

Professor Schmitt, why is a laboratory necessary to explore the future of cities?

Because today's cities are not sustainable. And if this trend continues, mankind will be faced with enormous problems.

How, and where, is this being manifested?

Today, more than half the world's population lives in urbanized areas. The problems are particularly evident where the density and influx into cities are the greatest. This is the case in the tropics and in a belt around the equator – in other words, where the majority of the world's population lives. We know that over the next 30 years, more than two billion people will need a new home and a new workplace in these geographic areas. If you were to simply transfer the European or American city model into these boom regions, exactly the same problems would arise that have taken Europe many painful years to resolve.

So the idea is to avert the impact on people and the environment in these regions right from the outset?

To some extent, the problems are already there. They range from air and water pollution to water scarcity, excessive density without services – including the social and health problems associated with it – and high fossil energy consumption. Not only does generally increased mobility lead to more traffic and thus more noise, air pollution and heat, but so does the increased separation between home and work. You see, it's a spiral of problems that is set in motion. This is why new cities, as well as cities that already exist but are expanding, must absolutely become more sustainable.

Since 2010, the ETH Zurich has been exploring what this sustainability might look like in its Future Cities Laboratory in Singapore. Why is this work being undertaken there?

Switzerland is home to about one one-thousandth of the world's population, whilst in Singapore, we are in the geographical centre of a booming region. Singapore is a dynamic platform between East and West, between India and China, and it also offers an efficient interface between theory and practice. At the same time, we can learn a lot from its existing infrastructure – for example, the transport system, which functions in a densely built city with five million inhabitants, all living in a space the size of the surface of Lake Geneva. Of the nearly 140 employees of the Singapore-ETH Centre, for example, not one drives a car. Everyone uses public transportation, taxis or bicycles. We ask ourselves, could this work for others as well? What could be optimised?

Couldn't you also conduct the research from Zurich?

Part of the research is done in Zurich. But if you really want to understand a city, a region and its culture, you have to be present locally. However, in order that students in Zurich can draw the maximum benefit from our location here, I give lectures in Singapore that are transmitted via telepresence to Zurich. To do this, we built a mirror of the Value Lab Research Laboratory based at the ETH Zurich here in the Future Cities Laboratory in Singapore – a day-lit room outfitted with the most advanced equipment, with large touch screens and excellent video transmission capabilities.

Future workshop for cities

The Future Cities Laboratory in Singapore is a novel platform for urban development. Together with the National University of Singapore and Nanyang Technological University, scientists from the ETH Zurich are exploring and designing the urban phenomenon, based on a holistic interdisciplinary approach. The focus is on three key areas: sustainable building technologies, the city as an urban system, and the relationship between urban and rural areas. Their guiding principle is to regard the city as a kind of organism, one whose metabolism can be modeled and improved by self-organisation with the goal of controlled sustainability. The laboratory's ca. 140 architects, planners, engineers, sociologists and computer scientists see and design the city as a dynamic system in which people interact and resources like energy, water, space, capital, materials and information are constantly in flux. In their work, the researchers use, among other things, actual construction projects and cities as laboratories for new developments. This makes possible the direct application of innovations in the real world.

How is the Future Cities Lab different from other laboratories set up to study urban development?

Three things differentiate us: We conduct basic research, looking at the entire range of relevant categories. If you want to build and develop a city, you have to have deep understanding of economics, air, water, materials, energy, sociology, flows of information, and especially people – amongst many other things. We are transdisciplinary. And we question the traditional way of planning cities and regions. Our work goes beyond the notion of architecture, as we are concerned not only with the city's buildings, but with the entire habitat.

Let's talk about some of the findings of your laboratory. Worldwide, will all cities grow?

In Europe, cities will grow – if at all – predominantly because of internal migration. In most Asian countries, cities are growing mainly by migration from rural to urban areas within the same country. An exception is Singapore, which is experiencing significant immigration from other countries. In many Asian regions, for some time we will see developments like those that happened in the 19th century in Europe and America. London, for example, tripled its population between 1830 and 1890 – as did Singapore between 1960 and 2010.

What developments do you see for the cities of Africa?

Globally, the fastest population growth is occurring in Africa, and to this trend you have to add the increasing internal migration. Together, these two factors mean that in the next 20 years, many cities there will undergo significant expansion. Simultaneously, Africa is a continent that still has sufficient surface area to produce food. So international pressure on Africa will greatly increase. African cities will have to make sure that the exodus from rural to urban areas is not excessive. Otherwise, the population's connection to the land will be destroyed, and sustainable production will decline rapidly – which would lead to additional problems.

So despite, or because of, increasing urbanisation, rural areas will remain very important?

The balance of urban and rural areas is essential; you should not favour one over the other. In rural areas, food production, the unbuilt land, the peace and quiet, and nature itself all have value. The city is the source of dynamism and great innovations. In the city, many green technologies – green tech and clean tech – are being developed in order to make agricultural production more sustainable, whilst at the same time in rural areas, technologies are being developed that people can also introduce into the city – for example, urban farming or urban fish farms that can increase the respect for food production.

If you could fly over a prototype of the city of the future, what it would look like from an architectural and planning point of view?

That depends very much on where this city is located – in the tropics, at an altitude of 2,000 metres, or on the coast? There is

In the photo, Gerhard Schmitt is seen with a drone which provides the aerial photography that allows the laboratory to create 3-D models of designated metropolitan areas.



Photo: Callaghan Walsh

Prof. Dr. Gerhard Schmitt (58) is the Director of the Singapore-ETH Centre (SEC) for Global Environmental Sustainability, with its first research programme "Future Cities Laboratory". In addition, he teaches information architecture at the ETH Zurich. Schmitt studied architecture in Munich, Los Angeles and Berkeley. His current areas of research and teaching include the Simulation of Future Cities, Knowledge Visualisation and spatially distributed Collaborative Design. Schmitt lives with his wife and three daughters in Singapore.

no such thing as "the" city of the future; the ideal sustainable city will look different in every geographical setting. And this is a wonderful thing, because it means that the regional character of a city will still be expressed. What they have in common is that, at the end of the day, all cities consist of physical elements and infrastructure in which energy is transformed. The production of that energy will, to some degree, take place within the city. Every type of climate will exert its own influences on how sustainability is achieved.

In what direction will a German city develop?

In German cities, as in almost all European cities, population growth has come to a standstill. However, there is a large need for maintenance and renewal. You can transform the functions in the city to bring working and living closer together again, and thus reduce the daily requirement for mobility. Or you can transform individual buildings into small "power plants" that produce

more energy than they consume, which would be useful for electromobility, among other things. This could give the much-criticized single-family houses an additional function and change attitudes towards energy.

And what does the future hold, for example, for Asian cities?

In the temperate regions of Asia, the cities could function much like those in Europe. Use of fossil fuels would be reduced, and the (preferably renewable) energy produced is ultimately transformed into heat. The resulting heat islands benefit the urban climate in the colder months. In tropical parts of Asia, however, the situation is completely different. There are several reasons why it is better in those regions for density to remain higher, with shorter distances between services and greater infrastructure efficiency. High energy consumption there generates too much heat – and this is to be avoided in order to prevent any further increase in demand for energy needed for cooling purposes.

“There is no such thing as ‘the’ city of the future – they will be different all over the world.”

So the city of the future can assume a very different shape depending on the differences in the prevailing conditions from one country to another. Are there also cultural differences in the way a sustainable city is understood?

Oh yes, there are huge differences. A Brazilian description of a sustainable city is fundamentally different from, for example, one that is German or Chinese. In areas that are in a major expansion phase, it is often economic development that is associated with “sustainability”. The factors Europeans take into consideration when thinking about sustainability, for example environmental friendliness, are only second or third on the list. On the other hand, countries that have extensive oil resources but little water cannot understand that we use water to produce or store energy. For the most part, sustainability is, unfortunately, focused on only two or three aspects at the present time. This is why it is so important that we try to comprehend all the aspects of sustainability in a city. Only the totality of all these factors can give us a picture of whether a city is sustainable or not.

The automobile pioneer Henry Ford once said, “If I had asked people what they wanted, they would have said: faster horses.” How do you make sure that your solutions don’t bypass the needs of the people?

That’s a good quip. Well, we are trying to understand the city of today and explain the changes that will be necessary for the city of the future. In every city in which we are active, we encounter a different culture, different decision makers and conditions. In other words, we talk with many, many people and try to explain to them our ideas and future scenarios. In Singapore, we are working with the Agencies, i.e. the city authorities. However, since Singapore is a city-state, such an office is almost the equiv-

alent of a government ministry. In Brazil, on the other hand, it is different, as you have large communities that come together and get involved. We invite the stakeholder groups and, by using simulations, we can show them images of what their city would look like in the future. In Switzerland, we also work with stakeholder groups in a participative way. In this way, we gradually move from the desirable toward the feasible.

What changes are needed in the field of architecture for the city of the future?

Building materials and their combination are very important for sustainability. The development of glass is interesting, for example, as it will have more functionalities in the future and play an increasingly important role in architecture. In addition, every building will be more closely linked in with its environment, through sensors, dynamic earth storage systems, and heat pumps.

These are technologies that are already in use and are able to reduce the total fossil fuel consumption of a building while providing more freedom in design. Optimised and applied more broadly, these technologies will have a massive impact on the sustainability of a city. If you can manage to use fossil-fuel based energy only in those applications where a substitute is difficult, such as fuel for aeroplanes or certain other vehicles, then we will be making good progress.

What about a city’s slums? Will they be left behind by these developments toward more sustainability and quality of life?

On the contrary. Slums are a manifestation of imbalance and injustice that are maintained over a long time. But temporary imbalances can exist as well, such as imbalances resulting from historical development. These are reflected, for example, in the favelas in Brazil. Expulsions, occupations and rapid migration into the area are some of the reasons they came into being. To improve the situation, missing infrastructure has to be created, the root causes of drug trafficking and oppression of the people by gangs have to be removed, and efficient governance needs to be established. All these things sound logical from today’s European perspective, but to be effective, they require a better understanding of the interrelationships at work, opportunities to take effect, and time.

Can one already point to any promising developments in these favelas?

Yes, the favela called Complexo do Alemão in Rio de Janeiro would be one case in point. More generally, the situation for people in the favelas is improving, for example, thanks to the use of new means of transport such as cable cars – already in use in Rio and Caracas. There, the favelas are built on hillsides, and the cable cars connect important points with each other and are

creating a new transportation mode. In Rio, a situation that a few years ago would have been unthinkable, is that foreign students are renting small apartments in the favelas, whereas earlier they had to take rooms in the safety of a hotel. But concrete measures are also possible in other favelas and disadvantaged neighbourhoods in South America: our ETH colleagues Brillembourg and Klumpner were recently honoured with the Golden Lion at the Venice Biennale for their work on “Torre David / Gran Horizonte,” focusing on an informal community that has occupied a high-rise building in Caracas.

May we dare to conclude with a glimpse into the future of the Future Cities Laboratory itself? What will be the long-term result of the laboratory’s work?

Of course, our output will include guidelines, books, reports, computer programs, inventions, patents, and practical examples of sustainable urban development. But another important objective of our work is to create a new university curriculum that

comprehensively and region-specifically covers sustainable urban and territorial planning. Today there is still no adequately complex and deep understanding of this type of urban planning. Only by combining a large number of specialists from different fields and countries will it be possible to address the large spectrum needed to make responsible judgments about a city and shape its development. We work in a field of research which is being met with great interest and which is significantly gaining in importance. For a sustainable urban development of the future, we are already preparing the curriculum now. ■



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Singapore is a dynamic platform between East and West, between India and China, and is the geographical centre of a booming region.

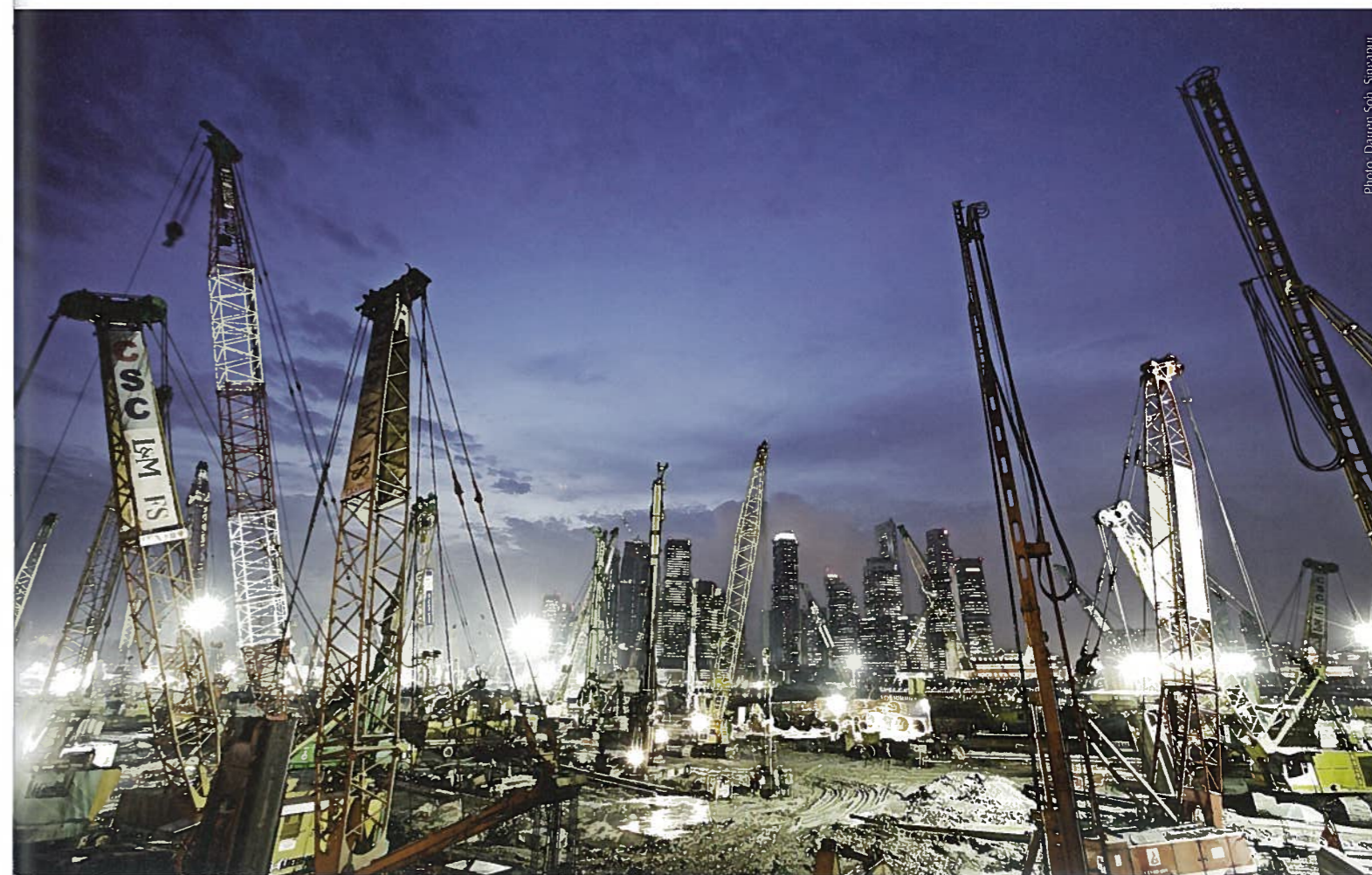


Photo: Darren Soh, Singapore

828 m

is the height of the tallest building in the world, the Burj Kahlifa in Dubai.



80%

of global greenhouse gas is emitted from cities, which also account for 75% of the total energy consumed globally – even though they make up less than 1% of the earth's surface.

By **2050**, 70% of the world's population will live in cities.

In **1950**, only one city in the world had a population of more than 10 million inhabitants. In the year 2000, there were already twenty. Today it is well over 50.

1,300,000 people per square kilometre was the highest population density ever recorded on earth. This "achievement" was attained by Kowloon's Walled City, a district of Hong Kong that was demolished in 1993.

10.58% per year is the growth rate of the Chinese city of Beihai, the fastest growing city in the world by 2020.

5000 t

of pollutants are the amount belched out every day by the factories in the Siberian city of Norilsk. It is considered the world's dirtiest city. Copper, platinum and nickel are found under the city. The people who live there earn a good living in the mines and smelting works, but they pay a heavy price. Many of the town's inhabitants don't live beyond the age of 60, and lung disease is already prevalent in children living there. The cleanest city in Europe, by the way, is Riga in Latvia.

34,500,000 people live in Tokyo, the world's largest city in terms of population.

23 inhabitants is the total population of Hum in Croatia, the smallest city in the world. Its townsfolk take turns running the village pub. To elect the mayor, the candidates hand each of Hum's citizens a piece of wood with his or her initials carved in it. Voters simply cut a notch in the wood of their preferred candidate.

180,000 people move every day from the countryside to the city.

77,000 people per square kilometre live in the "Florida" quarter of the Spanish city of L'Hospitalet de Llobregat, making it the most densely populated district in Europe.



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