, reports, briefings

Partners in the City Insights Network receive periodic newsletters with information about current research projects, conferences and events, and with information on important developments and initiatives in key sectors of interest.

Information on organizational issues (workshops, events, decisions) will be disseminated through e-mails. The results of systems analysis will be communicated in compressed reports and briefing documents.

4.3.2 Online platform

In addition to in-person meetings, an online platform will facilitate the information flow and enables interaction between all project partners. Through the online-platform members will have the opportunity to exchange ideas and information and to extend contact networks. »M:CI« will provide up-to-date information and documents exclusively for the project members on the online platform.

In addition, newsletters and briefing documents will be available for download exclusively for project members.

4.3.3 International meetings

One of the key institutions of the City Insights Network will be regular in-person meetings facilitated for the purpose of initiating projects and exchanging ideas and best practices. Progress in individual fields of investigation will be presented in the plenum and will be discussed and evaluated by the project members. The project meetings will be complemented by expert lectures and visits to thematically interesting locations (e.g. model regions, sites, research institutes etc.) with best-practice tours of ground-breaking projects.

4.3.4 Steering Committee

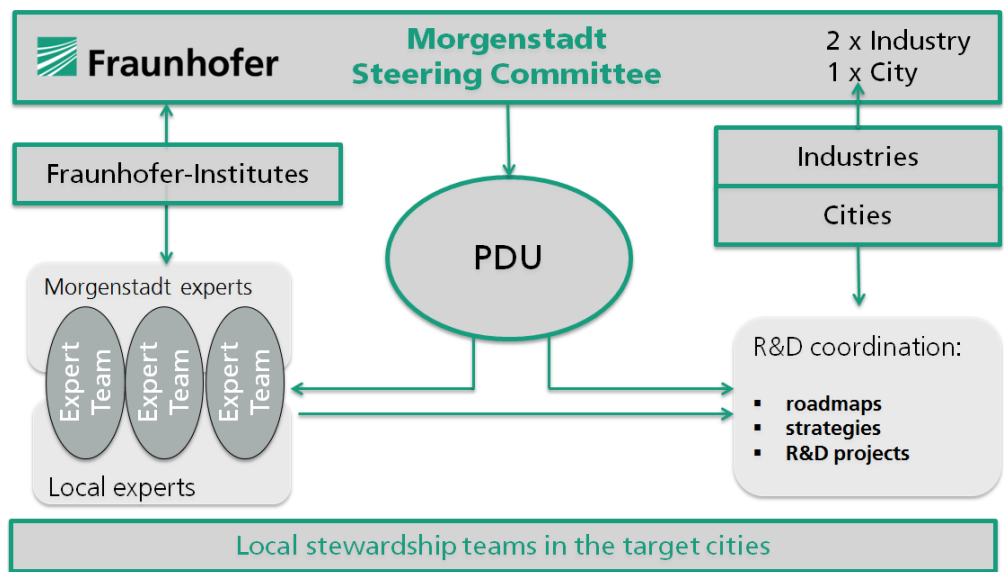


Figure 4
Organization Structure

The »M:CI« Steering Committee represents an equal share of Fraunhofer representatives (3) and project partners (3: 1 city partner, 2 industry partners).

The goal of the steering committee is to achieve the best representation and integration of the interests of research, cities and industry throughout the course of the project. Representatives from industry and city partners on the »M:CI« steering committee will be elected on an annual basis by all project members.

The steering committee will determine the allocation of resources for the project development team. It will also stipulate which cities the project development teams will visit, along with the number of project experts.

4.3.5 Associated Fraunhofer Institutes

The following Fraunhofer-Institutes are collaborating throughout the City Insights Network and cover the fundamentals of all relevant sectors of investigation and project development.

- Fraunhofer Institute for High-Speed Dynamics – Ernst-Mach-Institute EMI
- Fraunhofer-Institute for Open Communication Systems FOKUS
- Fraunhofer Institute for Industrial Engineering IAO (project coordination)
- Fraunhofer Institute for Building Physics IBP
- Fraunhofer Institute for Material Flow and Logistics IML
- Fraunhofer Institute for Manufacturing Engineering and Automation IPA
- Fraunhofer Institute for Solar Energy Systems ISE
- Fraunhofer Institute for Systems and Innovation Research ISI
- Fraunhofer Institute for Factory Operation and Automation IFF
- Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB

4.3.6 Additional Partners:

Economic Transformation Group (ETG)

Fraunhofer experts are supported by the Economic Transformation Group (ETG) with knowledge and experience in economic development and business innovation. With over 20 years of hands-on experience around the globe, Economic Transformations Group brings together leaders from business, government, education, and community to define effective strategies and to take specific actions to achieve sustainability and real prosperity.

ETG has led the field with hands on experience in regional economic development, urban planning, innovation, and sustainable business practices. From Silicon Valley to Slovenia and from Morocco to Mexico, ETG has succeeded in inspiring, forming, and supporting action teams of business,

government and community leaders to develop and implement strategies for sustainable and competitive economic growth. ETG's networked team of consultants includes experienced economists, management consultants, implementation specialists, and systems and institutions designers. All of ETG's affiliates are committed to the principles of sustainability.

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Approach and work streams
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Other Partners

We are currently in communication with established value partners of the »M:CI« Network (ICLEI; WBCSD) in order to integrate their experience and global network into »M:CI« phase II.

5 Project duration, funding and contact

5.1.1 Project duration

The second phase of »M:CI« will start on January 1, 2014. Since it is designed as a long-term alliance, there is no defined end-date to the network.

Membership starts at a two-year contract and can be extended on an annual basis.

5.1.2 Project financing

»M:CI« is financed by network partners. The participation fee for various member categories is as follows:

| | |
|--------------------|---|
| Enterprises | Participation fee: 50.000 € per annum |
| SMEs, NGOs | Participation fee: 25.000 € per annum |
| Cities | Participation fee: 000 € per annum Systems analysis: from 50.000 € |

Project partners that sign a contract over three or more years can be granted a discount to the total membership fee. Full yearly fee applies regardless of initiation date of the contract.

The budget covers the engagement of Fraunhofer-Society researchers and as-needed additional expertise, travel expenses for on-site research, workshop expenses and expenditures on literature and materials that will be used and generated within the project.

5.1.3 Project language

The official »M:CI« language is English. Some specific activities, however, must be conducted in German.

- Research activities and project development in German cities will be conducted in German.
- International research activities and project development will be conducted in English.
- Important documents for all project members will be provided in English. German summaries will be provided upon request.

CONTACT

Fraunhofer Institute for Industrial Engineering IAO

Nobelstrasse 12
70569 Stuttgart

Prof. Dr.-Ing. Wilhelm Bauer

(Head of project)

Phone +49 711 970-2090

wilhelm.bauer@iao.fraunhofer.de

Alanus von Radecki

(Project manager)

Phone +49 711 970-2169

alanus.radecki@iao.fraunhofer.de

Dr. Alexander Rieck

(Deputy project manager)

Phone +49 711 970-5478

alexander.rieck@iao.fraunhofer.de

Steffen Braun

(Deputy project manager)

Phone +49 711 970-2169

steffen.braun@iao.fraunhofer.de