YOUNG RESEARCH FORUM

Research Papers for Future Megacities on Governance, Water, Planning, and Mobility

Lukas Born (Editor)

Book Series
Future Megacities
Additional Volume

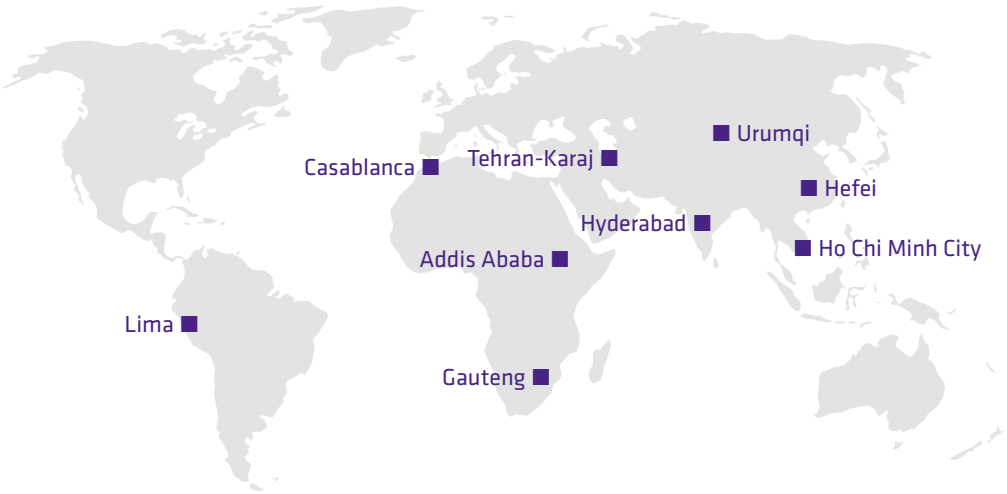
jovis

Young Research Forum

In addition to senior scientists, who have summarised their main results in the five volumes of the Future Megacities Book Series, ambitious young researchers have also contributed substantially to the German research programme on sustainable development of future megacities. The authors included in this volume were honoured with the research programme's Young Researcher's Award in 2013. These awards are the base for this small but exemplary selection of the wide range of young researchers' scientific work within the programme. Main topics are mobility with transit-oriented development and public transport in China, water demand and supply issues in the arid cities of Lima and Urumqi, governance questions in South Africa and India in the wide framework of energy, and improvement of urban planning procedures in Ho Chi Minh City.

Book Series Future Megacities

With its funding priority "Research for the Sustainable Development of Megacities of Tomorrow", the German Federal Ministry of Education and Research is focusing on climate-responsive and energy-efficient structures in fast-growing cities as they offer the opportunity for sustainable urban development. The programme supports projects on various topics: Transportation Management (Hefei, China), Energy and Climate Protection (Gauteng, South Africa), Urban Agriculture (Casablanca, Morocco), Adaptation Planning (Ho Chi Minh City, Vietnam), Solid Waste Management (Addis Ababa, Ethiopia), Water Management (Lima, Peru), Resource Efficiency (Urumqi, China), New Town Development (Tehran-Karaj-Region, Iran), and Governance for Sustainability (Hyderabad, India).
The books offer a variety of good practice, ranging from analytical instruments and strategic models to realised pilot-projects, innovative technologies, and locally implemented processes.


Urumqi
Tehran-Karaj
Casablanca
Hefei
Hyderabad
Ho Chi Minh City
Addis Ababa
Lima
Gauteng

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The Book Series "Research for the Sustainable Development of Megacities of Tomorrow" is sponsored by the German Federal Ministry of Education and Research (BMBF) through the funding priority "Research for the Sustainable Development of Megacities of Tomorrow". The authors would like to thank the Ministry for this initiative, for the financial support, and for the extraordinary opportunity to connect activity- and demand-oriented research with practical implementation in various pilot projects targeting the challenges of Future Megacities.

The book series "Future Megacities" is published by Elke-Pahl-Weber, Bernd Kochendörfer, Lukas Born, Jan Müller, and Ulrike Assmann, Technische Universität Berlin. The series contains the cross-cutting results of the nine projects. These results are the intellectual property of the authors.

This additional volume "Young Research Forum" is edited by Lukas Born, Technische Universität Berlin (cross-project programme support of the Future Megacities Programme). The editor would like to thank Francisco Aguilera S. and Lascha Sochadse for their support of the editing process.

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PREFACE AND INTRODUCTION

CASABLANCA: Young trees planted in an act of "guerilla gardening" in Casablanca's suburbs [Lukas Born]

Elke Pahl-Weber, Bernd Kochendörfer, Irmgard Kasperek, Lukas Born, Carsten Zehner

The Future Megacities Programme—Framework and Contribution of Young Researchers

The Future Megacities Research Programme

The Global Urban Future

The development of future megacities describes a new quality of urban growth with today's unprecedented pace and dynamics of urbanisation. At the beginning of the twentieth century, only 20% of the world's population lived in cities. Since 2010, however, the share of urban dwellers has dramatically risen to over 50%. By 2050, world population is predicted to increase from 7.0 billion to 9.3 billion and by that time, 70% of the population will be living in urban areas, many of them in urban corridors, city- or mega-regions [UN-DESA 2012; UN-Habitat 2012].

Urban areas contribute disproportionately to national productivity and national GDP. Globally, they are responsible for 80% of economic output [UN-Habitat 2012; UNEP 2011]. Urban areas thus also are very relevant in terms of energy consumption. Although cities cover only a small percentage of the earth's surface,[1] they are responsible for around 60–80% of global energy consumption as well as approximately 75% of global greenhouse gas emissions [UNEP 2011]. In the future, this will increase for cities in so-called developing countries, as they will be responsible for about 80% of increases in global annual energy consumption between 2006 and 2030 [UN-Habitat 2011]. Hence, cities are significantly contributing to climate change while, at the same time having to deal with its devastating consequences because many are located close to rising sea levels, in flood-prone or in arid areas. Cities therefore must take action to increase energy and resource efficiency as well as towards climate change mitigation and adaptation.

Megacities, as a spreading phenomenon, do have a special role in this context and illustrate the urban challenges of the future. These urban centres are not only reaching new levels in terms of size, but are also confronted with new levels of complexity. They are facing multifaceted problems directly affecting the quality of life of their inhabitants. In many cases, indispensable assets, such as social and technical infrastructure, delivery of basic services, or access to affordable housing are lacking. Capacities for urban management and legal frameworks tend to be chronically weak and are often insufficient for dealing with rapid population and spatial growth. Moreover, excessive consumption of resources, such as energy or water, is further aggravating existing problems.

In many countries, medium-sized cities are especially experiencing extraordinary growth rates. These "Future Megacities" are to be taken into consideration for sustainable urban development strategies and for urban and territorial planning as they still offer the opportunity for precautionary action and targeted urban development towards sustainability [UNEP 2011].

BMBF's Funding Priority on Future Megacities

With its funding priority "Research for the Sustainable Development of Megacities of Tomorrow", the German Federal Ministry of Education and Research (BMBF) is focusing on energy-efficient and climate-responsive structures in large and fast-growing cities or megacities. The programme is a globally focused component of the Federal Government's High-Tech Strategy in the field of action on "Climate and Energy". Moreover, it is a part of the framework programme "Research for Sustainable Development" (FONA) of the BMBF.

In its main phase (2008–2013), the funding priority currently covers nine international projects in Future Megacities of Asia (Tehran-Region, Hyderabad, Urumqi, Hefei, Ho Chi Minh City), Africa (Casablanca, Addis Ababa, Johannesburg region), and Latin America (Lima). Each project focuses on a particular city working on a locally-relevant thematic issue within the broader context of energy efficiency and climate change [project descriptions, p. 201 ff.].

An outstanding characteristic of the programme is the integration of the sustainable development concept. Ecological, economic, and social facets of the development of energy-efficient and climate-responsive structures in urban growth centres are to be considered in a comprehensive and long-term manner. In this context, the programme follows an innovative methodology that includes analysing spatial, social, and technical dimensions in combination with applied research, using broad methodological approaches such as pilot projects, action research, and research by design. The research approach thus differs from other forms of fundamental research due to its practice-oriented focus that takes into account local needs as a basis for the development of applicable solutions. The transdisciplinary research is conducted through interdisciplinary consortia with partners from research institutions, civil society, politics, administration as well as the private sector. International collaboration among project partners from Germany and the partner countries is an essential aspect of the programme.

The objective of the Future Megacities Programme (FMC) is to create good practice solutions for sustainable urban development. Therefore, the bilateral teams:

1. research, plan, develop, and realise technical and non-technical innovations for the establishment of energy-efficient and climate-responsive structures in an exemplary way,
2. enable the city, along with its decision-makers and inhabitants, to bring about increased performance and efficiency gains in energy production, distribution, and use, and
3. demonstrate that resource consumption and greenhouse gas emissions by high-energy consumption sectors can be reduced in a sustainable way in the future [DLR-PT 2012].

Outcomes and Results of the Research Programme

Outcomes of the nine projects have been generated in different thematic fields of action, which also serve as a structure for this publication series. Within these thematic areas, a great variety of good practice for building energy-efficient and climate-responsive structures in urban growth centres has been generated, ranging from scientific knowledge, analytical instruments and strategic models, all the way up to realised pilot-projects, innovative technologies, applied products and locally implemented processes. In the field of action on "Energy and Sun", concepts for the urban use of renewable energies with particular focus on solar power have been elaborated for different sectors in order to decrease the use of fossil fuels and reduce carbon-dioxide emissions and air pollution. The topic "Mobility and Transport" comprises concepts for sustainable transportation through intelligent management ap-

proaches, innovative planning instruments and systems for enhancing public transit. Within the area of "Planning", solutions for increasing energy efficiency in architecture and urban design, instruments for integrated urban planning, as well as efficient management tools for climate change mitigation and adaptation have been developed. The programme's area of action on "Resources" focuses on generating new approaches for the sustainable management of waste, the careful use of scarce resources such as water, as well as efficient material cycles in the industrial sector. In the field of "Governance", models for multistakeholder systems, new approaches to inclusive decision-making processes, as well as community participation and bottom-up engagement have been developed. Outcomes within the area of action on "Capacities" include measures for vocational training in various practical fields, as well as new concepts for education and awareness raising focusing on the younger generation.

This book series presents results generated within these thematic fields of action in terms of cutting-edge research as well as practical outcomes. Whereas the other volumes emphasise one specific topic, this particular volume focuses on almost all the topics mentioned above. This is because the aim of this volume is to present and appreciate the particular contributions of rather young researchers to the research programme as a whole. Answers are given on innovative aspects, applicability, transferability, or dissemination of the solutions in the framework of future megacities in general.

Additionally, all nine participating cities and projects are presented in the appendix, where the complexity of the research priority, the different approaches, and a short overview of the most important outcomes are shown.

The Role of Young Researchers within the Future Megacities Programme

Without a doubt, senior scientists and project coordinators were responsible for the project layout and programme outcomes. But they were usually accompanied and supported by many PhD, master, and bachelor students. All of these young researchers have provided substantial input to the research on megacities and to the efforts to implement innovative ideas in the nine cities. Many of them have invested not only time, ideas, and enthusiasm, but personal financial means as well. Hence, their work was an integral part of the success that the Future Megacities Programme has impressively achieved. Therefore, and on behalf of the many institutions and universities, we would like to express our gratitude for their valuable contributions.

As a sign of our appreciation towards young researchers, this additional volume of the book series has been published, even though it presents only a small selection of the vast amount of scientific work accomplished by young researchers. Providing a just overview of all the scientific papers written in the context of this research programme would be an almost impossible undertaking; basing the selection on the winners of the Young Researchers' Award 2013 has therefore eased this challenging task (see more details below).

DAAD's Scholarship Programme on Future Megacities

The special programme on "Study and Research Scholarships of Today for the Megacities of Tomorrow" was part of the Future Megacity Programme and was thereby also financed by the BMBF. The programme offered highly qualified students, doctoral candidates, postdocs, senior scientists, and senior experts from the above-mentioned countries the opportunity to study or conduct research in project-relevant subject areas at German universities and German research institutes that were contributing to the collaborative projects. On behalf of the BMBF, the German Academic Exchange Service (DAAD) has implemented the sub-programme.

The announcement of the DAAD programme was published twice, in 2009 and 2010. Within the funding period from 2009 to 2013, DAAD received a total of 218 applications. Out of these, 116 applicants finally received a scholarship for one of the nine projects in their respective cities: twenty-eight Indians (Hyderabad), twenty-five Iranians (Karaj-Tehran), nineteen Vietnamese (Ho Chi Minh City), fourteen Chinese (Urumqi), thirteen Peruvians (Lima), four Ethiopians (Addis Ababa), five Moroccans (Casablanca), four South Africans (Gauteng), and two Chinese each for Hefei and a project in Shanghai, which had already been finished much earlier than the other nine projects.

By integrating the scholarship holders into the work of the collaborative projects, the programme aimed to create sustainable networking between the scholarship holders themselves and the German project partners. So the DAAD invited thirty-two senior experts and twenty-seven scientists visiting the German project partners for between two weeks and three months, sixteen postdoctoral fellows conducting research up to two years, thirty-three doctoral candidates accomplishing their PhD-studies up to thirty-eight months, and eight graduates working on their Master theses for three to six months. Out of the forty-one young scientists, nineteen agreed to publish their research topics and contacts in the last section of this chapter [p. 21 ↗].

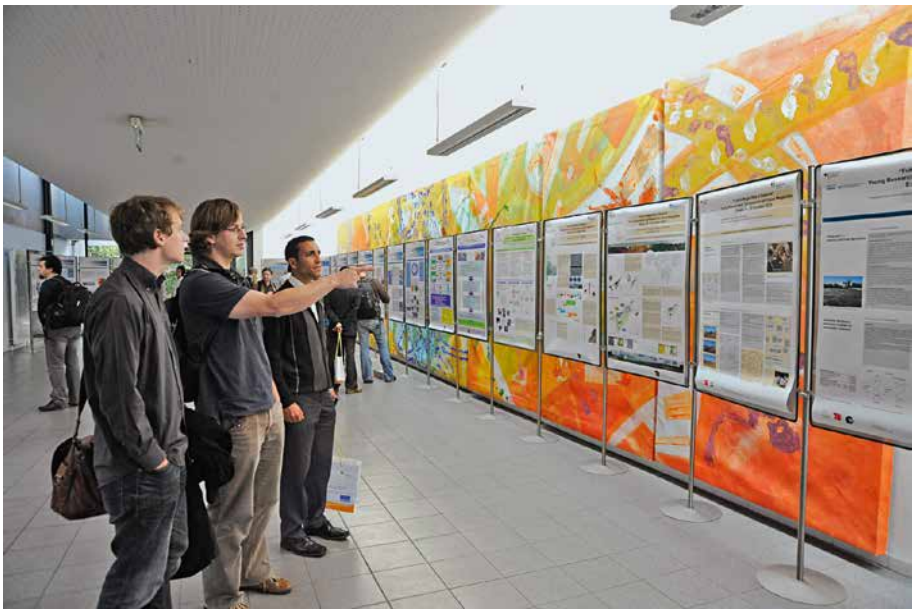
A highlight of the scholarship programme was the "Young Researchers' Symposium on Future Megacities" in the German city of Essen and the first "Young Researchers' Award". It was organised by DAAD together with the University of Duisburg-Essen under the patronage of the BMBF in October 2010. DAAD published the discussions, presentations, and findings out of this fruitful meeting in a conference volume.[2]

2nd Young Researchers' Forum and Award, Hamburg 2013

In addition to the applicants for the DAAD-scholarships, many other young scientists were involved in the research on Future Megacities. Either they were studying at German universities or research institutions that were involved in the nine FMC-projects mentioned above, or they were graduates from universities in one of the nine countries. These scientists were the focus of the Young Researchers' Forum and the second call for the Young Researchers' Award in 2013. Both events were organised by the support team for the FMC-programme from Technische Universität Berlin and TÜV Rhineland in collaboration with the German Aerospace Center/ Project Agency.

Around seventy young researchers participated in the forum. They also took the opportunity to present their work on posters during the international conference "Future Megacities in Action" in May 2013 in Hamburg and during the forum itself, which was organised as a pre-event of the conference. A rather small number of applicants for the Young Researchers' Award was

Fig. 1 Young Researchers' Poster Exhibition in Essen 2010 [DAAD]



also among forum participants. Finally, this number presented only the tip of the iceberg of the many scientific works done in the context of the FMC-programme. This was mainly due to the fact that only finalised and formally assessed works were admitted for the award.

In addition to the criteria for proper scientific work, the applicants were asked to comply with criteria such as the applicability of their work to practice, the transferability or importance of the research to other future megacities, the degree of technical or non-technical innovation for the energy-efficient and climate-responsive design of cities, the consideration of the concept of sustainability, or whether the work took a cross-sectoral approach or tackled only an isolated sectoral problem. The awarded winners were granted a financial bonus and the promise that their work would be published. That promise is now accomplished with this book.

The Young Researchers' "Hamburg Declaration"

During the Young Researchers' Forum, the graduates worked on a declaration and used the opportunity to present their remarks and demands during the conference held in May 2013 in Hamburg. Due to the location, they called it the "Hamburg Declaration". They recognised firstly the successful involvement of several generations of PhD, Master, and Bachelor students in various projects throughout the programme's duration. Secondly, they highlighted the importance of the emerging transdisciplinary science of megacity studies and efforts of international organisations to attain the Millennium Development Goals, the World Summit on Sustainable Development objectives, and other key international development strategies. Furthermore, they highlighted the importance of megacity research and the interdependence of basic or practice-oriented research and applied solutions for a sustainable urban development in the future.

Fig. 2 Winners of the Young Researchers Award and YRF Participants Presenting the Hamburg Declaration on May 15, 2013 [Lukas Born]

But they also demanded the need for continuity and long-term partnerships for ensuring the success of megacity research and development. They called upon the BMBF, the DAAD, and all other contributing organisations, institutions, and individuals (1) to establish lasting networking opportunities for the alumni of this project programme; (2) to assist in the continuation of capacity building efforts; (3) to establish new or connect existing knowledge databases, including contact information and research results as an information reference for project participants and others; (4) to ensure continued study opportunities for German and foreign students and graduates, for example through the organisation and support of follow-up initiatives; and (5) to establish a fund for the development and realisation of research projects initiated by young researchers dealing with the issues of Future Megacities [Hamburg Declaration 2013].

The Book Series' Volume on the Scientific Work of Young Researchers

The volumes of the book series tackle respective topics with specific emphasis on the sustainable development of megacities: energy and resources, mobility and transportation, planning and design, capacity development, and governance (local action). Whereas the topic of energy plays an important role in some of the articles in this book (e.g., Kimmich, Ntuli), the field of capacity development is not represented at all. But this is only due to the fact that no one contributed a thesis with this topic to the Young Researchers' Award.[3] However, the four

topics (I) mobility, (II) urban resources, (III) planning and design, and (IV) governance are the main chapters of this volume on young research. Each chapter starts with extended articles by winners of the Young Researchers' Award summarising their PhD, Master, or Bachelor theses. The chapters end with few abstracts of research papers by applicants to the award who were not granted a prize or special recognition.

Furthermore, almost all articles are connected to one of the nine projects. Therefore, most of the articles in this volume can be read as additional and valuable information to contributions in other volumes of this series. Respective special notices in the following section, which describes the contributions in brief, will give you an overview of these connections with other volumes.

Governance in the Energy Sector in India and South Africa

Decision-making processes in cities often go beyond formalised procedures of local authorities and result in rather informal processes of negotiation. Formal governments are no longer the only key stakeholders on urban issues; many actors are on stage competing for resources and decisions. Negotiations involve multiple players ranging from politicians and public administrators, to civil society and the private sector. Furthermore, the effectiveness of planning and governance depends upon the persuasive power that can lead to collective actions [UN-Habitat 2009]. In this wide thematic field of governance, two papers were submitted for the award.

In his dissertation, **Christian Kimmich** focuses on the situation of farmers close to Hyderabad. He argues that agriculture is a crucial sector either enabling or impeding a transition path towards the sustainable development of urban areas. Rural-urban linkages touch topics, such as migration, food security, water allocation for agricultural production versus drinking water supply in the city, or electricity allocation for agricultural production versus urban consumption. Decisions on these topics are crucial and have long-lasting consequences for both urban and rural spheres. Kimmich limits his analysis to the electricity-irrigation nexus and includes as stakeholders, farmers, the electricity provider, and local governments. He describes electricity providers as having reduced investments, monitoring capacities, and grid maintenance. The connectedness of decisions of all stakeholders contributes to high voltage fluctuations, poor power quality, pump-set burnouts in the countryside, and to increasing blackouts in Hyderabad as well. Pump-sets of poor quality in combination with unqualified repairs increase energy inefficiency and further deteriorate power quality. But this situation leads to high costs and various heavy burdens on farmers as well. To ease the situation and to assist technology adoption, Kimmich recommends the application of social learning and governance mechanisms. The results have served to design a pilot project which is described in detail in the first edited book *Energy and Sun* of the book series ↗.

Ntombifuthi Ntuli also describes governance issues in the field of energy in her master's thesis. She focuses on the Clean Development Mechanisms (CDM). This arrangement was established under the Kyoto Protocol to reduce global greenhouse gas emissions. It allows rich countries to virtually meet their emission reduction targets through investing in projects that reduce CO_2 emissions and contribute to a sustainable development in emerging and developing countries. These projects generate credits called Certified Emission Reductions (CERs) which help the buyers to meet their national reduction obligations. Once they are sold, CERs create revenues for the authorities in the developing countries. Using

different qualitative research techniques, she illustrates the perspectives of European CER buyers, the CDM project developers in South Africa, and the Gauteng municipal officials responsible for CDM project development. With only twenty registered CDM projects by June 2011, South Africa lagged far behind other developing regions. Ntuli's research identifies obstacles that prevent the implementation of more CDM projects by municipalities in the Gauteng region. Furthermore, she investigates reasons why municipalities lagged behind the private sector in CDM project development (e.g., inadequate capacity in responsible administrations, high CDM transaction costs, or scepticism regarding the benefits of CDM). Because there is no significant revenue stream from the sale of CERs, the study indicates that the CDM is not an appropriate way for South Africa to substantially reduce global greenhouse gas emissions. Moreover, South Africa's contribution to climate protection must be financed through other mechanisms.

Studies on Water Issues in the Arid Cities of Urumqi and Lima

While the general issue of urban resources touches topics like material cycles, (re)use and management of waste or water, a chapter in this book deals exclusively with water due to the applications for the Young Researchers' Award. The massive and still rising consumption of water is a huge challenge in emerging megacities especially in arid and semi-arid areas. The demand for water often exceeds existing natural water resources further deteriorated by climate change, leading to more scarcity. This overexploitation becomes visible by falling groundwater tables or polluted streams and calls for urgent action—e.g., decentralised water treatment, reuse of treated wastewater, or upgrading of water and wastewater infrastructure. Moreover, often missing is basic knowledge of existing water resources.

Katharina Fricke's PhD thesis covers a wide range on questions on future ground water resources in Urumqi. Set in a semi-arid climate and close to high mountains feeding the city's water resources mainly with melting water, Urumqi will receive more water flow in the higher mountain areas and up to 12% less in the lower areas due to climate change reducing snowfall and meltwater in the coming years. Groundwater recharge thus will decrease and actual evapotranspiration will rise, especially in agricultural areas. Fricke's water forecasts are based on a combination of a hydrological water balance model simulating water supply with a socio-econometric model projecting future water demand. By doing so, she considers five different climate scenarios. Adaptation strategies focus on measures to reduce the absolute or relative water demand, especially in the agricultural sector. A shift of production and infrastructure into areas with lower evapotranspiration and higher precipitation, even outside Urumqi Region, is proposed. Fricke's essential contribution has a high value as basic research for the efforts of the Urumqi-Project in its task force on water-resource efficiency.

The interdisciplinarity of the Future Megacities research programme becomes evident in **Kara Jean McElhinney's** master's thesis. Starting in the field of water resources engineering and management, the author links her study with the subject of landscape planning: with regard to a necessary energy-efficient and climate-responsive urbanisation, a fundamental change in the way water is managed is required. Such a change must focus on sustainability and integration. The author proposes "water-sensitive urban design" as a tool. Departing from the traditional design paradigm, water-sensitive urban design takes a renewed approach to urban water management. It considers the total water cycle and infrastructure as experienced by city inhabitants via its integration into the urban landscape. Such integration

supports the natural habitats of flora and fauna, creates urban green and recreational spaces, alleviates water scarcity, and integrates wastewater treatment. Based on her knowledge of engineering, McElhinney collects data regarding quantity, temperature, oxygen balance, salt content, acidity, nutrient content, microbiology, and heavy metal content in local water sources using a variety of tools including observation, estimation, and field and laboratory testing. These audit results were then very practically applied to water-sensitive urban designs developed for different kinds of water resources in specific neighbourhoods by a group of architecture students (i.e., constructed wetlands for water treatment, dikes for flood protection, et cetera).

Like Urumqi, Lima is also situated in a dry climate and surrounded by high mountains and melting glaciers. Touching these natural and topographical similarities, **Myriam Laux** describes comparable problems in her diploma thesis about Lima. Lima's water availability is completely based on resources from the Andes. Severe problems will occur if no actions are taken to adjust the high future water demand to the scarce water availability. Laux bases her scenarios and solutions for Lima on a mass-flow analysis called LiWa-tool, which has been developed in the context of the LiWa-Project in Lima. In her simulation model, she considers the construction of big reservoirs, as well as more decentralised measures producing and using more treated wastewater.

Connected to both research projects on Lima, and possibly serving as a small-scale solution, **Zarela García Trujillo** writes in her master's thesis about domestic wastewater treatment with aquatic plants. She describes a very local, decentralised and individualised solution for getting more treated waste water at the household level.

Planning, Space, and Design: Case Studies on Ho Chi Minh City and Climate-responsive Architecture in Iran

Mainly in the twentieth century, but in certain regions even today, rational comprehensive planning has been recognised as a discipline that can solve major urban problems. Often resulting in master plans, this planning paradigm has repeatedly been criticised. Today, cities and with them urban planning, are confronted with many future challenges: besides the often referred-to urban spatial growth, cities are both contributors and victims of climate change. Located in different climatic areas, each city has to address the challenges of climate change in an individual and local manner. Although ruled by different political frameworks, probably all cities will be confronted with certain demands for decentralisation, and multi-level or collaborative governance far beyond administrative boundaries. Furthermore, the growing unwillingness among citizens to passively accept top-down planning decisions will lead to the demand for more participation. Economic changes in the shape of rising inequality and poverty, or high levels of informal activities may perform the tasks that ought to be considered by urban planning in the future. While some ideas of comprehensive planning may have been maintained, a growing number of governments and municipal authorities reform their planning systems or parts of them to match these tasks and local demands. Nowadays, planning processes and results have thus become increasingly participatory, flexible, strategic, and action oriented [UN Habitat 2009].

A stunning description of such a process towards a more flexible, participatory, and environmentally oriented planning culture is **Ngoc-Anh Nguyen's** master's thesis. Her paper on the integration of environmental components in land-use planning in Ho Chi Minh City

is mainly based on expert interviews done in various planning administrations. The rapid urbanisation and dense population growth in the past twenty years has significantly affected the city's land use, as well as had adverse effects on urban flooding, urban climate, and its vulnerability to climate change. Land-use planning, at the same time, is a key measure for helping the city to adapt to the environmental consequences and climate change impacts through the integration of environmental components and urban climate management. The article reveals three main obstacles to the desired adjustments: (1) land-use planning in the contradictory framework of other spatial plans; (2) challenges in the policy and legal frameworks; and (3) challenges in procedures, policy, and management frameworks. To foster the integration of environmental and climate parameters in Ho Chi Minh City's land-use plan, two tools are discussed: the Strategic Environmental Assessment (SEA) and land-use zoning. While the SEA requires nationwide policy and enforcement as well as methodological tools, land-use zoning needs more careful management adjustment for acceptance and adoption at the city and local levels.

As the former article could also be placed in the chapter on governance, the next paper deals with almost the same topic in the same city but in the field of geomatics. In his bachelor's thesis, **Jakob Kopec** detects and analyses the land-use change of Ho Chi Minh City for three periods starting in 1989. This has been achieved by remote-sensing techniques and methods on the basis of Landsat satellite imagery. Based on the derived data, he describes and evaluates urban growth by urban density gradients, the jaggedness degree, the centre-oriented entropy, and the fractal dimension. As a result of his very sophisticated research, he highlights interesting phenomena such as the fact that Ho Chi Minh City has an urban growth rate of 70% almost every two years, or that nowadays the density of buildings is much higher in areas outside the centre than in previous years. Furthermore, he shows that the combination of remote sensing techniques and geostatistical methods creates a useful tool and monitoring system for establishing effective spatial control plans. Having these enormous growth rates in mind, and remembering the administrative difficulties discussed by Ngoc Anh Nguyen, it is obvious that Günter Emberger in the volume *Mobility and Transportation* ↗ has serious doubts as to whether HCMC will reach its CO_2 targets for the transportation sector. Further issues referring to planning topics in Ho Chi Minh City can be found in the volume *Space, Planning, and Design* ↗.

The chapter closes with three abstracts. In his diploma thesis in landscape architecture, **Yassine Moustanjidi** takes Casablanca as a case study and proposes approaches, methods, and tools to integrate a green and productive infrastructure based on urban agriculture as a multifunctional component of urban planning.

Two abstracts on architecture-related topics follow. Not only urban planning with its wide range of issues, but also urban design and architecture will be confronted by some of the challenges mentioned above, specifically by climate change. As a result, architecture needs to find answers on how to approach new demands on insulation, energy saving up to energy production, or recyclable building materials. In her PhD, **Shabnam Teimourtash** investigates the impacts of climate-responsive construction on reducing the energy demand of residential buildings in Iran on the basis of vernacular architecture. **Nadia Poor Rahim's** diploma thesis offers a feasibility study for an office building in Hashtgerd New Town, Iran. This building stands as an example of a new generation of buildings in terms of energy efficiency. The study has considered interdisciplinary scientific aspects like sociology, urban planning, construction, ecology, economy, and project management.

In 2005, 47% of all trips in urban areas worldwide were private and motorised. In 2009, transportation has caused 22.6% of worldwide CO_2 emissions; the highest in Latin America with 34.8%, and the lowest in China with 6.9% [UN Habitat 2013]. Generating this large proportion of greenhouse gas emissions, transportation bears a high share of responsibility for global climate change. Moreover, traffic accidents are among the main reasons for premature deaths in many cities, and noise and air pollution significantly affect public health. Due to the enormous growth of cities, distances between residential areas and places of employment become longer as well. This leads to an increasing amount of commuting time and an increasing proportion of income spent on it. Those who cannot afford transportation are among the urban poor to whom this development leads to social isolation.

The remaining trips in urban areas are either non-motorised, 37%, or made by public transport, 16% [Ibid.]. Emissions from these two traffic modes are insignificant compared to those from motorised transport. Despite these facts, many cities in developing countries come up with solutions to build even more streets and flyovers for cars. Yet, the investments in public transport and infrastructure for pedestrians or cyclists are still comparably low. Thus, the relative share of public transport has decreased or stagnated in many of these countries [Ibid.] To accelerate a more sustainable transportation development, this trend needs to be stopped.

Much of the complexity described above is illustrated in the Chinese cities of Hefei and Shenzhen. Two authors analyse the cities' public transport and thereby contribute to urgently needed answers for sustainable mobility. In her master's thesis, **Xiaoli Lin** states that Shenzhen's transport structure has changed dramatically together with its rapid population growth to more than ten million inhabitants. Situated in the industrial hub of Hong Kong and the Pearl River Delta, motorisation and traffic congestion turn out to be a huge challenge. By following the so-called Transit-Oriented Development, the city tries to increase the number of passengers in public transport by constructing a new public transport system and by developing mixed land use around the stations. But empirical studies show that the approach did not mitigate traffic congestion in the city. The author therefore recommends, among many other detailed proposals, that a holistic Transit-Oriented Development strategy should consider the public transport system as an integral system that integrates the public transport network with different mobility modes into its planning framework.

Like Xiaoli Lin, **Manuel Fiechtner** has done work in the context of the METRASYS project. In his bachelor's thesis, he provides insights into the public transportation system of Hefei, the capital of Anhui province with about 5.7 million inhabitants. Although not as dramatically as Shenzhen, Hefei is characterised by growth, reconstruction, and massive increase in traffic volume. Huge investments in transport infrastructure are necessary. Based on interviews, accessibility analyses, and GIS analyses, Fiechtner offers an extensive analysis of the current quality, major deficits, and an assessment of the effects and importance of Hefei's public transportation system. As a result of his studies, he proves on the one hand that the bus system is not only best in the centre, but also makes vast areas of the city and the administrative district of Hefei accessible. On the other hand, he states that many residential areas suffer from bad access to bus stops in an appropriate radius and thereby do not fulfil governmental standards and goals. In an extensive outlook, Fiechtner notes that Hefei will undergo dramatic changes in the upcoming years with the implementation of Bus Rapid Transit and Metro systems, and due to new intermodal train stations. Additional urban traffic planning

and the adjustment of planned urban traffic projects will be necessary to keep pace with coming urban developments.

There are more articles about Hefei's traffic challenges and some solutions: The volume *Mobility and Transportation* ↗ contains an article on intelligent traffic management based on Floating Car Data (FCD).

Caused by the rising interest in traffic surveillance for simulations and decision-making, many planners are in urgent need of data. As conventional data collection systems often do not meet the demands, **Karsten Kozempel** has developed and evaluated the Airborne Traffic Detection System, which is more flexible and based on cameras. The innovation of this PhD refers to the combination of rapid preselection and more reliable verification of object hypotheses.

In his diploma thesis, **Steffen Bubeck** describes perspectives for Gauteng's transportation sector and its impact on the reduction of greenhouse gas emissions. The results show a significant potential for Bus Rapid Transit systems at relatively low costs. Investments in trains can increase passenger volumes as well, but at much higher costs. As both continue to have a low share of total transport demand until 2040, their impact on the reduction of greenhouse gas emissions is negligible.

This book collects contributions by young researchers. But this is no verdict on the papers' quality as being "junior research" in comparison to "senior research". On the contrary, the various topics are of general interest and the scientific quality of the articles are convincing according to their respective thesis level (BA, MA, PhD). Because young research lacks a clear definition, lines are fluid to senior research—especially for PhDs. Nevertheless, what counts is the authors' outstanding and fabulous passion for knowledge in the challenging field of megacity research.

DAAD's "Study and Research Scholarship of Today for the Megacities of Tomorrow": List of Young Researchers and Research Topics

Resources	
Ana María Acevedo Interdisciplinary Research Unit on Risk Governance and Sustainable Technology Development University of Stuttgart aacevedo@fovida.org.pe	Risk Management in the City of Lima in Climate Change Scenario
Keerthi Kiran Bandru Division of Resource Economics Humboldt University Berlin bandrukk@hu-berlin.de	Enforcement in Environmental Pollution Regulation: The Case of Environmental Complaint System in Hyderabad, India.
Ruhi Gandhi Division of Resource Economics Humboldt University Berlin ruhi_123@yahoo.com	Vulnerability of Urban Poor to Changes in Food Accessibility: A Study of Opportunities and Constraints for Adaptation to Climate Change and Rapid Urbanisation in Hyderabad
Ivan M. Lucich Helmholtz Centre for Environmental Research-UFZ ivanlucich@yahoo.es	Drinking Water Regulation
Rajeshwari S Mallegowda Institute for Cooperative Studies Humboldt University Berlin ranjuhcp@gmail.com	An Institutional and Economic Analysis of Vegetable Production and Marketing in the Emerging Megacity of Hyderabad, India.
Mabel Morillo Viera Regulatory Agency of Water and Wastewater Services – Peru mmorillo@sunass.gob.pe	Methodology To Determine the Tariff for the Service of Rain Drainage
Vikram Patil Division of Resource Economics Humboldt University Berlin vickyagrico@gmail.com	IoS Framework To Analyse the APWALTA (Andhra Pradesh Water, Land and Tree Act)
Ben Solis Sosa Helmholtz Centre for Environmental Research-UFZ bensolis37@hotmail.com	Water and Sanitation Services

Space, Planning, and Design	
Vahabi Moghaddam Department of Urban and Regional Planning Berlin Institute of Technology d.vahabi@gmail.com	Achieving Sustainable Urban Form for the Young Cities of Tomorrow: A Contextual Study of the Relationship between Housing Consumption and Physical Urban Planning in Iran–Case of Tehran-Karaj Region
Nguyen Anh Tuan Ho Chi Minh City Architecture & Planning Research Centre tuankts@gmail.com	Productive Landscape System in the Fringe Area of Ho Chi Minh City
Maryam Zabihi Centre for Technology and Society Berlin Institute of Technology zabihi.maryam@gmail.com	Application of Transit-Oriented Development Criteria in Developing Hashtgerd New Town