

Emerging risks in Megacities¹

The growth of very large cities has been rapid over the last half of the 20th century and is a trend that seems likely to continue, to the extent that Megacities – defined by the UN as cities with 10 million or more inhabitants – have been called the ‘urban phenomenon of the 21st century’ [GlobeScan, 2007]. While, in 1950, there were only two megacities (New York and Tokyo), by 1990 this number had increased to 12, and by 2005 it had increased to 20. In 2010, there are at least 26 cities that can be considered megacities, many of them in the developing world (see table 1, below).

Table 1: Today's megacities

Rank	Name	Country	Population	Remark
1	Tokyo	Japan	34,000,000	incl. Yokohama, Kawasaki, Saitama
2	Canton	China	24,200,000	Northern Pearl River Delta incl. Dongguan, Foshan, Jiangmen, Zhongshan
2	Seoul	Korea (South)	24,200,000	incl. Bucheon, Goyang, Incheon, Seongnam, Suweon
4	Mexico City	Mexico	23,400,000	incl. Nezahualcóyotl, Ecatepec, Naucalpan
5	Delhi	India	23,200,000	incl. Faridabad, Ghaziabad
6	Bombay	India	22,800,000	incl. Bhiwandi, Kalyan, Thane, Ulhasnagar
7	New York	United States of America	22,200,000	incl. Newark, Paterson
8	Sao Paulo	Brazil	20,900,000	incl. Guarulhos
9	Manila	Philippines	19,600,000	incl. Kalookan, Quezon City
10	Shanghai	China	18,400,000	
11	Los Angeles	United States of America	17,900,000	incl. Riverside, Anaheim
12	Osaka	Japan	16,800,000	incl. Kobe, Kyoto
13	Calcutta	India	16,300,000	incl. Haora
14	Karachi	Pakistan	16,200,000	
15	Jakarta	Indonesia	15,400,000	incl. Bekasi, Bogor, Depok, Tangerang
16	Cairo	Egypt	15,200,000	incl. Al-Jizah, Hulwan, Shubra al-Khaymah
17	Beijing	China	13,600,000	
17	Dacca	Bangladesh	13,600,000	
17	Moscow	Russia	13,600,000	
20	Buenos Aires	Argentina	13,300,000	incl. San Justo, La Plata
21	Istanbul	Turkey	12,800,000	
21	Tehran	Iran	12,800,000	incl. Karaj
23	Rio de Janeiro	Brazil	12,600,000	incl. Nova Iguaçu, São Gonçalo
24	London	Great Britain	12,400,000	
25	Lagos	Nigeria	11,800,000	
26	Paris	France	10,400,000	

Source: Thomas Brinkhoff: The Principal Agglomerations of the World, <http://www.citypopulation.de>. Population estimates as of 01/01/2010

¹ This paper aims to illustrate some of the contributing factors to the emergence of risks described in the IRGC report “The Emergence of Risks: Contributing Factors”. This report is part of phase 1 of IRGC’s project on Emerging Risks. More information can be found online at <http://irgc.org/Project-Overview,219.html>

Megacities are qualitatively different from other urban agglomerations. They are more connected to global processes and they have influence on (at least) a regional scale [Butsch et al., 2009]; “their scale creates new dynamics, new complexity and new simultaneity of events and processes – physical, social and economic; [and] they host intense and complex interactions between different demographic, social, political, economic and ecological processes” [Kraas et al., 2005;]. It is these qualitative differences that make megacities the foci of global risks and opportunities.

Megacities are foci for opportunities because they are very dynamic, they have large populations (which are equivalent to large amounts of human capital – ideas, skills, knowledge) and they are key nodes in international and/or regional financial and trading systems. As a result, megacities act as magnets for industry and incubators of innovation. They hold the promise of employment opportunities, better education and higher standards of living [Kraas et al., 2005].

Megacities are foci for risks because their unprecedented size magnifies the risks associated with any urban centre: natural disasters; infrastructure failures; pollution; poverty; shortages of food, water or fuel; crime and corruption; or social tensions. The human and economic loss potentials are much higher: not only are more people directly at risk should, for example, a large earthquake hit a megacity, but the repercussions of such an event will be felt by many, physically remote actors and systems, due to the interconnectedness of the megacity. On a global scale, political linkages, financial markets, and trade in goods and services could all be disrupted.

Developing an understanding of the future evolution of megacities is thus a crucial first step to assessing the risks involved and developing plans to manage them. With the amount of human capital and resources available to megacities, such knowledge and understanding could act as a powerful attenuator of risk. But because the megacity is a relatively recent phenomenon, it is not easy to study. With little past experience to extrapolate from, rapidly adapting systems and sheer size to complicate matters, **scientific unknowns** are many and modelling megacity futures is challenging.

The complexity of systems in megacities is another reason why modelling is made difficult. This complexity is created by the interactions and interdependencies between vast infrastructure networks (water, electricity, healthcare, security), formal and informal economies, social and ecological transformations (human effects on the natural environment and vice-versa), and linkages on the spatial scale (local-global networks), all compounded by the factor of size [Butsch et al., 2009]. Tight connectivity within these networks can result in a **loss of safety margins** and leave the system at risk of cascading failures (where a failure at one point in the system could cause the whole system to fail). This has the effect of amplifying the likelihood of occurrence or the consequences of an emerging risk.

However, under the right conditions – weak, as opposed to tight connections between nodes in system networks, with the presence of built-in redundancies and firewalls – high levels of connectivity in systems can also act as a risk attenuator by increasing the average fitness of systems. Complex systems also “tend to self-organise in a way which is adaptive to the environment and often robust and resource-efficient” [Helbing, 2009]. The quicker flow of goods, knowledge and money in megacities has the potential to optimise efficiency, use resources more effectively and increase flexibility and adaptive capacity [Butsch et al., 2009].

Nevertheless, even if maximum efficiency were to be attained, the sheer scale of a megacity means that its inputs and outputs will be substantial, and thus will impact the natural environment. Access to natural resources is a key issue: requiring far more food, water and energy as inputs than can be produced within the city’s limits, megacities are largely dependent on surrounding land or on the ecologies of other countries to farm food and provide energy sources. The large amounts of solid, liquid and gaseous effluent they produce contribute to air and water pollution at a local or regional level, and climate change

at the global level. Waste management on such a scale is a constant challenge and is linked to issues of basic sanitation and disease prevention. Environmental degradation and such large-scale resource dependence act as risk amplifiers in megacities.

The tendency for cities to prioritise economic development over environmental sustainability – to get rich first before worrying about becoming clean later – could also be an environmental disaster in the context of megacities and at the scale that exists today. **Social dynamics** thus play a key role as the degree of development and poverty that exists in a megacity can amplify or attenuate the likelihood that a new risk will emerge or the severity of its consequences. ‘Mature’ megacities in developed countries have considerable resources to spend on things like renewable energy, waste management, healthcare, transportation infrastructure, crime-fighting etc. Developing megacities, on the other hand, not only have fewer resources but are also characterised by social dynamics that, in combination with this comparative resource paucity, can further amplify risks: fast population growth, including a lot of immigration (fuelling the expansion of informal settlements and slums), plus growing inequalities in the distribution of wealth and economic opportunities [Globescan, 2007; Kötter, 2004; Munich Re, 2004]. Both trends fuel social diversity and can create social divisions. Different ethnic, linguistic and religious groups may have competing values and interests, as do the richer and poorer segments of society which exist side by side in the megacity. Under certain circumstances, this could lead to tensions and conflict, acting as a risk amplifier. However, it is also possible that greater social diversity could lead to more tolerance and less racism within a megacity, thus acting as a risk attenuator.

The risk profile of developed megacities is quite different, especially with regard to social dynamics. Developed country megacities are growing at much slower rates, or have even reached stasis (see table 1). This poses risks related to ageing populations and pressures on healthcare systems. Immigration in a developed megacity could attenuate risks by maintaining the size of the active workforce, whereas in a developing megacity it could function more as a risk amplifier.

One factor that affects **varying susceptibilities to risk** but is *not* influenced by development level is geographical location. In both the developed and the developing world, the geographical location of megacities can act as a strong amplifier of risk. This is because many (if not most) megacities are located in hazardous locations in coastal areas or river deltas (vulnerable to storms or floods), in seismically active zones (vulnerable to earthquakes), or near active volcanoes. For example, Tokyo, Los Angeles and Mexico City are vulnerably to earthquakes, while Manila, Mumbai, Shanghai and Calcutta are vulnerable to floods and cyclones. A recent Munich Re report goes so far as to say that many megacities are “virtually predestined to suffer major natural disasters” [Munich Re, 2004]. The urban sprawl, often with complicated street patterns, areas of ‘informal settlements’ and multiple municipal jurisdictions then creates challenges for transport systems and also for coordinated administration, especially in emergencies. Megacities with prior experience of natural disasters, however, may respond better in emergency situations. Tokyo, for example, has experienced many earthquakes and the knowledge and learning of its residents (who know how to act) and its engineers and planners (who have designed urban structures specifically to withstand earthquakes) contributes to attenuation of earthquake-related risks.

When it comes to risk governance in megacities, just as a megacity is qualitatively different from a ‘normal’ city, so too must its governance structures be qualitatively different – organisations responsible for risk governance must realise the special challenges posed by the sheer scale of megacities if they are to succeed in attenuating risks.

“One of the greatest challenge of agglomerations and megacities is their governability [...] the possibilities of traditional forms of centralised governance with top-down strategies are restricted because of the extension, highly dynamic and highly complex interactions within the megacities and also with their surroundings” [Kötter, 2004]

As a city grows, it is essential that its governance institutions adapt to change and plan ahead. “Governance structures need to balance the needs of the city with the wider

metropolitan area, and also take into account the interdependencies between the various infrastructures (water and healthcare for example) [GlobeScan, 2007]. For the reasons given above, a centralised governance structure may have to be adapted to become more decentralised. But at the same time, authority and responsibility must remain clearly defined and distributed. Many megacities currently “have a multitude of administrative bodies with overlapping and poorly defined responsibilities, which inevitably saps efficiency and makes strategic planning difficult” [GlobeScan, 2007]. Such a governance structure could be acting as a risk amplifier.

The importance of an efficient governance structure is illustrated by its consequences for the implementation and enforcement of regulations. Because megacities make a disproportionately large contribution to GDP and economic growth at a national level, it is especially important that regulations are business-friendly, and that they are seen to be clear and well enforced, so as to create a secure environment that will attract international investment. Mature megacities have managed to achieve this (e.g., New York and Tokyo), thus securing for themselves substantial financial resources that can be used to attenuate emerging risks. Most developing megacities are not yet at this stage.

The drive for economic growth is so strong in many megacities that it is often prioritised over social and environmental concerns. Results from a recent survey of key stakeholders in megacities showed that decision-makers will try to balance the desire for economic growth with sustainable social and environmental solutions “wherever this is viable and affordable”, but such **conflicts of interest** are much more likely to be made in favour of economic interests. On the one hand, such trade-offs may be seen as failures to overcome the short-term orientation of reward-systems – prioritising short-term monetary gain over long-term environmental sustainability, for example. However, on the other hand, such trade-offs may be justifiable and necessary under conditions of rapid population growth and surging demand for resources, jobs and services. Whether this trend acts as a risk amplifier or attenuator may therefore depend on the particular megacity in question. Mature megacities will have very different priorities from developing megacities.

In conclusion, megacities are places where many factors converge to create fertile grounds for risk emergence. It is clear that the scale on which megacities operate creates numerous challenges for governance. Governance issues related to adapting institutions, dividing responsibilities, setting agendas and making trade-offs can lead to amplification or attenuation of risks in megacities, but which occurs could depend on the specific circumstances of the megacity, and above all on its level of development.

References

- [Butsch et al., 2009] Butsch, C., Etzold, B. and Sakdapolrak, P., The Megacity Resilience Framework, United Nations University, Institute for Environment and Human Security, <http://www.ehs.unu.edu/file.php?id=631>
- [GlobeScan, 2007] GlobeScan and MRC McLean Hazel, Megacity Challenges: A stakeholder perspective, http://w1.siemens.com/pool/en/about_us/megacities/MegaCity-Report_1439020.pdf
- [Helbing, 2009] Helbing, D., Systemic Risks in Society and Economics, paper prepared for IRGC
- [Kötter, 2004] Kötter, T., Risks and Opportunities of Urbanisation and Megacities, paper presented at FIG Working Week 2004, http://www.fig.net/pub/athens/papers/ps02/ps02_2_kotter.pdf
- [Kraas et al., 2005] Kraas, F., Aggarwal, S., Coy, M., Heiken, G., de Mulder, E., Marker, B., Nenonen, K., Yu, W., Megacities: our global urban future, Leiden, Earth Sciences for Society Foundation, <http://www.yearofplanetearth.org/content/downloads/Megacities.pdf>
- [Munich Re, 2004] Munich Reinsurance Group, Megacities – Megarisks: trends and challenges for insurance and risk management, Knowledge series, http://www.munichre.com/publications/302-04271_en.pdf
- [UN, 2005] UN World Urbanization Prospects: the 2005 Revision, Fact sheet 7: Megacities, http://www.un.org/esa/population/publications/WUP2005/2005WUP_FS7.pdf
- [Wisner, 2003] Disaster Risk Management in Megacities: Making the Most of Human and Social Capital, in Kreimer, A., Arnold, M. and Carlin, A. (eds) Building Safer Cities, the Future of Disaster Risk, Washington DC, The World Bank, 2003, <http://www.bvsde.paho.org/bvsacd/cd46/cap13-risk.pdf>