Outlook Earth
Research on global change

In the City of the Future

Intelligent – Climate-friendly – ecological?

Photo: Fotolia

Research for the City of the Future

More and more people are moving to urban areas. The United Nations predicts that three quarters of the world's population will live in cities by 2050. 70 percent of the greenhouse gases generated by humans are already being emitted in cities, and 75 percent of energy is consumed in cities. One thing is thus very clear: cities are facing major ecological and social challenges.

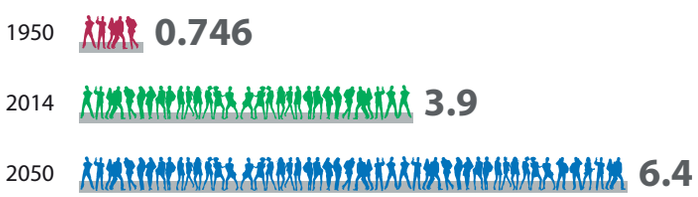
Issues such as adaptation to climate change, energy security, secure jobs, affordable homes, sustainable mobility, health, migration and demographic change come together in cities in a particularly critical manner.

For this reason cities have to play a keyrole in finding answers to all these issues. Concepts for sustainable urban development are urgently needed that will result in CO_2-neutral, energy-efficient and liveable cities. Solution approaches already exist for these issues, but there are still lots of open research questions. The main task here is to implement successful models – such as new mobility concepts, urban agriculture or the increased use of renewable energy sources – in the city in question, whether this is New York, Casablanca, Mumbai or Frankfurt am Main.

In Germany too, three out of every four people already live in cities. Modern cities are more than just places to live and work. They are centres of our lives and represent environments full of things to experience. Cities are also places that create a sense of identity. In a globalised world therefore cities are the new anchors of identity.

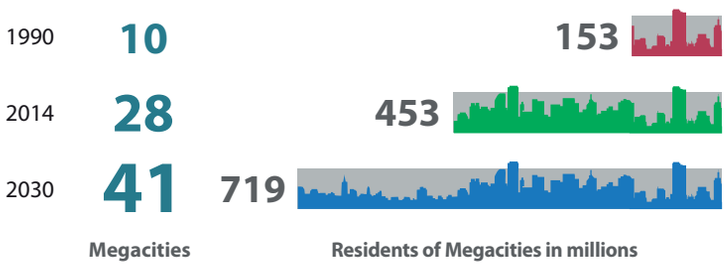
With its "FONA – Research for sustainable development" framework programme, the German Federal Ministry of Education and Research (BMBF) is funding numerous research initiatives that are helping to shape our cities and metropolitan regions in a sustainable, liveable manner. We present four projects and funding focuses in this publication.

Global urban population in billions



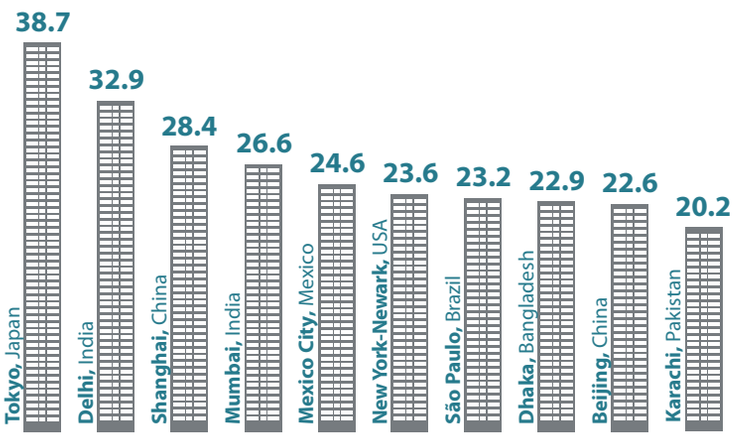
Source: United Nations, www.un.org/en/development/desa/news/population/world-urbanization-prospects-2014.html

Global Megacities (over 10 million residents)



Source: United Nations, www.un.org/en/development/desa/news/population/world-urbanization-prospects-2014.html

Megacities in 2025 Residents in millions



Source: United Nations, blog.knowledgeshare.com/thinking-beyond/rise-megacities-facts-urbanisation

„Quality of Living"-Ranking 2015

1. Vienna	6. Dusseldorf	14. Berlin
2. Zurich	7. Frankfurt	16. Hamburg
3. Auckland	8. Geneva	21. Stuttgart
4. Munich	9. Copenhagen	25. Nurnberg
5. Vancouver	10. Sydney	59. Leipzig

Source: Mercer, www.mercer.com/newsroom/western-european-cities-top-quality-of-living-ranking-mercer.html

Photo: German Government, Steffen Kugler

„We need sustainable, liveable cities. What is at stake here is the *Heimat* of urban residents."

Prof. Dr. Johanna Wanka,
German Federal Minister of Research

More people already live in cities than in rural areas today. What should a future-oriented city look like?

Above all, the city of the future should be liveable. Just a few years from now, three out of every four people will live in towns and cities. All of the major challenges of our times manifest themselves in a particularly critical manner in urban centres. However, cities also stimulate change. We all want a clean environment, a well-functioning transport system, reliable and affordable energy, and a positive social coherence. In other words, we want sustainable, citizen-friendly cities. What is at stake here is the *Heimat* of urban residents.

What do we need to do?

A lot of recommendations and research findings already exist with regard to sustainable redevelopment of cities. These include the decentralised reuse of rainwater, PV systems on unused building surfaces and other unused urban areas, and urban agriculture on roofs in cities. What is missing is the adaptation of these measures for the conditions in individual cities and for the needs of citizens. Involving urban stakeholders at an early stage so as to explore and identify solutions together that will enjoy the support of citizens is a key aspect.

What is the BMBF doing?

In our new framework programme "Research for sustainable development", the city of the future is one of three central topics alongside the energy transition and sustainable economic activity. With the choice of these focal areas, we are aiming to support interdisciplinary and applied research. In the international arena, we are cooperating with regions experiencing dynamic growth, such as Addis Ababa in Ethiopia. We have installed a number of pilot plants for waste recycling there, which now form the basis for a larger scale plant in Nairobi, Kenya. Our recent "Rapid Planning" research initiative also focuses on sustainable urban planning concepts in other countries in Africa and Asia.

What is the road ahead for the City of the Future?

The first phase of the City of the Future competition already provided a lot of stimuli for changes. A lot of good ideas have been initiated in the 51 participating municipalities since 2015: how access routes could be transformed in parks and shared zones, for example. I am sure that the cities and towns that have now qualified for the second round will continue along this path with the same level of dedication and creativity. In the current, second phase of the competition, the most convincing suggestions will now be turned into plans that can be implemented from 2018 onwards. The municipalities will receive up to 200,000 euros each here. In this way, we are developing solutions that will show the way for others – both nationally and internationally.

Content

Additional links

- ➤ www.fona.de/en/
- ➤ www.fona.de/en/zukunftswerkstadt-14451.html
- ➤ www.dlr-pt.de/umwelt

Urban agriculture: Fashionable trend or strategy for the future?

Digging, planting, harvesting: urban gardening continues to become increasingly popular as a lifestyle choice. If stressed-out city-dwellers in Germany are rediscovering allotments gardens and turning neglected sites into areas of greenery, this is not really in response to urgent needs. However, the situation in rapidly growing cities and in future megacities in emerging and developing countries is quite different; these cities would be threatened by real shortages if vegetables and crops were not grown locally. If the right concepts are in place, local supplies and the urban climate can both be improved.

Source (3): UAC, TU Berlin

School garden in Ouled Ahmed

Constructed wetland in Ouled Ahmed

Selling organic agricultural products, pedagogical farm, Casablanca

Urban agriculture in Casablanca

For a long time, the agricultural potential of Casablanca – which has a population of four million – and its surroundings remained untapped. Fresh fruit and vegetables are generally transported to the city from hundreds of kilometres away. Four pilot projects within the "Future Megacities" funding initiative have investigated the issue of urban agriculture as it relates to other relevant sectors.

A pilot project in Ouled Ahmed is demonstrating how urban agriculture can improve living conditions in informal residential settlements by employing innovative interrelated approaches. Cucumbers, tomatoes, cabbages, lemon balm, mint and coriander are being grown on the "ferme solidaire" – a 1,600 m^2 community garden. Women from the neighbourhood are being trained here in healthy food production by a local NGO. In this way, a green oasis has been created in the city that now supplies eleven families with fresh vegetables and culinary herbs and is even providing a small income for these families.

The water required comes from the hammam across the street, which sends its wastewater through a constructed wetland to the agricultural plots. In order to purify this water to the necessary degree, it is let through a newly constructed wetland with a gravel filter. The residual phosphates from soaps and shampoos serve as free fertilisers. "The project is no longer just a social meeting point in Ouled Ahmed, but also demonstrates to experts and decision-makers just what can be achieved with the simplest of means," reports the project coordinator Prof. Undine Giseke from the Technical University of Berlin. Alongside the farm, a school garden has also been created where the local children can become familiar with plants and how to cultivate them and can learn about fundamental environmental issues. The module for reuse of water from local hammams for irrigation of gardens and green areas was supported by the city administration and recommended to local investors.

This is just one major achievement of this project, which was supported by the BMBF between 2008 and 2014 with total funding of 6.4 million euros. In parallel, researchers from Morocco and Germany and local partners have improved the reuse of industrial wastewater at a site close to the airport, developed an initial concept for organic farming combined with local tourism, and founded a brand for sustainable organic agricultural products. All in all, this research project is an excellent example of how flagship projects can be started that have a positive long term impact even after the funding has come to an end.

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Links
www.uac-m.org
www.future-megacities.org

Rapid Planning: Kigali

The challenges facing tomorrow's cities are immense: they will have to accommodate more and more people and provide functioning infrastructure for transport, utilities and waste disposal – and all this in a manner that is kind to the environment and the climate. The ideal situation is a city that is sustainable and CO_2-neutral. However, many rapidly growing cities largely lack the planning structures that would take into account all the relevant issues and the interactions between these issues. The "Rapid Planning" project attempts to identify answers to the issue of what type of good infrastructure management citizens and authorities require on the ground.

In order to cover as many representative types of cities as possible, the Rapid Planning research project is focussing on four urban centres: Da Nang in Vietnam, Assiut in Egypt, Kigali in Rwanda and Frankfurt am Main in Germany.

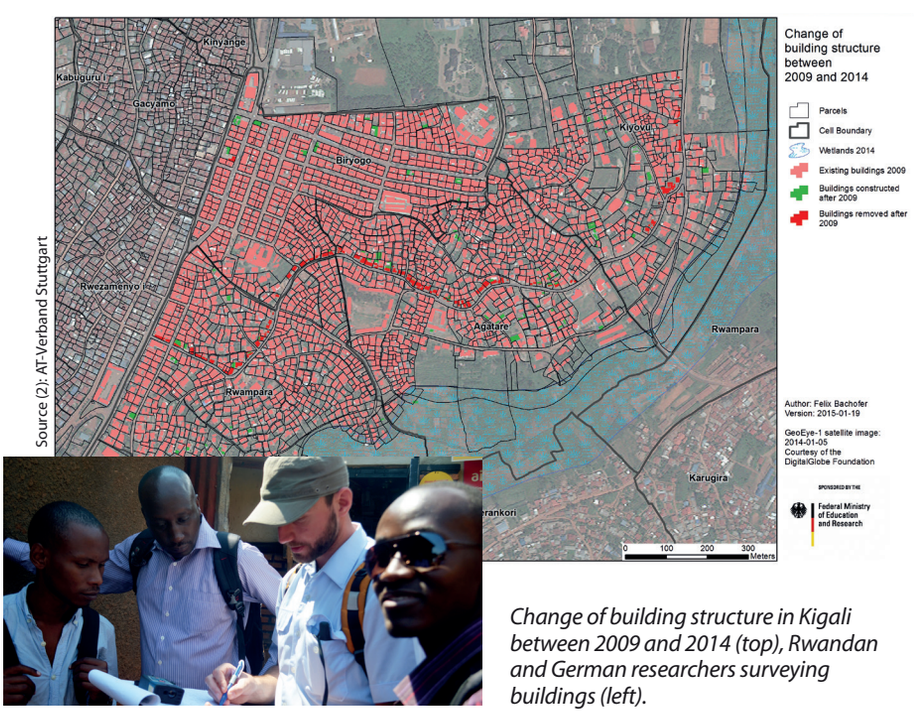
Urban management in Kigali

Kigali, the capital city of Rwanda with a current population of around 1.1 million, will grow by 4.5 percent per annum in the coming years according to government plans. However, the development of the city has evolved with limited planning codes. Many districts of the city – including more attractive residential areas – have developed in an "informal" manner, i.e. without the relevant participation of the city authorities. In cases where the city has been active, construction projects are often not based on detailed analyses. Researchers refer to this as building "on the basis of non-data".

To respond to this need, around 35 researchers from Germany and 15 Rwandan colleagues are currently gathering the necessary data. Customer-developed apps support the data acquisition. This includes surveying the existing building stock and interviewing residents: What buildings are people living in in the various areas of the city? How much water and energy does each resident use, and how much wastewater and other waste is produced per capita? And what type of waste is this? Only then will it become clear where what materials are being generated and disposed of that might be worth collecting for recycling purposes. The researchers wish to develop methods for utilities supply and waste disposal on this basis:

The aim is to identify where it would actually be worth building a biogas plant at a location where organic waste is available in the locality, energy is needed and the residual sludge can be used. In this way, plants are to be avoided that are built with high aims, but cannot be run economically in the long term. At the same time, a so-called entry project is intended to deliver quick results. For example, how can hygiene be improved in city districts that are not connected to the sewer system? How can local systems provide energy to meet peaks in demand? In order to ensure necessary support from the residents, the city is sending employees out into the city districts to ask residents about their problems and wishes and consider them.

This participative approach in particular is an area where Frankfurt am Main could also learn from Kigali. After all, this is a key component in "Rapid Planning": the aim is that cities should swap information and benefit from the experience of the partner cities.



Source (2): AT-Verband Stuttgart

Change of building structure in Kigali between 2009 and 2014 (top), Rwandan and German researchers surveying buildings (left).

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Dynaklim: Extreme weather events and water management

The Emscher-Lippe region – a conurbation area situated between the cities of Dortmund, Bochum, Essen and Duisburg – forms the central core of the Ruhr area and is one of the most densely populated economic regions in Europe. 3.8 million people live in the catchment area of the Emscher and Lippe rivers. In the future, the climate in this region will be characterised by wet, moderately cold winters and hotter, drier summers with frequent heavy rain events. The average annual temperature in the area around the Emscher and Lippe rivers will rise by between 2 and 3.5 degrees Celsius by the year 2100. The annual precipitation will increasingly shift from summer to winter.

The average annual temperature in the Emscher-Lippe region is expected to be up to 3.5°C higher than today by the end of the century. In addition, experts predict that there will be greater quantities of precipitation and that it will rain much less often in summer, but more often in winter. These changes will have a noticeable effect on the water budget and thus also on the living conditions of humans and on the reliability, quality and costs of water supply and wastewater management. As part of the Dynaklim project, an interdisciplinary network was established between 2009 and 2014 that has developed a successful catalogue of adaptation measures ("Roadmap 2020") alongside a range of pilot projects.

Many places in Germany will increasingly have to deal with flooded streets, squares and basements after heavy summer rains. However, the problem is that local authorities do not have sufficient funds to prepare properly for these occurrences. As part of the "Water-sensitive urban development" topic, Dynaklim has developed guidelines in cooperation with a network of stakeholders and further urban actors; these guidelines pave the way for the implementation of flexible, affordable measures. Places that are particularly at risk were identified in pilot areas and drainage systems were adapted. The specific aim was to drain water from surfaces and not to have it disappear into the nearest gully, but rather to store it temporarily in public spaces or parks.

For example, the rainwater from a street in Duisburg that is at risk of flooding is to be guided to an existing skate park after the park's terrain will have been lowered. A total volume of up to around 750 m^3 of water can be stored in this basin, thus preventing flooding of the street.

Source: Emschergenossenschaft/Lippeverband, Jochen Durchleuchter

River Lippe at Olfen

As part of another project, Dynaklim is addressing the problem of urban heat islands. This phenomenon is accentuated by densely built environments, a lack of vegetation and sealing of ground surfaces. There is a lack of stored water which could evaporate and cool down the air when it gets hot. As part of the "Heat-adapted urban structures" topic, measures have been identified that range from reducing the building densities and the creation of water areas, through to the greening of old industrial sites. A ground information system (URBIS-ER) was developed to identify ground-cooling potential for parts of the Ruhr area. Covered ground areas were converted and made permeable again – for example, in the city of Bottrop. This latter example in particular shows that adaptation measures are only possible if various public authorities work together: a compact city with short journeys is desirable from the perspective of climate protection, but less ground sealing and more greenery are beneficial in terms of climate change adaptation. The Dynaklim project is regarded as particularly successful as the necessary cooperation between administration, the political sphere, civil society and industry in the Emscher-Lippe-Ruhr region is still active today even though the funding expired. "Roadmap 2020", which is being continued on an ongoing basis, is now regarded as a pioneering project for climate change adaptation and has been included in the programme for the state-wide KlimaExpo 2022 exhibition.

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ZukunftsWerkStadt promotes citizens' dialogue

Around half of the world's population now lives in cities. It is predicted that this fraction will rise to over two thirds by 2050. In Germany, 74 percent of the population already live in urban areas today. The aim of *ZukunftsWerkStadt* is to involve citizens in municipal projects in the area of sustainable urban development – in both growing and shrinking cities. In total, eleven cities and districts were selected for the implementation of projects on site. The successful achievements in various municipalities have demonstrated that the involvement of citizens at an early stage leads to more dialogue, participation and transparency in issues of sustainable urban development.

ZukunftsWerkStadt II

There is a close connection between sustainable urban development in German cities and rural districts and the challenges presented by urbanisation, climate change, resource scarcity, globalisation and demographic change. Concepts for mobility, infrastructure and climate protection or the implementation of the Energy Transition must be adapted to regional differences and the demand structures that arise from them. This requires a strong civil society. To ensure citizen participation in the changes necessary for sustainable urban development from an early stage, 15 cities and rural districts were chosen to develop community sustainability projects, together with their citizens, as part of the funding measure "ZukunftsWerkStadt", which was launched by the German Federal Ministry of Education and Research (BMBF) within the "Science Year 2012 – Project EARTH: Our Future". The successes of the 15 communities have shown that early citizen participation in questions of sustainable urban development lead to more fruitful dialogue, commitment and transparency. It was evident throughout that an unprejudiced, early, regionally and implementation-orientated dialogue was more likely to make citizens feel that their personal efforts would make a difference and contribute to the sustainable development of their communities.

The concept development stage is now complete and the participating cities and rural districts are about to enter a phase of "on-the-ground" implementation. For the purposes of consolidating citizen participation and the implementation of the projects, all participants were invited to apply for a second funding phase.

Leipzig: Sustainable City Finances

Sustainable city financing is a major subject in discussions concerning Leipzig's budget. Tied into the results of the BMBF funded project, "Leipzig weiter denken", the aim is to encourage citizen participation in budget discussions. The focus is on making Leipzig's financial data available to relevant groups and increasing transparency. Building upon the experiences made by other cities, the preexisting online tool "Haushaltsplanrechner" (budget calculator) is being redesigned and a group oriented consultation concept developed.

Harz district: "Vision 20Plus - Achieving more together"

The continuation of the work from the first phase will further the process of answering the central questions posed by ZWS: How do we want to live? How should we economize? And how can we save the environment? These key questions played an important role in the first phase and will continue to play an important role in the second phase. At the forefront of the process is citizen participation, as this proved to be useful in the development of a sustainability strategy for Osterwieck. A new aspect will be the analysis of intercommunal cooperation, an important factor in sustainable development. The aim of the scientific support in the second phase of ZWS is to analyze catalysts and barriers for sustainable city development in a rural area and to extrapolate the approaches for developing a sustainable and climate friendly society.

Source: Leipzig City, Alexandra von Pawlowski

Leipzig - forward thinking

Source: Harz district

ZukunftsWerkStadt Harz: Kids' University

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