

Allianz Risk Pulse

The megacity state: The world's biggest cities shaping our future

November 2015



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**THE MEGACITY
STATE:
THE WORLD'S
BIGGEST CITIES
SHAPING OUR
FUTURE**



November 30, 2030, late autumn morning: Who hasn't wondered how life will be in the future. Imagine you live in a modern megalopolis, with millions of other people? What would have changed from today? Often it is the small, mundane things that ultimately make the biggest difference. Let's fast-forward to the year 2030. Whereas, in the past, after getting up you may have only checked e-mails and posts on your smartphone, now you also take a quick glance at a wall monitor. It tells you: Apartment battery 80% charged. The solar panels and algae bioreactors that cover your tower block are working well. There is plenty of water too, captured during last night's rainstorm. You notice the view has improved since the green roof law came in. Which reminds you: the vegetables in the high-rise across the road are ready to collect. Gone are the days when fruit and vegetables were grown only in the countryside – now, crop fields stretch over several stories in so-called vertical farms.

It is a beautiful sunny morning. However, air pollution is particularly high on days like this so the smart traffic management system has restricted private vehicles. No matter, cycling to the station is good exercise. Before you set off, you empty your garbage: food waste into the composting tube, the rest into the tube for the district power plant.

Outside, you cycle past the driverless cars reserved for senior citizens – these days 15% of the world's population is older than 60.¹ On your way to the next local transport stop, you take a route that is lined in its entirety by solar panels. You then pass a construction site where entire apartment blocks are created using 3D printers. When you reach the railway station, you decide to take the express bus. Although the magnetic levitation train you initially wanted to take is even faster, it is totally packed today. While the bus is racing past endless traffic jams, you relax into your seat to prepare for the day ahead in the megacity.

¹ UN, 2014. Population Facts No. 2014/4 – Population ageing and sustainable development www.un.org/en/development/desa/population/publications/pdf/popfacts/PopFacts_2014-4.pdf

From cities to megacities to gigacities

More than half of the world's population already lives in cities today.² And the urbanization trend continues: in **2030, it will be two-thirds**. Most of these urban areas will be located in the developed countries of Northern America (82 % of total population), Latin America and the Caribbean (80 %) as well as Europe (73 %). While vast parts of Africa and Asia are still mostly rural, their cities are among the fastest growing in the world.

An increasing number of urban areas are exceeding 10 million inhabitants. We call them megacities. Urbanisation is progressing ever faster. A new category of urban agglomeration has emerged: gigacities. These would be supercities of more than 50 million inhabitants, an almost unimaginable number. And yet gigacities may soon become reality in China. The Chinese government is reportedly planning to connect multiple cities in five integrated urban conurbations which would together be

home to half a billion people by 2020.³ If these ambitious plans are realized, there will be four urban areas in China each with more inhabitants than the whole of Germany. Greater Shanghai could in theory contain more than 170 million inhabitants by 2020.

This extreme concentration of people is causing big challenges, particularly in the area of sustainable development.⁴ According to the UN, the world's cities only cover 2 % of global land area, but they account for 70 % of greenhouse-gas emissions.⁵ How do we find the right balance between growth, quality of life and climate protection? What does a city of the future have to look like in order to make life worth living in it? There's not a one-size-fits-all answer to it, but many smart ideas and approaches to the most pressing challenges in the field of demography and mobility. This 'Allianz Risk Pulse' is taking a closer look at them.

Why megacities matter

"The course of how we will live in the future is being set in these megalopolises. This is where tomorrow's trends are emerging," predicts Allianz SE Board Member **Axel Theis**. "The megalopolises show where urban development is headed – and how transport, energy, culture, and economies can be organized. Allianz will play a key role in urban development as we accompany our customers in the megacities. Their changing living conditions will create new needs which we as an insurer will have to be able to serve. With knowledge comes the responsibility to act, especially when it comes to managing risks such as natural catastrophes or climate change, and protecting and investing in critical infrastructure."

The challenges are huge – and so are the dimensions: In 1950, there were just two of these conurbations of at least 10 million people, New York and Tokyo. In 2015, there are 29, 16 of them in Asia. **By 2030, there will be 41** (see Figure 1).

Megacities punch above their weight. In 2010, 6.7% of the global population lived in these cities. Their thirst for energy, measured in terms of global consumption, was just as high. They used 3% of global freshwater⁶ and generated 14.6% of global GDP. The most powerful megacities – New York, London, Tokyo and Paris – have bigger economies than most other countries. New

² UN, 2014. World Urbanization Prospects. Highlights

³ www.welt.de/wirtschaft/article139351977/Mega-City-China-baut-schon-an-Giga-Staedten.html

⁴ UN, 2014. World Urbanization Prospects. Highlights

⁵ UN HABITAT, 2011. Hot Cities: battle ground for climate change

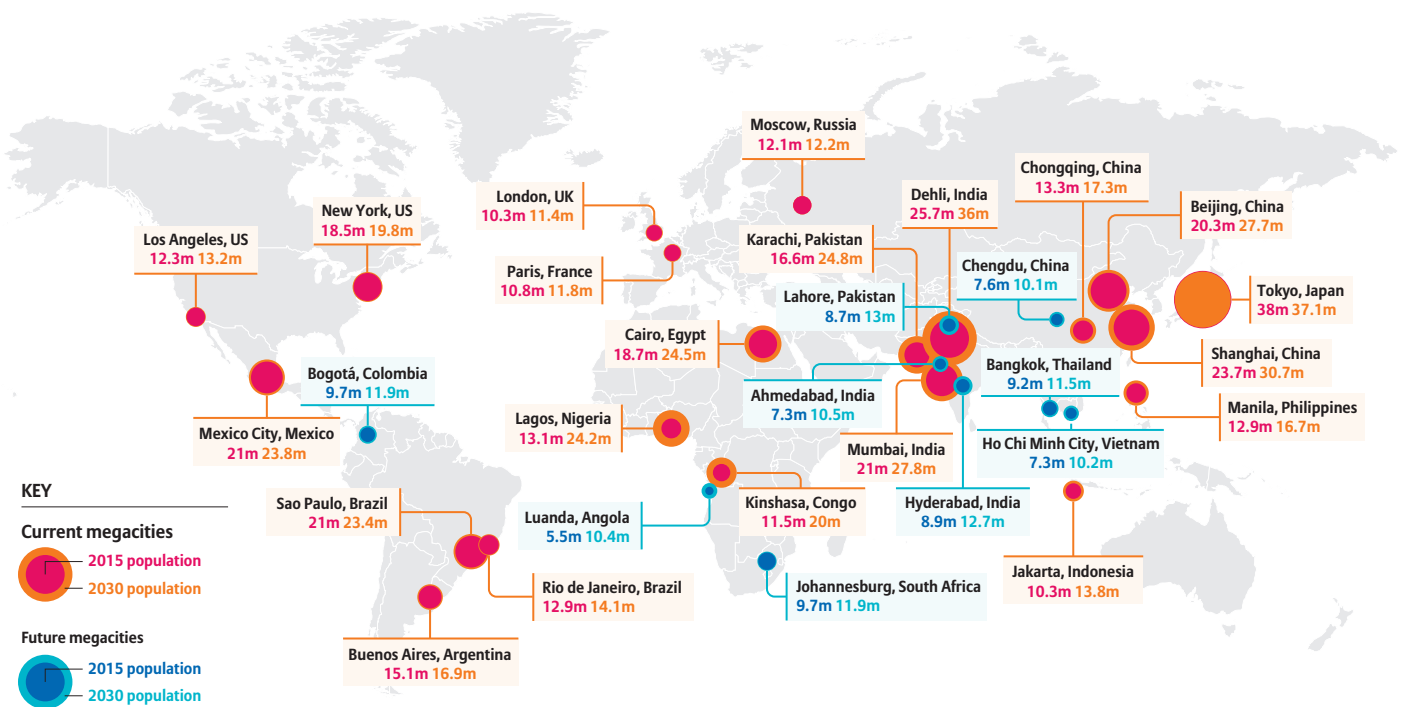
⁶ Kennedy, Christopher A. et al., 2015. Energy and material flows of megacities. Proceedings of the National Academy of Sciences, vol. 112, no.19. www.pnas.org/content/112/19/5985.abstract

York generates \$1.4 trillion in total economic output, London \$836 billion.⁷ According to the OECD, it is only a matter of time before the economic strength of numerous urban agglomerations is greater than that of most OECD countries.⁸ Megacities concentrate opportunities, talent and investment. A large portion of the estimated \$100 trillion assets under management by 2030 is likely to be traded in the growth regions. "We expect further asset growth to particularly take place in Asia," says **Jay Ralph**, Member of the Board of Management of Allianz SE. "By the end of 2014, 11% of our overall third party assets came from clients in this region. We already benefit from an increasing demand by a growing number of wealthy clients. Estimates by the OECD indicate that 1.75 billion people in Asia will be

defined as 'middle-class' by 2020, today it is 500 million. An increasing demand for retirement products will be another growth trigger as Asian societies are aging fast."

Apart from the opportunities, megacities also concentrate risks. "Development of these cities will not only require huge investments in infrastructures," notes Axel Theis. "The value concentration in megacities also results in accumulation risks which tend to be heavily interdependent, especially when you think of business interruption scenarios. This poses a major challenge for insurers, particularly in natural catastrophe-prone areas." Most megacities are indeed low-lying coastal settlements vulnerable to extreme weather and climate change impacts (see Box **Megacities exposed to flood risks**, p.10).

Figure 1 Selected current and future megacities 2015 to 2030



Source: World Urbanization Prospects: The 2014 Revision

⁷ Citylab.com, 2015. Sorry, London: New York Is the World's Most Economically Powerful City www.citylab.com/work/2015/03/sorry-london-new-york-is-the-worlds-most-economically-powerful-city/386315/

⁸ OECD, 2015. The Metropolitan Century: Understanding Urbanisation and its Consequences www.oecd.org/regional/regional-policy/the-metropolitan-century-9789264228733-en.htm

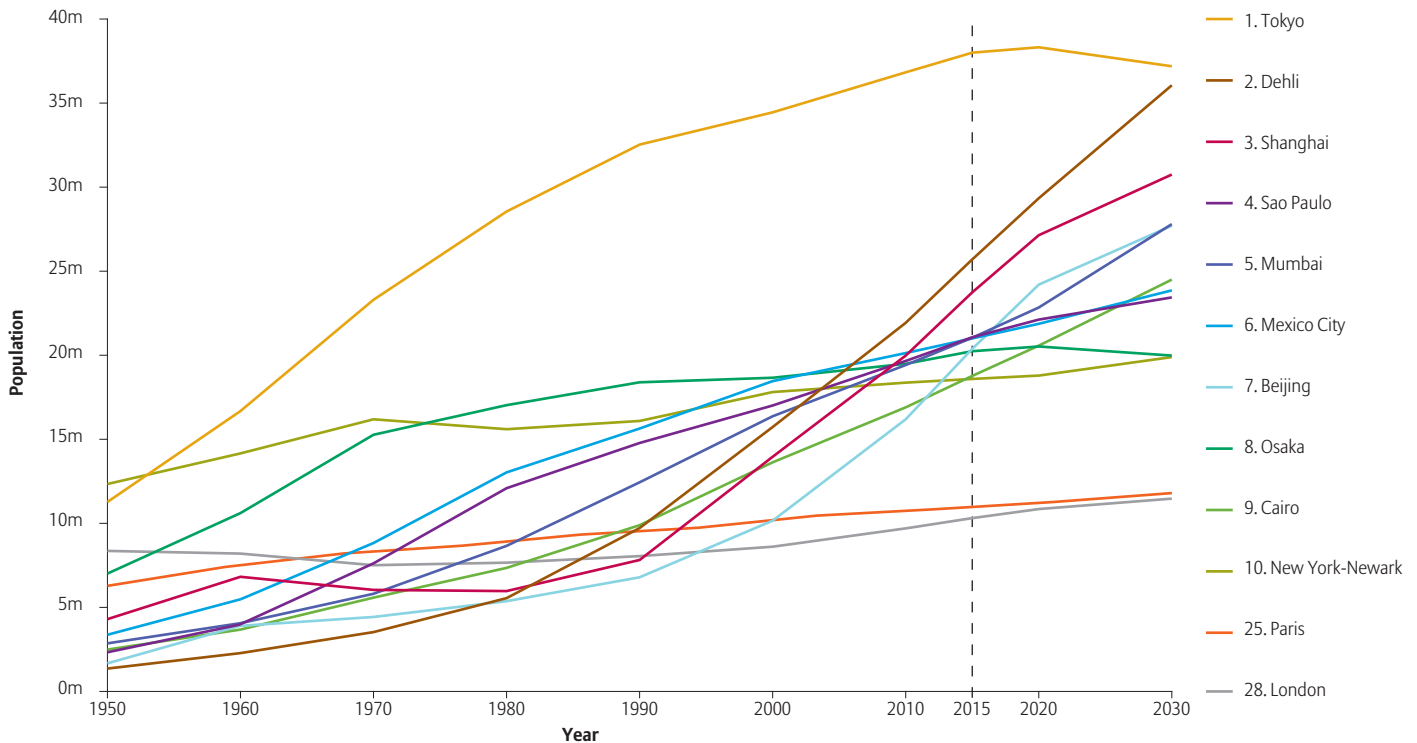
Megacity growth patterns

More than 12% of global city dwellers live in the 29 megacities existing in 2015. That is more than 470 million people.⁹ Tokyo (38 million), Delhi (25.7 million) and Shanghai (23.7 million) are the largest ones. They will remain so up to **2030, by which time 12 new megacities will have emerged, 10 of them in Asia or Africa.** Delhi, Dhaka, and Lagos will each have added around 10 million inhabitants – the equivalent of another megacity. African and Asian megacities are the fastest growing metropolises: Delhi, Dhaka and Lagos will grow by 10 million inhabitants each. “Right now, the growth of megacities is largely an Asian phenomenon, with six of the 10 most populous cities located in the region,” adds **Ralph.**

By contrast, Japanese, American and European megacities are barely growing at all. By 2030, Tokyo and Osaka will be smaller than today. London, Paris and New York will have added just one million citizens each (see Figure 2).

All megacities face the twin global pattern of declining household size and growing numbers of households. These propel demand for housing and infrastructure. The strongest growth in housing demand to 2025 will be in Beijing, Shanghai, and Tokyo.¹⁰ The Chinese high tech company Yingchuang New Materials counters the threatening housing shortage with a particularly innovative solution: **3D-printed houses using recycled construction waste.**¹¹

Figure 2 Past and future growth of Top 10 megacities, plus Paris and London



Source: United Nations Population Division: World Urbanization Prospects, the 2014 revision

⁹ United Nations Population Division, 2014. World Urbanization Prospects, the 2014 revision

¹⁰ McKinsey Global Institute, 2011. Urban world: Mapping the economic power of cities www.mckinsey.com/insights/urbanization/urban_world

¹¹ Computerworld, 2014. 3D printer constructs 10 buildings in one day from recycled materials www.computerworld.com/article/2489664/emerging-technology/3d-printer-constructs-10-buildings-in-one-day-from-recycled-materials.html

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GREEN ROOFS

Absorb heat, filter air pollutants and CO2. Rainwater harvested can be used for toilet flushing

DRONE DELIVERY

Courier service for small packages

SOLAR FILM ON BUILDING FRONT

Generate electricity stored in batteries

FARMSCRAPERS

Farmscrapers reduce land, water and energy required for food production

STORM WATER DRAINAGE

Reduce runoff and flood risk. Rainwater harvested can be used for farming

SMART ENERGY

Stores, manages energy from renewable sources and waste so

ELEVATED PEDESTRIAN PARK

Routes connect infrastructure avoiding traffic and road crossings, enhancing walkability

UNDERGROUND FARM

Hydroponic, pesticide-free, water-efficient farming using low-energy LED lights

UNDERWATER TURBINES

Tidal turbines in river feed smart grid

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Megacity solutions

Megacities must adapt and innovate to meet the challenges residents face. Here are some solutions that could make megacities greener, more efficient and more pleasant places to live.

ALGAE ENERGY FARM

Building panels absorb CO₂ to grow algae that is fermented to produce biogas

WASTE-TO-POWER PLANT

Incinerators turn garbage into power fed into local smart grid

ELECTRIC CAR CHARGING POINTS

e-vehicle charging points powered by the smart grid

WASTE DISPOSAL TUBES

Pneumatic pipes suck garbage from homes and offices to recycling stations and incinerators

3D PRINTED HOMES

Affordable houses built by giant 3D printers using recycled construction waste as building material

ELECTRICITY GRID

Gathers and distributes solar, algae, hydro sources

WIRELESS DRIVERLESS CARS & BUSES

Vehicles charged wirelessly through streets connected to smart grid

CYCLE SHARING SCHEME

Bike-sharing bays beside subway/ railway station and at edge of the city

TRAFFIC & POLLUTION SENSORS

Continuously send data to a city traffic management system. Mounted on buses, streetlights and other infrastructure

BARRIER-FREE INFRASTRUCTURE

Escalators, elevators and walkways cater for aging populations

MAGLEV SUBWAY

High-speed system uses magnets to levitate and propel subway cars

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Living longer and poorer?

The age structure varies enormously between megacities (see Appendix on page 12). Many societies are aging rapidly. When the population of a country is aging on average, clearly also the inhabitants of cities are aging. However, this trend cannot be translated at a ratio of 1:1 to the demographic development of megacities. After all, the way the population of a specific country evolves results in different age structures. However, since the people moving to urban areas are generally young, cities are aging more slowly than the country they are located in and again much more slowly than rural areas.

In this context, one also has to keep in mind that the challenges arising from an aging population might be easier to address within cities, as there is already an existing infrastructure which is relevant for the elderly, i.e. hospitals, care facilities, social logistics. Construction projects can often be realized more easily in major cities than in the countryside. For example, compared with rural areas, it is easier and less expensive to equip urban centers with sidewalks adapted to the needs of aging citizens.

In China's megacities, at least 80% of residents were of working age in 2010, with relatively few children, last but not least because of the country's one child policy. Right now, these cities' **key challenge is providing sufficient jobs and housing for workers.** There is a real risk that the development of prosperity and affluence may not be able to keep pace with the demographic evolution. Poverty looms. The lack of children might mean they have far fewer workers to propel economic growth and support care of the elderly over the long run.

"In China, the number of people aged over 60 is projected to exceed the entire US population by 2035," says **Jay Ralph**. Shanghai is expected to be home to twice as many elderly people as New York in 2025.¹²

For the financial provision of the elderly this means: As Asian societies are aging rapidly and life expectancy is increasing at the same time, people will increasingly have to tap into their savings to pay for care or housing. A longer life expectancy means more time spent in retirement for which people have to save.

Birth rates in India have declined as well. At 1.8 children per woman, birth rates have fallen far below replacement level.¹³ However, India's large urban agglomerations currently have much larger proportions of children (25% in Delhi and 22% in Mumbai) than China's megacities and so in the next two to three decades they will have the demographic dividend of large cohorts of working age people relative to dependent seniors and children. In 2025, 72% of Delhi residents will be working age and just 9% over 65 years old.

In Asian and African megacities, children younger than 15 years make up at least a quarter of the population. In these places, basic sanitation, energy, healthcare, education and transport services will be critical to enable young people to become productive citizens and thereby allow societies to fully exploit their demographic dividend.

In Tokyo and Osaka, the Japanese megacities, the situation is completely different. **One in five residents is aged 65 or over.** These cities will have to adapt streets, sidewalks, transport services and road crossings for the elderly. The concept of accessibility will take on a whole new meaning then. Vital services must be close to transport hubs. Taxation and social security systems also face drastic reforms as the falling working-age population has to fund a rising number of retirees. The aging process affects all areas of society, even those pop culture segments that used to be a stronghold of youth: already today, there are bands with over 90 year old artists.

¹² McKinsey Global Institute, 2011. Urban world: Mapping the economic power of cities www.mckinsey.com/insights/urbanization/urban_world

¹³ James, K.S. & Kavitha, N., 2015. View from a fast-growing nation: What demographic change means for India, in 'Our World and Us: How our environment and our societies will change', Allianz SE.

Three development stages of megacities

Many megacities undergo different phases of life, similar to human beings. Others experience stagnation. Megacities can be roughly categorized as low, medium or high maturity. "There are major differences between mature and developing megacities (see Figure),¹⁴" observes **Tina Baacke**, Global Head of Catastrophe Risk Management, Allianz Global Corporate & Specialty (AGCS). "These include building standards, disaster preparedness and maintenance of vital infrastructure systems."

▶ **Low maturity** megacities such as Dhaka, Kinshasa and Lagos are fast-growing and youthful with many unplanned slums, minimal building standards and large informal economies. These cities are characterized by enormous inequalities, relatively weak administrations, fragmented public transport, congestion and a shortage of basic services.

▶ **Medium maturity** megacities like Shanghai, Sao Paulo and Mexico City are growing at markedly slower rates and are beginning to age. They are richer and better-governed than low-maturity megacities but do not necessarily boast superior infrastructure and urban planning. Unbridled traffic is one of the main problems as more and more people can afford a car, resulting in congestion, chaos and air pollution.

▶ **High maturity** megacities like Tokyo, New York, London and Paris have aging populations and infrastructure in need of modernization. Their key strength is their wealth. These cities have the means to invest in innovative solutions. The Thames Barrier protecting London from flooding is a notable example. The public transportation system is highly developed, but may be in need of upgrading. Rising living costs are expanding gaps between rich and poor, leading to social exclusion and segregation.

	Dhaka	Shanghai	London
Maturity Level	Low	Medium	High
Characteristics	<p>Examples: Dhaka, Kinshasa, Lagos</p> <ul style="list-style-type: none"> ▶ High growth rate ▶ Young population ▶ Unplanned slums ▶ Limited mass transit ▶ Fragmented governance ▶ Weak energy, health, education infrastructure 	<p>Examples: Shanghai, Mexico City, Rio de Janeiro</p> <ul style="list-style-type: none"> ▶ Continuing growth ▶ Signs of aging population ▶ Urban planning evident ▶ Expanded mass transit ▶ Coordinated governance ▶ Improved energy, health, education infrastructure 	<p>Examples: London, New York, Tokyo</p> <ul style="list-style-type: none"> ▶ Flat or negative growth ▶ Aging population ▶ Coordinated urban planning ▶ Embedded mass transit ▶ Centralized governance ▶ Established energy, health, education infrastructure
Challenges & Risks	<ul style="list-style-type: none"> ▶ Extreme poverty ▶ Extreme social segregation ▶ Inadequate housing ▶ Transport congestion ▶ Chronic air, water pollution ▶ Poor health outcomes ▶ Low education & skills ▶ Weak governance, corruption & crime ▶ High disaster risk 	<ul style="list-style-type: none"> ▶ Pockets of poverty ▶ Chronic social segregation ▶ Unequal access to basic services & infrastructure ▶ Inefficient urban sprawl ▶ Chronic air pollution & congestion ▶ Vulnerable to natural & climate-related disasters 	<ul style="list-style-type: none"> ▶ Widening inequalities ▶ Aging infrastructure requiring low-carbon, smart alternatives ▶ Aging mass transit requiring upgrading, expansion ▶ Air pollution requiring traffic controls ▶ Energy- inefficient housing ▶ Value concentration risks

Adapted from: Ericsson. 2013. p.4. *The next age of megacities* www.ericsson.com/res/docs/2013/the-next-age-of-megacities.pdf
UN Habitat report – The city we need mirror.unhabitat.org/downloads/docs/The%20City%20We%20Need.pdf

¹⁴ Ericsson, 2012. The Three Ages of Megacities www.ericsson.com/res/docs/2012/ns_megacities_report_4.pdf

Mobility in megacities: short distances are the key

Due to the urbanization of the world's population, which in some cases is occurring at rapid speed, politicians, city planners and transport developers are facing unknown challenges.

For many academics, **the key for the city of the future lies in its compactness**. They likewise warn against de-urbanization. This term is used by experts to refer to vast settlements without links to public transport, the conventional suburbs in Western countries, or totally vacant pockets of land in China's new towns.

"Building better connected, more compact cities based on mass public transport can save over \$3 trillion in investment costs over the next 15 years. These measures will improve economic performance and reduce emissions, raising the quality of life." This was the conclusion reached by the authors of the latest New Climate Economy Report.¹⁵

"The ideal city is one that consists of multiple self-contained centers," says climate expert **Thomas Liesch** from Allianz Climate Solutions. He is a fan of short distances. His idea is that "in the city of the future, people would work and live in their respective districts, thus saving a great deal of time and energy, and reducing traffic density. Fewer cars would mean more space for pedestrians, while a network of green spaces would connect the individual neighborhoods. Not only would this

improve the climate, but it would also allow more space for leisure activities and food production."

Although it doesn't count as a megacity, many experts consider Singapore to be a prime example of the ideal city, also in terms of compactness. The Interlace project saw the creation of a **vertical village in the city**: apartment blocks were stacked on top of one another rather than being built side-by-side, with roof gardens, playgrounds and courtyards included in the development.

In other locations, projects such as the High Line Park in New York, the congestion charge in London, or the public rental system for electric cars in Paris, seem to suggest that the human race is slowly getting to grips with the traffic issue, and increasingly using the reclaimed living space for its own well-being.

Nevertheless, in most megacities the reality looks quite different. Ho Chi Minh City is one example. Roughly 7.3 million people currently live in the largest city in Vietnam. According to UN estimations, by 2030 this figure will reach more than 10.2 million (see diagram on page 3). That's roughly the same as the population of London today. The British capital is home to the third longest subway system in the world, with a total length of 400 kilometers. In Ho Chi Minh City, on the other hand, the subway is only just being built. The first two lines are planned to go into operation in 2018.



Above: High Line Park in New York

Left: Singapore roof garden

¹⁵ Source: newclimateeconomy.net/content/press-release-economic-growth-and-action-climate-change-can-now-be-achieved-together-finds



Mexico City house facade

Photo: elegant embellishments/Alejandro Cartagena

The **lack of public transport is particularly striking in emerging megacities**. The consequence: total gridlock and smog alert. In 2014, the lowest pollution load in New Delhi was higher than the highest level in Beijing – a city notorious for smog as it is.¹⁶ The main source of the particulates is cars. The health hazard is enormous: according to King's College London, nearly 9,500 people died in London alone in 2010 as a consequence of air pollution – despite all of the city's efforts to curb traffic density.¹⁷

Other cities besides London have also picked up the pace in the battle against particulates. In Mexico City, for instance, a house facade that can neutralize the particulate air pollution from 1,000 cars every day (see image above) is currently being developed.

Traffic jams and pollution: two terms that the cars of tomorrow will hopefully no longer be associated with. More efficient combustion engines are designed to give cars a cleaner image. An even easier way to cut emissions is to leave your car at home altogether, or start a car pool. In the long term, however, engineers are planning to revolutionize the way we drive. Automated cars could have taken over on the roads by 2030, according to experts.

In theory, these automated cars could simply drop their passengers off at their desired location and then leave the city boundaries until they are summoned again via an App, just like taxis. This would be a huge gain for city residents, who are all plagued by large volumes of

traffic. "Automatic driving makes the road use more efficient since you can squeeze more cars into a single lane. You could save two or three lanes, which in the end gives space for green areas and wider sidewalks. Furthermore, electric cars would help reduce emissions and noise levels. Once highly unpopular areas along busy roads would regain appeal," says architect Jürgen Mayer, winner of the Audi Urban Future Award 2010.¹⁸

Digital infrastructure with sensors fitted in cars and on entire roads is supposed to make traffic jams and parking space problems a thing of the past. According to a study by Navigant Research, the installed base of sensor-enabled on-street smart parking spaces is expected to surpass 1 million globally by 2024.¹⁹

Alongside arterial roads, attention is also turning to energy supply as a target for future investments. It's the Achilles' heel of a city. A power outage lasting days isn't just a test of endurance for civilization, for social cooperation; a blackout can bring the whole system to its knees.

With resilience in mind, academics, politicians and business representatives have developed the vision of a Smart City. The nervous system of tomorrow's intelligent city is based on the Internet: electricity, transport, supply and disposal systems are electronically linked. Buildings produce their own electricity and store it in powerful battery storage devices for example. This results in a decentralized energy-generation and storage system, which will also mitigate the impact of power outages if

¹⁶ Source: energydesk.greenpeace.org/2015/03/09/india-air-pollution-delhis-smog-still-worse-beijings/

¹⁷ Source: www.independent.co.uk/news/uk/home-news/nearly-9500-people-die-early-in-a-single-year-in-london-as-a-result-of-air-pollution-study-finds-10390729.html

¹⁸ Source: www.allianz.com/en/about_us/open-knowledge/topics/mobility/articles/120418-future-car-logs-onto-city-streets.html

¹⁹ Source: www.navigantresearch.com/research/smart-parking-systems

push comes to shove. Traffic control systems respond to real-time data, reduce traffic and redirect it. The workplace and the home merge. Supply chains are optimized.

The necessary infrastructure requires secure support. The insurance industry's role is to protect people,

property and systems alike – regardless of their complexity and size. By pushing the boundaries of insurability, the (re)insurance business can make an effective contribution to the development of megacities. In this way, the insurance industry is a powerful tool to strengthen the resilience of local and national economies and societies at large.

Megacities exposed to flood risks

According to a study by World Bank and OECD, climate change, rapid urbanization and subsiding land are putting the world's coastal cities at increasing risk of dangerous and costly flooding. The study found that the average global flood losses could rise from \$6 billion in 2005 to \$1 trillion per year in 2050 if cities don't take steps to adapt.²⁰ At particular risk are coastal megacities in Southeast Asia and the eastern US. In its Revision of the World Urbanization Prospect, which is published every two years, the UN (2011) revealed that a total of approximately 890 million city residents are currently exposed to natural disasters.²¹

Axel Theis explains that a completely new risk landscape has developed for the insurance industry: "The frequency and intensity of climatological events has increased on a global scale over the last 50 years – and with it the concentration of insured assets. At the same time infrastructure expansion cannot keep pace with the increasing needs of the population. This imbalance makes cities extremely vulnerable to natural disasters, especially in Asia." Already today, cities like Beijing, Delhi, Jakarta, Manila, Mumbai, Shanghai and Taipei are all at risk from flooding and/or typhoons.

In comparison to the United States, Asia is 62 times more vulnerable to flooding, and 40 times more vulnerable to tropical cyclones. Asia stands to lose much more in natural disasters. At the same time, there is still a serious insurance protection gap for natural catastrophe risks.

Catastrophes such as the flood in Bangkok in 2011 costing \$45 billion demonstrate the accumulation of risks is rising exponentially with 'hidden risks' such as contingent business interruption increasingly prevalent.

Climate change is set to further exacerbate the situation in Asia. Unless managed appropriately – for example, through such measures as insurance solutions as well as adaptation and



Bangkok flood in 2011

Photo: Voice of America, via Wikimedia Commons

mitigation strategies –, the potential extent of damage and the repercussions on the population would therefore be significant in Asia's urban centers. And while insurance density continues to grow thanks to greater prosperity, so do the uncertainties in the insurance industry due to paucity of risk assessment data.

"In order to keep up with the rapid changes in risk concentration, we're using the most modern technology and models," says Theis. "For instance, by utilizing satellite technology and 3D imaging we can assess risks precisely – down to the level of individual buildings. But the most sophisticated mathematical model in the world can only work if the data used is correct and the risk is clearly identifiable. The Thailand flood was a mega-occurrence of this kind that couldn't be modeled beforehand. Many company premises were submerged, which led to supply chain interruptions across the world. To be able to even better assess risks in the future, technological advances such as geocoding but also an ongoing direct dialogue with the customer are fundamental."

²⁰ Source: www.worldbank.org/en/news/feature/2013/08/19/coastal-cities-at-highest-risk-floods

²¹ Source: www.un.org/en/development/desa/publications/world-urbanization-prospects-the-2011-revision.html

The World's Megacities: Population Highlights

Megacity	Country	2015 population in millions	2030 population in millions	2030 population growth	2010 population age distribution (%)			2010 population density per km ²	2015-2020 average annual population growth rate (%)
					0-14	15-64	65+		
Tokyo	Japan	38.00	37.19	(-0.81)	12	69	19	4,400	0.17
Delhi	India	25.70	36.06	(10.36)	25	71	4	12,100	2.65
Shanghai	China	23.74	30.75	(7.01)	9	80	11	6,100	2.67
São Paulo	Brazil	21.07	23.44	(2.37)	22	71	7	7,500	0.98
Mumbai	India	21.04	27.80	(6.76)	22	72	6	32,400	1.64
Mexico City	Mexico	21.00	23.86	(2.86)	25	68	7	9,700	0.81
Beijing	China	20.38	27.71	(7.33)	9	80	11	5,500	3.43
Osaka	Japan	20.24	19.98	(-0.26)	13	67	20	5,400	0.28
Cairo	Egypt	18.77	24.50	(5.73)	26	69	5	8,900	1.83
New York-Newark	US	18.59	19.89	(1.3)	19	68	13	1,800	0.21
Dhaka	Bangladesh	17.60	27.37	(9.77)	30	65	5	43,500	3.52
Karachi	Pakistan	16.62	24.84	(8.22)	37	60	3	23,400	2.92
Buenos Aires	Argentina	15.18	16.96	(1.78)	23	65	12	5,300	0.92
Kolkata	India	14.86	19.09	(4.23)	26	69	5	12,200	1.13
Istanbul	Turkey	14.16	16.69	(2.53)	24	70	6	9,800	1.28
Chongqing	China	13.33	17.38	(4.05)	15	72	13	7,700	2.67
Lagos	Nigeria	13.12	24.24	(11.12)	32	65	3	14,500	4.17
Manila	Philippines	12.95	16.76	(3.81)	31	66	3	15,300	1.48
Rio de Janeiro	Brazil	12.90	14.17	(1.27)	21	70	9	5,800	0.65
Guangzhou	China	12.46	17.57	(5.11)	11	82	7	6,000	3.94
Los Angeles	US	12.31	13.26	(0.95)	21	68	11	2,400	0.23
Moscow	Russia	12.17	12.20	(0.03)	12	74	14	3,500	0.50
Kinshasa	DRC	11.59	20.00	(8.41)	46	51	3	19,900	3.95
Tianjin	China	11.21	14.66	(3.45)	11	78	11	5,400	2.68
Paris	France	10.84	11.80	(0.96)	20	68	12	3,800	0.77
Shenzhen	China	10.75	12.67	(1.92)	8	91	1	6,900	0.98
Jakarta	Indonesia	10.32	13.81	(3.49)	24	73	3	9,500	1.81
London	UK	10.31	11.46	(1.15)	18	68	14	5,900	1.01
Bangalore	India	10.09	14.76	(4.67)	23	73	4	8,400	3.20

Sources:

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