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# LIVABILITY AND SUSTAINABILITY IN LARGE URBAN REGIONS

*THE HAGUE* CENTRE FOR STRATEGIC STUDIES AND TNO



LIVABILITY AND SUSTAINABILITY IN LARGE URBAN REGIONS  
*THE HAGUE CENTRE FOR STRATEGIC STUDIES (HCSS) AND TNO*

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The TNO and *The Hague* Centre for Strategic Studies (HCSS) programme Strategy & Change analyzes global trends in a dynamic world affecting the foundations of our security, welfare and well-being.

The programme attempts to answer the critical question: what are the policies and strategies that must be developed to effectively anticipate on these emerging challenges?

Strategy & Change provides both a better understanding and feeds the agenda for a sustainable future of our society.

# TABLE OF CONTENTS

<b>1</b>	<b>INTRODUCTION</b>	<b>7</b>
<b>2</b>	<b>MAIN FINDINGS</b>	<b>9</b>
<b>3</b>	<b>METHODOLOGY</b>	<b>13</b>
3.1	An emerging issue: trends in the debate	13
3.2	Results of the text-mining analysis	13
3.3	Research questions	16
	<b>SECTION I</b>	
<b>4</b>	<b>THE RISE OF LARGE URBAN REGIONS: TRENDS AND DRIVERS</b>	<b>17</b>
4.1	Urban population explosion	18
4.2	The rise of megacities	19
4.3	Living in the future megacity	22
	<b>SECTION II</b>	
<b>5</b>	<b>MEGACITIES, MEGA-CHALLENGES</b>	<b>23</b>
5.1	What makes a city livable?	23
5.2	Megacities are both victims and perpetrators of risks	25
	<b>SECTION III</b>	
<b>6</b>	<b>BUILDING LIVABLE AND SUSTAINABLE MEGACITIES</b>	<b>35</b>
6.1	Human, social and cultural resources	36
6.2	Greening the Megacity: Environmental capital and new urban morphologies	39
6.3	Governing the Megacities	44

<b>7</b>	<b>CONCLUSION</b>	<b>49</b>
	Livability and Sustainability in Megacities	49
	<b>AFTERWORD – FOR EUROPE</b>	<b>51</b>
	European ‘mega-regions’	51
	Challenges for urban regions in Europe: Three avenues for research and reflection	52
	<b>AVENUE 1</b>	
	Economic vitality, innovation and attractiveness in European cities	53
	<b>AVENUE 2</b>	
	Security and Safety in European cities	56
	<b>AVENUE 3</b>	
	Cultural diversity and social integration in European cities	62
	<b>BIBLIOGRAPHY</b>	<b>65</b>

# 1 INTRODUCTION

This Vision Paper is a focused discussion of the topic ‘Livability and sustainability in large urban regions’ identified within the Strategy & Change program (theme: Sustainability). This paper represents an initial exploratory research phase whose primary purpose is to help identify the most important challenges of the topic, describe their dimensions and boundaries and their relevant implications for sustainability. An overview of solutions for these challenges provides inspirational avenues for strategic agendas, policy debates and further research.

Although UN research shows that the world’s 40 largest urban conurbations cover only a small part of the surface of our planet, and shelter less than 18% of the world’s population,<sup>1</sup> these regions are of particular interest for foresight research as they present a number of social, environmental and economic challenges that have a far-reaching impact for policy makers around the world. In fact, as focal points of both risks and opportunities, megacities are ideal laboratories to detect the worst human threats, observe their overlapping dynamics, and explore solutions to mitigate their effects.

This Vision Paper is divided into three sections. Section 1 investigates the mega-trends and drivers behind the development of densely populated urban regions. This section introduces the notion of Megacities, used throughout the paper to address large, densely populated urban regions. Section 2 is based on the analysis of foresight studies; it aims to explore the underlying risks and vulnerabilities brought about by the rise of these densely populated areas, and examine the implications of these factors on

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1 United Nations Human Settlements Program, *State of the World’s Cities 2008/2009: Harmonious Cities*, Summary Report (UN-HABITAT, United Nations, 2008), <http://www.unhabitat.org/pmss/listItemDetails.aspx?publicationID=2562>.

urban livability and sustainability. Section 3 discusses the opportunities, assets and emerging approaches within megacities as a means to suggest a range of possible policy responses which appear indispensable in order to effectively prevent, deal with and respond to the so-called ‘megacity diseases’. Finally, the conclusion is followed by an afterword where the relevance for European urban regions and TNO is examined in the light of three main avenues for further research and reflection.



## 2 MAIN FINDINGS

As shown in the table on the next pages, the human and economic intensity of large, densely populated urban regions gives rise to issues that represent both challenges and opportunities for change. Through the use of appropriate policies and technology, these urban regions can take the lead in implementing innovative solutions which will have a tremendous impact on social inclusiveness, economic vitality, cultural attractiveness and environmental wellbeing.

DRIVERS	ISSUES	CHALLENGES	OPPORTUNITIES	S&C THEME
Pressing demands for natural resources	Access to natural resources	Intensive land exploitation, food and fresh water shortages.	Infrastructure adjustments; sewage purification and solid waste treatment contribute to economic viability.	Sustainability Welfare & Wellbeing
Insufficient infrastructure	Health	Untreated sewage, spread of pandemics.	Urban regeneration projects, environmental management policies to improve sanitation, development of healthcare infrastructures with the help of multiple stakeholders.	Sustainability Technology & Innovation Welfare & Wellbeing
Waste mismanagement	Health	Increased demand for mobility, traffic congestion and rising ecological burdens (e.g. land development, pollutant burdens, noise emissions).	A transport infrastructure upgrade, new transportation schemes and the use of appropriate technologies contribute to the city's competitiveness.	Sustainability Technology & Innovation
Increasingly differentiated division of economic activities	Health	Spillage of the landscape, impairment of ecological functions.	Organization of relations between the city and its hinterland: joint planning frameworks and activities for a more sustainable land settlement development.	Sustainability
Urban sprawl: settlement pressure on land, urban invasion of arable land	Social cohesion, economic integration, environment	Loss of agriculturally-based livelihoods, overspill of monotonous suburbs.		Welfare & Wellbeing
Unaffordable housing in the center	Social cohesion, housing	Informal settlements, urban spatial divisions and socio-economic segregation.	Investing in city branding and human capital (knowledge cities, innovation). Planning strategies to reinvent the city's morphology, real estate development, urban revitalization (e.g. slum upgrading programs) with multiple stakeholders (e.g. NGOs).	Welfare & Wellbeing
Urban inequality, poverty	Security	Criminality, urban violence, urban warfare.	Use of technology: development of a high-tech approach in security.	Technology & Innovation Security
Rural-to-urban migrations	Economic vitality, social cohesion	City reputation, insecure climate for the business community.	Cultural diversity, creativity, social interaction: an opportunity to invest in social capital and social mix. Surface development policies (e.g. compact cities, satellite cities) to integrate urban functions and promote social mix. Urban image renewal through prestigious international events with a high impact for the city's reputation	Welfare & Wellbeing

MAJOR URBAN TRENDS: URBANIZATION, GROWING POPULATION DENSITIES

DRIVERS	ISSUES	CHALLENGES	OPPORTUNITIES	S&C THEME
Environmental degradation and climate change	Security	High urban ecological footprints, urban heat islands, extreme-weather events.	Use of renewable energy (e.g. solar energy, green walls) and spatial urban planning for land use, building, transport and commodities. Development of green, clean areas and	Sustainability
				Technology & Innovation Security
High energy consumption	Security	Widespread power outages, urban exposure to energy insecurity.	Encourage the use of renewable energy for the construction of physical infrastructure, creating an investors haven and potential savings.	Sustainability Technology & Innovation Security
Presence of historical infrastructures	Social cohesion	Infrastructure maintenance of transportation networks is expensive and insufficiently accessible for the disabled or the elderly.	Asset for the city's identity and attractiveness, promoted through the use of urban marketing policies.	Welfare & Wellbeing Welfare & Wellbeing
Concentration of economic activities	Economic integration	The globalization of markets, fierce economic competition and increased competition for local investment affect primarily the major urban centers.	Cities are engines of growth, attractive for businesses, skilled workers, residents and visitors.	Welfare & Wellbeing
Complex interaction of social, economic, environmental processes	Governance	Political distrust, inefficiency of traditional forms of centralized governance with top-down strategies.	Use of technology to integrate all stakeholders within the decision making and deliver transparency and efficiency in democratic processes.	Technology & Innovation
		Corruption, inadequate mobilization of local resources; lack of financial resources due to economic turmoil; shrinking revenue bases.	Promotion of collaborative efforts for the management of services with the private sector e.g. PPPs, private sector participation (PSP) to increase efficiency.	Welfare & Wellbeing

MAJOR URBAN TRENDS: URBANIZATION, GROWING POPULATION DENSITIES

## 3 METHODOLOGY

### 3.1 AN EMERGING ISSUE: TRENDS IN THE DEBATE

The Vision Paper is based on a broad-based analysis of sources related to various aspects of sustainability and development in large urban regions and megacities across the globe. A search of the Internet was conducted to identify the level of discussion over certain concepts or trends related to the issue. The analysis of statistics from the literature located through Google Scholar between 1990 and 2010 showed that there has been a significant increase in the prevalence of the issue. However, the year 2008 marks a decline in the discussion of topics related to sustainable cities and urban planning. This decline is likely related to the recent economic crisis which has displaced the urgency of the issue of sustainability on the policy agenda. Changes and development that would be more cost effective in the long-term may not be given priority due to financial constraints in the short-term.

### 3.2 RESULTS OF THE TEXT-MINING ANALYSIS

The in-depth analysis of foresight studies and a collection of secondary sources, including press articles, policy, academic, institutional and development papers, provided a comprehensive assessment of the various dimensions and future challenges related to the topic.

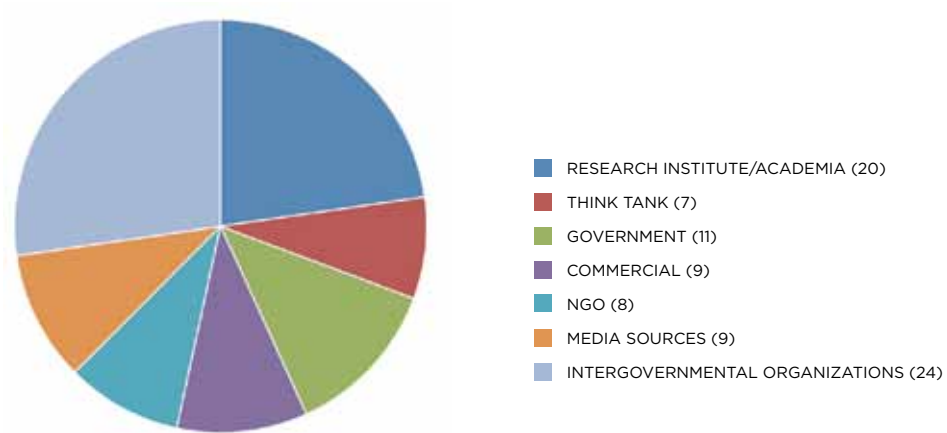


CHART 1: NUMBER OF REPORTS BY TYPE OF EXECUTOR

In addition, the sources were cross-referenced and complemented through the use of the text-mining software Leximancer. This tool extracts information from the selected documents and produces a numerical score based on the frequency of the appearance of main concepts and their association with other words. Leximancer offers a content analysis in the form of a 'concept map' (Figure 1).

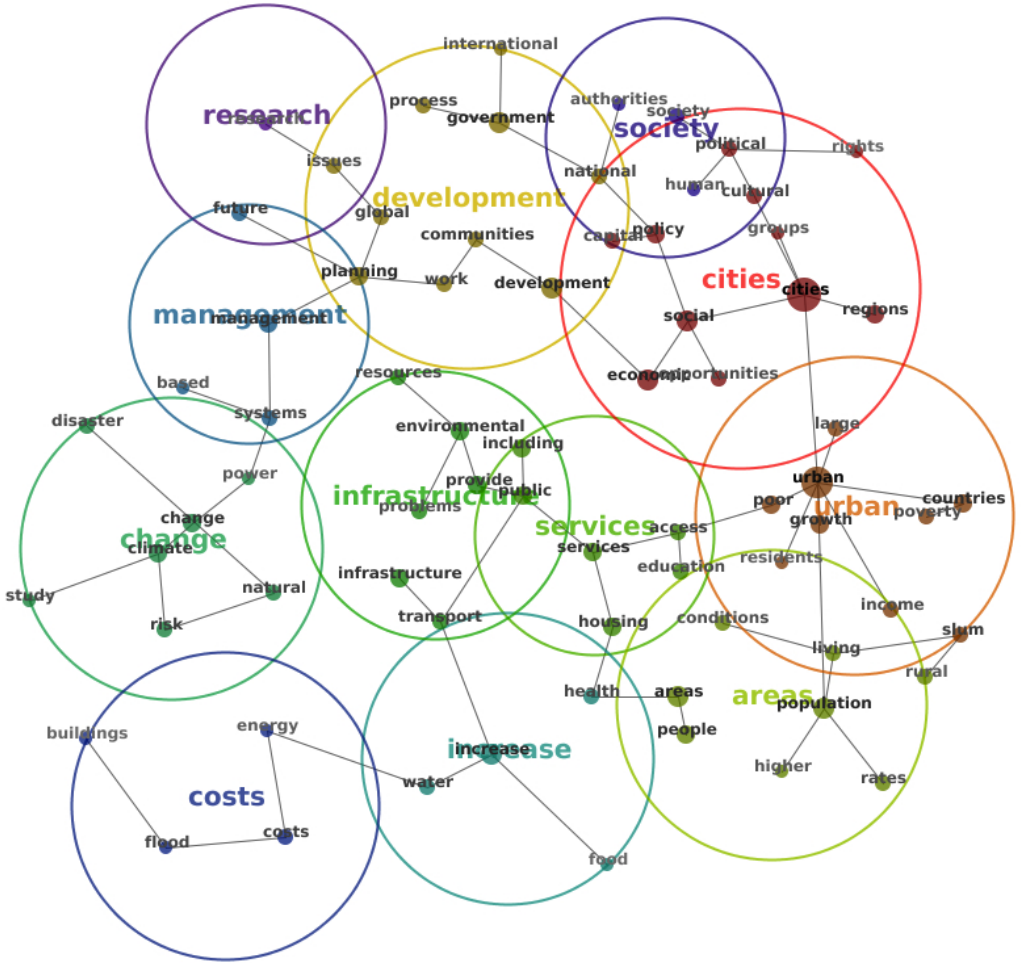


FIGURE 1: CONCEPT MAP. LITERATURE LANDSCAPE. SOURCE: LEXIMANCER.

The circles form a network of concepts that are grouped within specific themes. The most relevant and most frequently appearing concepts are mapped in warm colors (red, orange, yellow and green); they are related to the following themes: ‘cities’, ‘urban’, ‘infrastructure’, ‘development’ and ‘services’.

‘Infrastructure’ frequently co-appears with concepts such as ‘resources’ or ‘transport’. ‘Cities’ co-appears together with concepts such as ‘cultural’, ‘political’, ‘economic’ and ‘social’. ‘Urban’ appears with ‘slum’ and ‘poverty’.

Leximancer is an unbiased solution which supports the interpretation of a large set of data. The results unveil the meaning emerging from the data, and improve the rigor and integrity of the analysis. This background has guided and structured the research around the most relevant issues, including growth, society, planning, management, technology, energy.

### 3.3 RESEARCH QUESTIONS

**How can large urban regions and megacities deal with their current and future challenges and progress towards a more livable, sustainable, and well-designed urban future?** What are the current dynamics and challenges in these regions, and what are their implications on livability and sustainability? What are the urban resources, solidarities, policies or approaches that can help megacities reach harmony between the improvement of quality of life and the preservation of economic vitality? What are the practices currently implemented or being part of long term objectives, which can inspire policy-makers and secure a sustainable development of large, densely populated regions?

## 4 THE RISE OF LARGE URBAN REGIONS: TRENDS AND DRIVERS

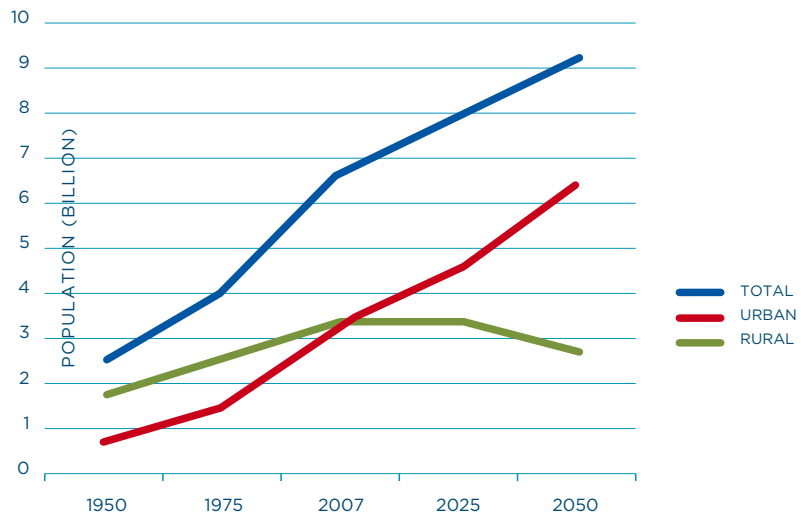


FIGURE 2: GLOBAL POPULATION INCREASE UNTIL 2050. SOURCE: UNITED NATIONS, WORLD URBANIZATION PROSPECTS: THE 2007 REVISION: HIGHLIGHTS, 2008. HCSS, FUTURE ISSUE: URBANIZATION, MARCH 2009.

The United Nations Human Settlements Program (UN-HABITAT) reports that “rapid urbanization, the concentration of the urban population in large cities, the sprawl of cities into wider geographical areas and the rapid growth of megacities are among the most significant transformations of human settlements”.<sup>2</sup> As cities grow, so do the challenges. Global

2 United Nations Human Settlements Program, *State of the World's Cities 2010/2011: Cities for All: Bridging the Urban Divide*, Summary Report (London: UN-HABITAT, United Nations, 2010), <http://www.unhabitat.org/pmss/listItemDetails.aspx?publicationID=2917>.



urbanization has increased the impact of megacities, both on their respective locality and more globally, on the future of humanity. In recent years, the vulnerabilities of megacities have gained attention from international organizations which have identified urbanization and high population densities as primary contributors to these vulnerabilities. City governments are increasingly pressured to take concrete action as they are faced with the dilemma of having to balance their insatiable drive towards economic development, whilst having to take measures mitigating the risks intrinsic to their urban gigantism.

#### 4.1 URBAN POPULATION EXPLOSION

The world is undergoing an unprecedented, large and unstoppable wave of urban growth.<sup>3</sup> While approximately half the world's population lives in urban regions today, projections estimate that by 2050, 69.6% will be urban,<sup>4</sup> with 86% of the developed world population and 67% of the developing world population living in urban regions.<sup>5</sup> In the foreseeable future, much of this growth will occur in Africa and Asia.<sup>6</sup>

#### DRIVERS OF URBANIZATION

First, economic growth – originally generated by industrialization and the development of technology – attracts people and workers towards urban areas,<sup>7</sup> creating new sources of wealth. Second, many established urban areas also grow due to natural increase, i.e. through high birth rates in

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3 UNFPA, "Linking Population, Poverty and Development - Urbanization: A Majority in Cities," *UNFPA*, May 2007, <http://www.unfpa.org/pds/urbanization.htm>.

4 Jean-Pierre Sueur, *Villes du Futur, Futur des Villes: Quel Avenir pour les Villes du Monde? - Tome 1: Enjeux*, Rapport Parlementaire d'Information, fait au nom de la Délégation à la prospective (Sénat français, June 2011), 65, <http://www.senat.fr/rap/r10-594-1/r10-594-1.html>.

5 Department of Economic and Social Affairs of the United Nations, *World Urbanization Prospects: The 2007 Revision*, Executive Summary (New York: United Nations, 2008), 2, [http://www.un.org/esa/population/publications/wup2007/2007WUP\\_ExecSum\\_web.pdf](http://www.un.org/esa/population/publications/wup2007/2007WUP_ExecSum_web.pdf).

6 United Nations Human Settlements Program, *State of the World's Cities 2010/2011: Cities for All: Bridging the Urban Divide*.

7 *Future Issue: Urbanization* (The Hague: The Hague Centre for Strategic Studies (HCSS), March 2009), <http://www.hcss.nl/reports/future-issue-urbanisation/35/>.

developing countries.<sup>8</sup> Third, urbanization is also triggered by rural-to-urban migrations. A spectacular example is given by UN estimations suggesting that the urban Chinese population will rise from 45% (presently) to 70% in 2050.<sup>9</sup> In addition, urban areas will increasingly experience complex flows of international migrations driven by globalization and inter-state economic disparities.



FIGURE 3: DRIVERS OF URBANIZATION AND THE ROLE OF THE URBANIZATION CYCLE IN THE RISE OF MEGACITIES

## 4.2 THE RISE OF MEGACITIES

As the world becomes more urban, cities are merging together to create massive urban settlements which take the form of mega-regions or megacities. These high-density conurbations of more than 10 million

8 Greg Tegart, *The Future of APEC Megacities: A Foresight Approach. Review of Studies by the APEC Center for Technology Foresight 1998-2000*, Working Group Report (Bangkok: The APEC Center for Technology Foresight, National Science and Technology Development Agency, November 2000), 18, <http://164.115.5.161/apec/publications/16.pdf>.

9 Jeffrey Hays, "Facts and Details: Urban Life, Cities, Model Cities in China," *Facts and Details*, July 2011, <http://factsanddetails.com/china.php?itemid=151&catid=11&subcatid=72>.

inhabitants<sup>10</sup> impact the economic vitality and sustainability of entire regions; combined with the impact of globalization, their influence increases tremendously.

In 1950, only four cities had more than 5 million inhabitants: New-York, Tokyo, London and Paris. Today, megacities listed by the UN represent a total population of approximately 280 million. According to official UN figures, 21 megacities shelter 9% of the world’s urban population in 2011, with estimates predicting that by 2025 there will be 29 megacities representing nearly 10.3% of the population. In addition, individual megacities continue to grow in size: Tokyo, which became the first megacity in the mid-1960s, is forecasted to increase to more than 37 million inhabitants by 2020.

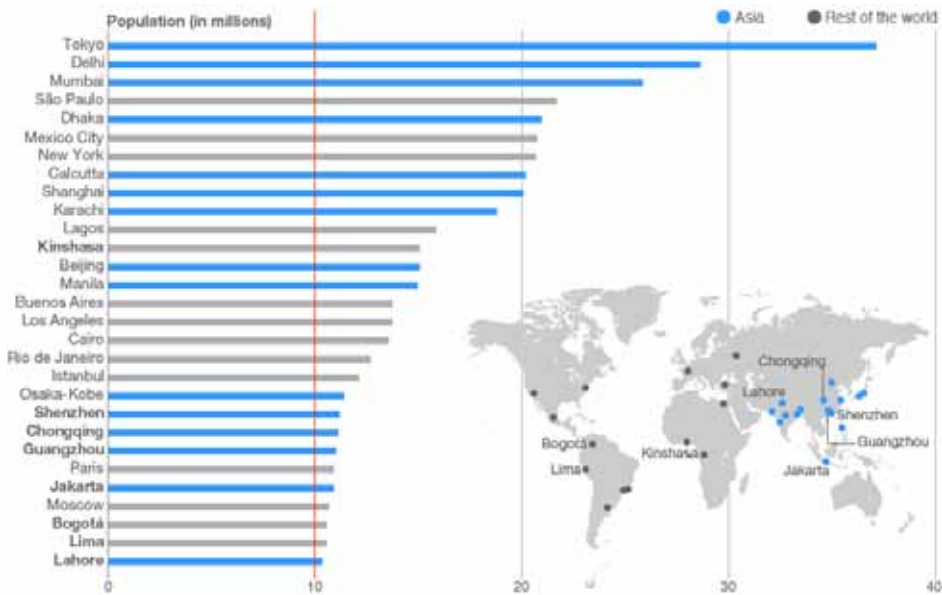


FIGURE 4: HOW ASIA IS LEADING THE GROWTH IN MEGACITIES. SOURCE: BBC NEWS, “RISE OF THE ASIAN MEGACITY”, JUNE 2011. UNITED NATIONS, *WORLD URBANIZATION PROSPECTS: THE 2009 REVISION*, 2010.

10 Official definition of the megacity, United Nations.

The rise of megacities will occur predominantly in developing nations such as India, Brazil and China, coinciding with forecasted future trends of productivity and wealth creation that are expected to increase in these parts of the world. In the rest of the developing countries, Dhaka, Cairo and Lagos will also experience drastic urban growth. Many of them will reach the status of ‘meta-cities’,<sup>11</sup> i.e. cities with more than 20 million inhabitants.

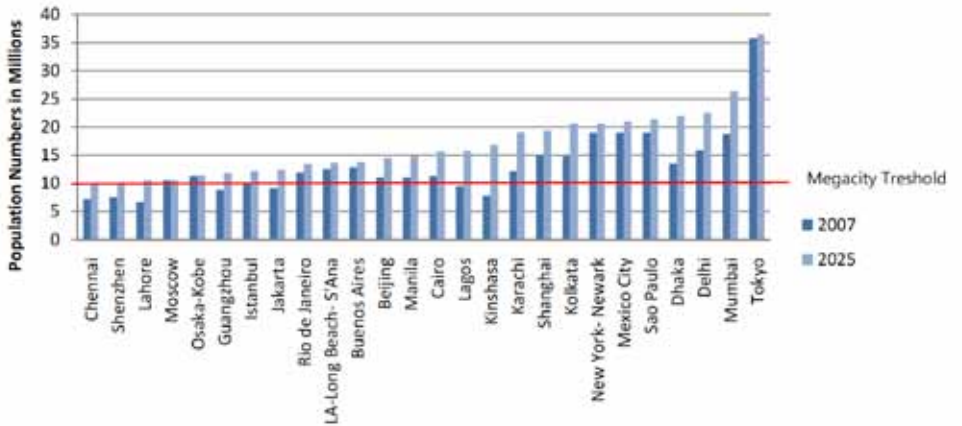


FIGURE 5: POPULATION NUMBERS IN 25 MEGACITIES IN 2025, COMPARED TO 19 IN 2007. SOURCE: UNITED NATIONS, *WORLD URBANIZATION PROSPECTS: THE 2007 REVISION: HIGHLIGHTS*, 2008. HCSS, *FUTURE ISSUE: URBANIZATION*, MARCH 2009.

11 United Nations Human Settlements Program, *State of the World's Cities 2006/2007: The Millennium Development Goals and Urban Sustainability - 30 Years of Shaping the Habitat Agenda*, Summary Report (London: UN-HABITAT, United Nations, 2006), [www.unhabitat.org](http://www.unhabitat.org).

### 4.3 LIVING IN THE FUTURE MEGACITY

Megacities are more than just large cities. They create a second urban world which magnifies intense interactions between demographic, social, cultural, political, economic and ecological processes. These processes operate with unprecedented levels of complexity in both the generation and resolution of human and urban problems. Although urbanization and the rise of megacities are driven by *and* are factors of economic development, they simultaneously damage social sustainability, public health, safety and the environment through increased energy consumption and air pollution. As a result, much of what used to be regarded as the major advantages of urban life, such as security, better housing and public service, is now increasingly considered as major weaknesses.

With the rapid globalization of economies, a greater focus has been placed on the economic vitality of megacities rather than on the impacts of their human and territorial expansion. However, the future challenge for the world's largest cities and their governments will not only be to remain economically competitive to attract business investments and global knowledge: megacities will also increasingly compete on the basis of the quality of life offered to their inhabitants.<sup>12</sup>

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12 Belind Yuen and Giok Ling Ooi, "Introduction: World Cities-Challenges of Liveability, Sustainability and Vibrancy," in *World Cities: Achieving Liveability and Vibrancy* (Singapore: World Scientific Publishing Co. Pte. Ltd., 2009), 1, [http://www.worldscibooks.com/etextbook/7398/7398\\_chap01.pdf](http://www.worldscibooks.com/etextbook/7398/7398_chap01.pdf).

## 5 MEGACITIES, MEGA-CHALLENGES

### 5.1 WHAT MAKES A CITY LIVABLE?

Large urban regions are increasingly faced with global challenges that affect their efforts towards achieving a higher quality of life for their citizens. According to the UN,<sup>13</sup> two of these challenges are the achievement of livability and sustainability. *Livability*, because as urbanization transforms human diversity and social stratifications, it impacts on society, cultural pluralism, crime and employment. *Sustainability*, for the overloaded urban ecosystem is often the focal point of many environmental problems that influence global sustainability. Sustainability agendas and livability initiatives often meet the same environmental, equity and economic goals; as a result, their definitions overlap substantially. This paper considers that one of the conditions for improved urban livability, is sustainability.

Researchers have developed a myriad of sophisticated instruments and conceptualizations of urban livability resulting in so-called 'quality of life rankings',<sup>14</sup> in which mid-size cities outperform megacities (see Tables 1 and 2 on the next page).

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- 13 United Nations Human Settlements Program, *State of the World's Cities 2004/2005: Globalization and Urban Culture*, Annual Report (UN-HABITAT, United Nations, 2005), <http://www.unhabitat.org/pmss/listItemDetails.aspx?publicationID=1163>.
- 14 City Mayors, "Melbourne, Vienna and Vancouver named world's most liveable cities: A report by the Economist Intelligence Unit," *City Mayors: Running the World's Cities*, September 5, 2011, [http://www.citymayors.com/environment/eiu\\_bestcities.html](http://www.citymayors.com/environment/eiu_bestcities.html).

MEGACITY	MERCER'S QUALITY OF LIVING INDEX 2009/2010 (RANK)
London	39
Shanghai	98
Buenos Aires	78
Beijing	113
Rio de Janeiro	116
São Paulo	117
Guangzhou	128
Mexico City	129
Delhi	145
Mumbai	148

TABLE 1: MERCER'S QUALITY OF LIVING INDEX 2009/2010

COUNTRY	CITY	RANK
Australia	Melbourne	1
Austria	Vienna	2
Canada	Vancouver	3
Canada	Toronto	4
Canada	Calgary	5
Australia	Sydney	6
Finland	Helsinki	7
Australia	Perth	8
Australia	Adelaide	9
New Zealand	Auckland	10

Economist Intelligence Unit (EIU), The top ten cities  
(100=ideal; 0=intolerable)

TABLE 2: LIVABILITY RANKING 2011: THE TOP TEN CITIES. SOURCE: THE ECONOMIST INTELLIGENCE UNIT, A SUMMARY OF THE LIVABILITY RANKING AND OVERVIEW, AUGUST 2011.

The different sources investigated take in consideration a variety of elements that characterize livability and sustainability in the City. For the purpose of this paper, they were integrated into the following definition: *Urban livability consists in the development of attributes and resources that help make the city pleasant to live in, and attractive for people, visitors and businesses. Livable and sustainable cities provide citizens with access to educational opportunities, healthcare, affordable housing and basic services; they improve demand management with efficient infrastructures for energy security, transportation or waste. Livable cities offer green public areas that are safe, secure and clean; they enhance individual wellbeing through social inclusiveness, social justice, ecological sustainability, cultural vibrancy, economic vitality, long-term oriented policies and integrated governance processes.*<sup>15</sup>

## **5.2 MEGACITIES ARE BOTH VICTIMS AND PERPETRATORS OF RISKS**

It is clear that by placing many burdens on their population, megacities threaten quality of life. They are vulnerable systems, because their high human densities are exposed to global socio-economic and environmental changes. At the same time, these high densities exacerbate the probability and consequence of specific risks generally associated with cities. According to the foresights available, this feedback loop generates ‘megacity diseases’, which are related to healthy and safety, socio-economic and socio-political dimensions, environmental changes, and the infrastructure (Figure 6).

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15 Willem van Vliet, “Cities in a globalizing world: from engines of growth to agents of change,” *Environment and Urbanization* 14, no. 1 (April 2002): 34; Belind Yuen and Ling Ooi, “Introduction: World Cities-Challenges of Liveability, Sustainability and Vibrancy,” 1-11.





FIGURE 6: 'MEGACITY DISEASES'

### 5.2.1 HEALTH AND SAFETY

Pressing demands for water (for domestic and industrial use) and intensive land exploitation for food supply lead to dramatic consequences for the population of megacities, particularly in the developing world. Fast-growing megacities will be hit by food and fresh water shortage unless their infrastructures are adjusted.<sup>16</sup> Wastewater mismanagement makes the issue even more urgent, as many megacities discharge their untreated sewage, farm chemicals and industrial effluents directly into rivers or the sea. In Shanghai, only 28% of residential wastewater is being treated; the Huangpu river is polluted by a daily flow of approximately 4 million cubic meters of untreated human waste.<sup>17</sup>

16 Anna Loza, "By 2050, Water Shortages in Megacities May Leave 1 Billion Thirsty," *The Utopianist*, April 4, 2011, <http://utopianist.com/2011/04/by-2050-water-shortages-in-megacities-may-leave-1-billion-thirsty/>.

17 United Nations, "City Profiles: Shanghai," *United Nations Cyber Schoolbus*, n.d., <http://www.un.org/cyberschoolbus/habitat/profiles/shanghai.asp>.

Poverty constitutes yet another safety issue which according to the World Bank will be predominantly located in cities by 2035.<sup>18</sup> The UN reports that child mortality rate, respiratory illnesses, water-borne diseases and the risk of contracting pandemics are much higher in cities with large slum populations.<sup>19</sup> Failure to improve quality of life for the urban poor will result in the further aggravation of health threats.

In addition, scientific evidence has associated the rise of chronic diseases such as allergies, asthma and cancer with factors related to urbanization such as poor air quality.<sup>20</sup> The World Health Organization (WHO) indicates that the population in Cairo ingests each day more than 20 times the safe level of acceptable air pollution. The developed world is certainly no exception to severe air pollution: 90% of the inhabitants of European cities are exposed to levels of air pollutants that are above the WHO air quality guidelines.<sup>21</sup> To further deteriorate the situation, many housing developments of megacities are located close to motorway networks. As a result, city dwellers are subject to persistent high levels of (traffic) noise that impair business productivity and are associated with irreversible damages on health such as heart attacks and strokes.

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18 GlobeScan, MRC Mc Lean Hazel, and Siemens AG, *Megacity Challenges: A Stakeholder Perspective* (Munich: Siemens AG, ed. The Economist Intelligence Unit, 2007), 16, [http://www.siemens.com/entry/cc/features/urbanization\\_development/all/en/pdf/study\\_megacities\\_en.pdf](http://www.siemens.com/entry/cc/features/urbanization_development/all/en/pdf/study_megacities_en.pdf).

19 United Nations Millennium Project, *A Home in the City. Task Force on Improving the Lives of Slum Dwellers*, Task Force Report (New York: United Nations, 2005), 19, [http://www.unmillenniumproject.org/reports/tf\\_slum.htm](http://www.unmillenniumproject.org/reports/tf_slum.htm).

20 World Health Organization, "Chronic respiratory diseases - Scope: Asthma," *World Health Organization*, n.d., <http://www.who.int/respiratory/asthma/scope/en/index.html>.

21 European Environment Agency, *Ensuring Quality of Life in Europe's Cities and Towns: Tackling the Environmental Challenges Driven by European and Global Change*, EEA Report (Copenhagen: European Environment Agency, European Union, May 2009), 13-14, <http://www.eea.europa.eu/publications/quality-of-life-in-Europes-cities-and-towns>.

### 5.2.2 SOCIO-ECONOMIC AND SOCIO-POLITICAL RISKS

A 2009 UN report<sup>22</sup> suggested that urban gigantism magnifies intra-urban inequalities and the polarization of living conditions, especially in the developing world. Indeed, when megacities reach their physical limits, urban land prices become prohibitively high. Beyond the risk of a real estate bubble, unaffordable housing in the center generates a phenomenon of urban sprawl or ‘spreading pancake’.<sup>23</sup> Sprawling megacities shrink the space of available arable and farming lands, causing the loss of agriculturally-based livelihoods; simultaneously, they generate or add to the proliferation of informal and unplanned urban settlements, i.e. slums or ghettos.<sup>24</sup>

Additional trends are also related to socio-political risks. First, the economic crisis and rising unemployment may significantly increase the number of people living in poverty. Second, by contributing to the rise of highly diverse urban cultures, global migrations and urban growth enrich megacities – but at the same time, add to the existing spatial, socio-economic segregation and to ethnic tensions. Combined with demographic developments such as youth bulges, these mega-trends may lead to explosive situations with severe consequences for security. Even developed world megacities are increasingly experiencing urban violence and riots, as seen with the riots in Paris in 2005, and London 2011.<sup>25</sup>

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22 World Health Organization, *Megacities and Urban Health* (Kobe City: World Health Organization: Centre for Health Development, December 2009), [http://www.who.or.jp/publications/2008-2010/Megacities\\_Report\\_Dec09.pdf](http://www.who.or.jp/publications/2008-2010/Megacities_Report_Dec09.pdf).

23 Ruth Kelly, John Ratcliffe, and Julia Gannon, *The Competitive Global City 2030: A Futures Approach* (Dublin: Futures Academy, Dublin Institute of Technology, 2006), 5, <http://arrow.dit.ie/cgi/viewcontent.cgi?article=1000&context=futuresacart>.

24 Sueur, *Villes du Futur, Futur des Villes: Quel Avenir pour les Villes du Monde? - Tome 1: Enjeux*, 201.

25 Nina Power, “There is a context to London’s riots that can’t be ignored,” *The Guardian*, August 8, 2011, Online edition, <http://www.guardian.co.uk/commentisfree/2011/aug/08/context-london-riots>.

The 2006 OECD Report on Competitive Cities<sup>26</sup> shows that extreme spatial disparities between wealthy areas and poor urban neighborhoods lead to significantly higher levels of criminality. In slum areas, crime (i.e. homicide, robbery, burglary, corruption, drug-, arms- and human trafficking and kidnapping) is often the primary reason for high mortality rates.<sup>27</sup> In São Paulo, where income inequalities are among the highest in the world,<sup>28</sup> the criminal rate has been rated as ‘critical’ by the US State Department. In addition, the global influence of megacities makes them vulnerable to terrorism: their large populations and the presence of important political institutions and business headquarters are attractive targets, as witnessed by the attacks in New York, London and Mumbai.<sup>29</sup> Furthermore, the existence and expansion of urban black holes or ‘no-go’ neighborhoods<sup>30</sup> in which government forces are unable to exert their control, offer potential areas of refuge for extremist activities of all types.<sup>31</sup>

These elements are both symptoms and contributors to a lack of livability. Combined, they form a veritable ‘breeding ground’ for social unrest, damaging the physical, territorial and economic security of urban areas and creating an insecure climate for the business community.

### 5.2.3 ENVIRONMENTAL CHANGES

Urban densities are hotspots of consumption, waste generation, increased pollution and energy use. Cities in general are responsible for 75% of global energy consumption and 80% of greenhouse gas emissions. The rise of

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26 OECD, *Competitive Cities in the Global Economy*, OECD Territorial Reviews (OECD, Directorate for Public Governance and Territorial Development, November 2006), [http://www.oecd.org/document/2/0,3746,en\\_2649\\_34413\\_37801602\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/2/0,3746,en_2649_34413_37801602_1_1_1_1,00.html).

27 United Nations Human Settlements Program, *Enhancing Urban Safety and Security – Global Report on Human Settlements 2007* (London: UN-HABITAT, United Nations, 2007), <http://www.unhabitat.org/content.asp?typeid=19&catid=555&cid=5359>.

28 Lawrence Lanahan, “Megacities by the Numbers: Mega-risks and Mega-rewards,” *ONE*, Johns Hopkins Carey Business School, Spring/Summer 2010, 2.

29 *Future Issue: Urbanization*.

30 United Nations Human Settlements Program, *State of the World's Cities 2010/2011: Cities for All: Bridging the Urban Divide*, 54.

31 Teun van Dongen, “Urban Black Holes: The changing face of state failure”, *Small Wars Journal*, September 9, 2011, <http://smallwarsjournal.com/blog/urban-black-holes>.

'energyvorous' megacities enlarges this already disproportionate ecological footprint. As a result, it will negatively contribute to other urban risks, and will further exacerbate problems associated with climate change – which is an absolute 'threat multiplier'.

As megacities aggravate environmental changes, they are very likely to be affected by them simultaneously (Table 3 and Figure 7). Scientific evidence of various reviews<sup>32</sup> shows that future increases of the average global mean temperature will generate urban heat islands and lead to a more frequent occurrence of extreme weather-related events e.g., droughts or heat waves. Rising sea levels are expected to cause flooding and mud slides around coastal areas or river floodplains, where many megacities are located.<sup>33</sup> In Dhaka, many slums are built on low-lying land. Shanghai is now sinking at an annual rate of 1.5 centimeters. The social and economic costs of natural disasters will thus be tremendous, and will also affect the developed world: Tokyo's score on Munich RE's 'Natural Hazards Risk' index is 710 – compared to 2.5 for São Paulo and 0.7 for Lagos (data 2007). The estimated monetary loss from a major earthquake in Tokyo is equal to 130% of Japan's annual budget.<sup>34</sup>

Yet many megacities continue to contribute to climate change, as many city governments overlook environmental regulations or safety standards in construction for the sake of increased commercial development.<sup>35</sup>

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32 R.K. Pachauri and A. Reisinger, *Climate Change 2007: Fourth Assessment Report (AR4)*, Synthesis Report (Geneva: Intergovernmental Panel on Climate Change (IPCC), 2007), chap. 5 – Observations: Oceanic Climate Change and Sea Level, [http://www.ipcc.ch/publications\\_and\\_data/publications\\_ipcc\\_fourth\\_assessment\\_report\\_synthesis\\_report.htm](http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm); Nicholas Herbert Stern, *The Economics of Climate Change: The Stern Review* (Great Britain: Cambridge University Press, 2007).

33 Pachauri and Reisinger, *Climate Change 2007: Fourth Assessment Report (AR4)*; Pillai Poonam et al., *Climate Risks and Adaptation in Asian Coastal Megacities*, Synthesis Report (World Bank, Asian Development Bank, Japan International Cooperation Agency, 2010), [http://siteresources.worldbank.org/EASTASIAPACIFICEXT/Resources/226300-1287600424406/coastal\\_megacities\\_fullreport.pdf](http://siteresources.worldbank.org/EASTASIAPACIFICEXT/Resources/226300-1287600424406/coastal_megacities_fullreport.pdf).

34 Lanahan, "Megacities by the Numbers: Mega-risks and Mega-rewards."

35 Yerach Doytsher et al., *Rapid Urbanization and Mega Cities: The Need for Spatial Information*, Research Study (Copenhagen: FIG Commission 3, International Federation of Surveyors (FIG), January 2010), 20, <http://www.fig.net/pub/figpub/pub48/figpub48.pdf>.

CITY	HAZARDS
Tokyo	Earthquake, flood
Mexico City	Earthquake, flood, landslide, volcano
Los Angeles	Earthquake, flood, wildfire, drought
Lagos	Flood
São Paulo	Landslide, floor
Mumbai	Earthquake, flood, cyclone
Shanghai	Earthquake, flood, cyclone
Calcutta	Flood, cyclone
Jakarta	Earthquake, volcano
Beijing	Earthquake, severe winter
Manila	Flood, cyclone

TABLE 3: MOST LIKELY HAZARDS THREATENING INFRASTRUCTURE IN A NUMBER OF CITIES AND MEGACITIES. SOURCE: WORLD BANK, BUILDING SAFER CITIES: THE FUTURE OF DISASTER RISK, 2003. HCSS, FUTURE ISSUE: URBANIZATION, MARCH 2009.

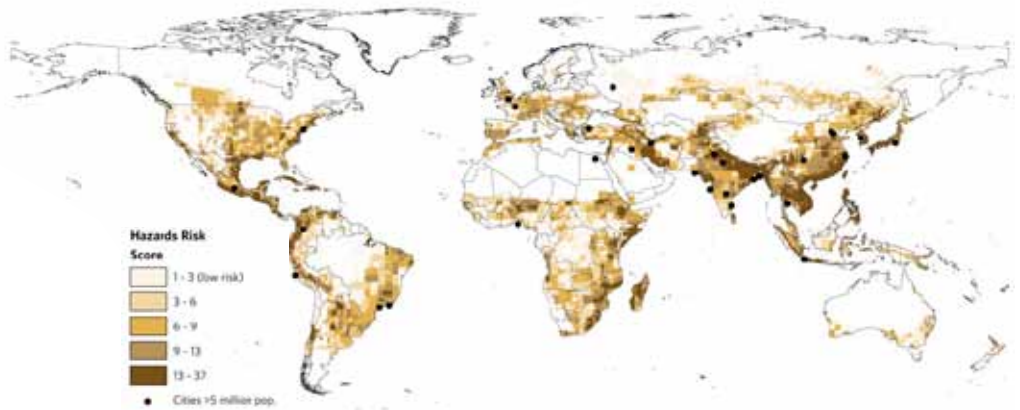


FIGURE 7: LARGE CITIES IN RELATION TO CURRENT CLIMATE-RELATED HAZARDS. SOURCE: UNITED NATIONS, STATE OF THE WORLD POPULATION, 2007.

#### 5.2.4 INFRASTRUCTURE RISKS

Rapid urbanization and population growth, uncontrolled urban sprawl and demographic challenges such as aging create increasing demand for healthcare, recreation, safe housing and mobility.<sup>36</sup> Studies observe that a number of megacities have not been able to keep pace with their phenomenal growth. Many are currently facing crisis situations related to their electrical, transportation and wastewater infrastructures which are severely technologically outdated, inadequate or overburdened.<sup>37</sup> This situation exacerbates most of the aforementioned megacity diseases.

**Infrastructure decay aggravates health and safety issues.** For 6000 tons of waste generated daily in Lagos, only 3000 tons are properly disposed of due to poor maintenance, a lack of adequate funding to finance urban development, and waste mismanagement.<sup>38</sup> The 2006 OECD report noted a correlation between deprived areas and the reduced development of public services and infrastructure<sup>39</sup> giving access to clean water, basic sanitation, healthcare and emergency services. This significantly contributes to the spread of pandemics. In addition, insufficient infrastructure results in traffic inefficiencies and congestion, i.e. increasingly overcrowded public transport and freeway bottlenecks which generate air pollution and have serious security implications: a striking example is the train system in Mumbai, which causes about 17 accidental deaths daily on the railways (2009 estimation).<sup>40</sup>

**Obsolete infrastructure hampers social cohesion.** Several (mega)cities have valuable historical buildings and distinctive neighborhoods which undeniably preserve their identity and attractiveness;<sup>41</sup> however, they also are expensive and difficult to upgrade in order to meet modern demands.

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36 TNO, *Top-sectoren en TNO: Position Papers 2011*, Position Paper (TNO, March 2011), 74, [http://www.tno.nl/downloads/position\\_papers\\_2011\\_top\\_sectoren\\_tno.pdf](http://www.tno.nl/downloads/position_papers_2011_top_sectoren_tno.pdf).

37 GlobeScan, MRC Mc Lean Hazel, and Siemens AG, *Megacity Challenges: A Stakeholder Perspective*, 2.

38 Lanahan, "Megacities by the Numbers: Mega-risks and Mega-rewards."

39 OECD, *Competitive Cities in the Global Economy*, 16.

40 Rhys Blakely, "Mumbai's overcrowded trains kill 17 people every day," *The Times - The Sunday Times*, April 1, 2009. Online edition, <http://www.timesonline.co.uk/tol/news/world/asia/article6011777.ece>.

41 TNO, *Top-sectoren en TNO: Position Papers 2011*, 74.

For example, many lines of the metro system in Paris do not include elevators or escalators; the morphology of streets in the center makes it difficult to extend the four tramway lines that are currently located at the periphery. As a result, an important part of the transportation network of the city remains inaccessible for the disabled and the elderly, which damages social cohesion.

**Insufficient infrastructure leads to energy insecurity.** The world's twenty largest cities represent 80% of the world's energy use.<sup>42</sup> Urban trends increase the demands placed on energy and the supply of non-renewable resources for power generation. Not only do these demands contribute to the negative feedback loop of climate change, they are also straining infrastructures to their limits: for example, widespread power outages are commonplace in many megacities. In addition, the predicted scarcity of fossil fuels - which urban viability highly depends on - jeopardizes the current energy paradigm and therefore, the performance of existing infrastructures itself.

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42 United Nations Human Settlements Program, *Cities and Climate Change – Global Report on Human Settlements 2011* (UN-HABITAT, United Nations, 2011), [http://www.unhabitat.org/downloads/docs/GRHS2011\\_Full.pdf](http://www.unhabitat.org/downloads/docs/GRHS2011_Full.pdf).



## 6 BUILDING LIVABLE AND SUSTAINABLE MEGACITIES

### **Megacities create considerable opportunities for a better quality of life.**

Their scale and dynamism harvest a variety of assets such as human talent, creativity, social interaction and cultural diversity.<sup>43</sup> They are innovation hubs, becoming the “new engines of global and regional economies”.<sup>44</sup> Foresight studies show that mid-size cities and megacities will be the driving forces for development and global growth,<sup>45</sup> with mega-regions already representing 66% of global economic activity and about 85% of technological and scientific innovation.<sup>46</sup> Tokyo itself accounts for nearly 40% of Japan’s total GDP.<sup>47</sup>

Megacities have an important role to play in keeping the impacts of present and future global trends within manageable boundaries. In fact, the vulnerability of megacities can be a powerful driving force in finding innovative solutions that will improve energy efficiency, eco-friendliness and quality of life. Megacities can create opportunities within several dimensions; as shown in Figure 8, they are all interrelated.

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43 Tegart, *The Future of APEC Megacities: A Foresight Approach. Review of Studies by the APEC Center for Technology Foresight 1998-2000*, chap. 7 – Sustainable Transport for APEC Megacities: Issues and Solutions.

44 United Nations Human Settlements Program, *Urban Trends: Urban Corridors - Shape of Things to Come?*, Update of UN-HABITAT’s State of the World’s Cities 2010/2011 Report (UN-HABITAT, United Nations, March 18, 2010), 1, <http://www.unhabitat.org/documents/SOWC10/R3.pdf>.

45 Richard Dobbs et al., *Urban World: Mapping the Economic Power of Cities*, Executive Summary (The McKinsey Global Institute (MGI), March 2011), [http://www.mckinsey.com/mgi/publications/urban\\_world/pdfs/MGI\\_urban\\_world\\_exec\\_summary.pdf](http://www.mckinsey.com/mgi/publications/urban_world/pdfs/MGI_urban_world_exec_summary.pdf).

46 Richard Florida, Tim Gulden, and Charlotta Mellander, *The Rise of the Mega Region* (Toronto: The Martin Property Institute, Joseph L. Rotman School of Management, University of Toronto, October 2007), <http://www.rotman.utoronto.ca/userfiles/prosperity/File/Rise.of.the.Mega-Regions.w.cover.pdf>.

47 GlobeScan, MRC Mc Lean Hazel, and Siemens AG, *Megacity Challenges: A Stakeholder Perspective*, 14.



FIGURE 8: DIMENSIONS OF OPPORTUNITIES WITHIN MEGACITIES

### 6.1 HUMAN, SOCIAL AND CULTURAL RESOURCES

In the global knowledge economy, megacities of today and tomorrow will compete with one another to be viewed as attractive places to live, work and learn – that is, attractive for businesses, skilled workers, residents and visitors. In an effort to make their cities more competitive and reduce the impact of socio-political risks, many cities have created programs aiming to eliminate poverty through income transfers or financial assistance. However, many of these attempts continue to fall short of the intended goals, and will require innovation on the part of policy makers and business investors to address these challenges in the future. A creative approach to encourage social cohesion between urban communities and promote positive change is to support the effective utilization of the megacity’s human, social and cultural capitals.<sup>48</sup>

48 PriceWaterhouseCoopers, *Cities of the Future: Global Competition, Local Leadership* (PriceWaterhouseCoopers, 2005), 18, <http://www.pwc.com/gx/en/government-public-services/issues-trends>.

### 6.1.1 HUMAN CAPITAL

Knowledge and innovation increasingly appear to be necessary for economic prosperity in the global competition for talent.<sup>49</sup> Megacities are increasingly interested in the concept of 'Knowledge City' already implemented in cities like Barcelona or San Francisco.<sup>50</sup> In 2010, the 'Guangzhou Knowledge City project' was launched in partnership with Singapore. Guangzhou is part of a mega-region project that will be the size of Switzerland. The city intends to become an attractive place for human talent, new industries, leading technologies and businesses. High-added value activities will be developed in areas that include education and training, health and wellness, energy and environmental technology, advanced and creative industries.<sup>51</sup> The ambition is to switch from relying on labor-intensive industries to creating a knowledge-intensive economy. The economic vitality generated by this platform of business opportunities should benefit local inhabitants as business parks, universities and convention centers will be constructed next to new residential areas. In order to phase out urban spatial divisions, planning strategies can create new opportunities through the relocation of human capital in the periphery, or through the transformation of deprived industrial areas into new centers of knowledge.

### 6.1.2 SOCIAL CAPITAL

Megacities can build up social capital by offering more possibilities of interaction between communities through the expansion of public meeting spaces (e.g., parks) and by actively promoting social mixing. Social capital must be developed carefully; for example, shopping malls should not replace parks as public meeting spaces, for their activities exclude the poor. In addition, as many interactive networks are now developing on the Internet, cities should take steps in providing e-literacy skills and access for all, thereby avoiding the further isolation of underprivileged citizens.

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49 Jane Marceau, "Introduction: Innovation in the city and innovative cities," *Innovation: Management, Policy & Practice*, December 2008, 136.

50 Francisco Javier Carillo, *Knowledge Cities: Approaches, Experiences and Perspectives* (Elsevier Butterworth Heinemann, 2006), 26, [http://books.google.nl/books/about/Knowledge\\_cities.html?id=5IZaumc3WbwC&redir\\_esc=y](http://books.google.nl/books/about/Knowledge_cities.html?id=5IZaumc3WbwC&redir_esc=y).

51 Aaron Low, "Singapore, Guangzhou signs Knowledge Deal," *Asia News Network*, November 15, 2010, <http://www.asianewsnet.net/home/news.php?sec=2&id=15487>.

Social links create a positive sense of identity which can influence the atmosphere and productivity of a whole city, as there is a positive correlation between high levels of social capital and constructive experiences in education, employment, housing, transports, urban design, community safety, health or sports.<sup>52</sup> For instance, the city of Vancouver has won a UN Public Service award for its innovative 'Neighborhood Integrated Service' teams that help residents solve difficult issues in their area.<sup>53</sup>

### 6.1.3 CULTURAL CAPITAL

As part of the global competition megacities engage in, it is important to maximize the attention they receive for their unique features.<sup>54</sup> Using urban marketing policies ('branding'), megacities can emphasize their powerful attributes e.g., institutions, architecture, events, knowledge or global connections. Here again, the purpose is to further attract international businesses and organizations. Renowned experiences are the specializations in culture or entertainment (films in Mumbai, carnivals in Rio de Janeiro), or the powerful one-off events e.g., World Cup venues. The 2010 World Expo hosted in Shanghai, which ran under the banner of 'Better City, Better Life', served as an international showcase, reenergizing the city's development in architectural innovation and new technologies, including a network of electric buses created for the event. In addition, prestigious international events can also spur opportunities to transform the face of a city and enhance social inclusiveness. For example, as London is preparing to host the 2012 Olympic Games, its deprived East End district is being brought back to life with Brownfield sites cleared, sport facilities renovated, and the creation of a new park almost as large as Hyde Park.<sup>55</sup>

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52 PriceWaterhouseCoopers, *Cities of the Future: Global Competition, Local Leadership*, 40.

53 City of Vancouver, "News Release," *City of Vancouver, City Clerk's Department*, March 11, 2003, <http://vancouver.ca/ctyclerk/NewsReleases2003/NRunaward.htm>.

54 PriceWaterhouseCoopers, *Cities of the Future: Global Competition, Local Leadership*, 22.

55 Carole Papazian, "À un an de leur ouverture, les JO de Londres font leur show," *Le Figaro*, July 26, 2011, Online edition, <http://www.lefigaro.fr/conjoncture/2011/07/26/04016-20110726ARTFIG00551--un-an-de-leur-ouverture-les-jo-de-londres-font-leur-show.php>.

## 6.2 GREENING THE MEGACITY: ENVIRONMENTAL CAPITAL AND NEW URBAN MORPHOLOGIES

As livability in urban areas is increasingly determined by the degree of climate-neutrality and the quality of the environment, megacities face the challenge of preserving their economic vitality while attempting to minimize their ecological footprint.<sup>56</sup> The finite nature of fossil fuels and the impact of human activity on the environment necessitate the utilization of new concepts in order to reduce the dependence on non-renewable resources while mitigating social and environmental costs.<sup>57</sup> Policy recommendations of the World Energy Council concerning future urban life include the promotion of energy efficiency along the energy value chain, as a tool to achieve a sustainable energy future.<sup>58</sup> This would be made possible through the upgrading of infrastructure, using appropriate technologies and making better choices in spatial urban planning for land use, transport and commodities.

### 6.2.1 TRANSPORTATION.

A large, affordable, and reliable public transportation system is a crucial aspect to promote city competitiveness.<sup>59</sup> First, it facilitates social cohesion and stability by keeping parts of the city in close connection, and by supporting access to basic services (education, healthcare) and leisure activities in the center. Second, it is an efficient way to reduce congestion costs such as air pollution. Many recommendations call for the development of alternative transport modes which reduce vehicle dependence through the expansion of pedestrian areas, innovative car- and bike-sharing

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56 European Metropolitan Network Institute, *A Network for Metropolitan Areas, Centres of Excellence, and National and European Governments - Closing the gap between urban practice, research and capacity building* (The Hague: European Metropolitan Network Institute (EMI Network), 2010), [emi-network.eu/dsresource?objectid=169168](http://emi-network.eu/dsresource?objectid=169168).

57 TNO, *Top-sectoren en TNO: Position Papers 2011*, 73.

58 Sueur, *Villes du Futur, Futur des Villes: Quel Avenir pour les Villes du Monde? - Tome 1: Enjeux*; World Energy Council, *Deciding the Future: Energy Policy Scenarios to 2050*, Executive Summary, Foresight Report (London: World Energy Council, 2007), [http://www.worldenergy.org/documents/scenarios\\_study\\_es\\_online.pdf](http://www.worldenergy.org/documents/scenarios_study_es_online.pdf).

59 GlobeScan, MRC Mc Lean Hazel, and Siemens AG, *Megacity Challenges: A Stakeholder Perspective*, 9-11.

schemes (e.g., the ‘Vélib’ system in Paris, since 2007) and busways.<sup>60</sup> London has introduced stricter policies like congestion charges, while investing heavily in attractive public transportation and extending bicycle networks. The city now has the second lowest transport ecological footprint per capita in England.<sup>61</sup> Developing world megacities are also starting to show their determination: for example, a railway line running through the Lagos metropolis is being constructed with plans of completion as early as 2012;<sup>62</sup> in Mexico City, comprehensive air quality management programs have been implemented and include the enforcement of vehicle inspections, and campaigns such as ‘No driving day’ (*Hoy No Circula*) have been used to raise awareness. As a result, important reductions in ambient concentrations of toxic gas have been achieved.<sup>63</sup> These efforts can be supported through increased investments in new technologies that reduce noise and air pollution (e.g., electric vehicles).

### 6.2.2 BUILDINGS

Megacities also have the potential to reduce their ecological footprint through the promotion of sustainable building practices that improve the efficiency of buildings and utilize renewable resources in the construction. Encouraging progress has been made in this direction. For example, Technopolis in Kolkata is India’s first green IT building. The project has achieved gold standard under the internationally recognized LEED (Leadership in Energy and Environmental Design) certification in 2010. It is expected to reduce the carbon emission by 7500 tones<sup>64</sup> and aims to

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60 ADC Forum, *ADC Cities Report: Enhancing Liveability*, Forum Report Part 1 (Sidney: ADC, 2010), [http://www.adcforum.org/assets/files/City%20Summit/ADC\\_Cities\\_Report\\_part\\_1.pdf](http://www.adcforum.org/assets/files/City%20Summit/ADC_Cities_Report_part_1.pdf).

61 Alan Calcott and Jamie Bull, *Ecological Footprint of British City Residents: What We Can Do to Reduce Ours*, Environmental Impact Report (Surrey, UK: Carbon Plan and World Wildlife Fund UK, 2007), 24, [http://www.wwf.org.uk/filelibrary/pdf/city\\_footprint2.pdf](http://www.wwf.org.uk/filelibrary/pdf/city_footprint2.pdf).

62 “Lagos Light Rail,” *Railways Africa, The Authoritative African Railway Publication*, December 3, 2010, <http://www.railwaysafrica.com/blog/2010/12/lagos-light-rail-2/>.

63 Mario J. Molina and Luisa T. Molina, “Improving Air Quality In Megacities: Mexico City Case Study” (Massachusetts Institute of Technology, USA, 2006), 3.

64 “Green India,” *GreenGlassStructures Blog*, August 1, 2009, <http://greenstructures.wordpress.com/tag/usgbc/>.

improve indoor air quality, as well as the safety and productivity of employees.

In addition, the democratization of additional technologies such as 3D printing for architecture, engineering and construction will facilitate the transformation of megacities with new, affordable, and secure buildings.<sup>65</sup>

Climate-adapted design can also play a crucial role in mitigating the consequences of natural disasters. Tokyo has maintained revitalization levels by focusing on infrastructure renovation and earthquake-resistant buildings. Environmental changes call for innovative practices incorporating structures and materials that are resistant to changing conditions, reduce air pollution and ensure water safety.<sup>66</sup> High comfort, air quality and energy-efficiency can be achieved with sun shading, insulated airtight building envelopes, soft ventilation system, and piping fresh air at ground level. Such systems are quiet and require less energy and equipment. An increasingly popular long-term solution to mitigate the effects of climatic conditions such as heat island effects, heat waves and storms may lie in growing plants on rooftops and creating sky-rise gardens.<sup>67</sup> The so-called green walls or roofs improve water recycling, cooling, ventilation, water recycling, water storage and water infiltration. Tokyo has been actively legislating for the creation of green roofs; Shanghai and Beijing have adopted similar policies in recent years.

It is important to note that by incorporating aesthetic features new urban design projects become iconic buildings that attract visitors, showing that commercial returns and green concepts are not mutually exclusive. Likewise, megacities that have attracted human capital benefit from the presence of creative industries which promote the construction of green buildings.

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65 Walter Derzko, "Smart Economy," *Smart Economy*, February 15, 2006, [http://smarteconomy.typepad.com/smart\\_economy/2006/02/contour\\_craftin.html](http://smarteconomy.typepad.com/smart_economy/2006/02/contour_craftin.html).

66 TNO, *Top-sectoren en TNO: Position Papers 2011*, 74.

67 Verlyn Klinkenborg, "Up on the Roof," *National Geographic*, May 2009, <http://ngm.nationalgeographic.com/2009/05/green-roofs/klinkenborg-text>.

### 6.2.3 SECURITY AND TECHNOLOGY

The scale of megacities requires a high-tech approach to security. In coastal areas, the presence of a well-functioning early warning system for natural disasters can save many lives. In order to improve the social climate, strategies of crime prevention through environmental design (CPTED) can be incorporated into the physical design of the city, including placing windows at the level of the street, widening streets and adding adequate lighting throughout the city. Furthermore, the use of spatial capabilities such as Spatial Data Infrastructures (SDI) can help monitor growth, forecast risk areas in urban planning and construction, measure the productive capacity of rural properties and support the management of natural disasters.<sup>68</sup> For example, land-use maps from satellite technology or the 3D visualization of the surface and subsurface can help identify resources and hazards.<sup>69</sup> SDI can help megacities achieve rural sustainability and self-sufficiency, through the promotion of policies that reduce urban sprawl, preserve arable lands in surrounding rural areas, and support the local economy with locally produced food.

### 6.2.4 NEW URBAN MORPHOLOGIES: GREEN AND COMPACT CITIES

As urban sustainability has become a crucial source of competitive advantage, it is becoming increasingly important to invest in the expansion of safe, green, and clean living environments. This includes the creation and preservation of high quality recreational space such as parks: they are vital contributors to the preservation of biodiversity, and maintain the quality of urban living. However, the incumbent lack of space in megacities does not facilitate the expansion of such places. Here again, green roofs and walls are efficient solutions. In addition, land-use ratios are key to ensuring a sufficient space for recreation, housing and future use.

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68 Paul Kelly, *Managing Megacities: A Spatial Solution* (Global Spatial Data Infrastructure Association, 2010), 8, <http://www.gsdi.org/gsdiconf/gsdii2/papers/7.pdf>.

69 European Environment Agency, *Ensuring Quality of Life in Europe's Cities and Towns: Tackling the Environmental Challenges Driven by European and Global Change*, 97; Doytsher et al., *Rapid Urbanization and Mega Cities: The Need for Spatial Information*, 11.



According to studies published by the OECD, the UITP, the WHO and the World Bank,<sup>70</sup> well-managed dense urban areas offer the opportunity to live more efficiently with respect to energy; the morphology of the so-called ‘compact cities’ allows for shorter possible distances and a reduction in pollution intensity.<sup>71</sup>

Strategies to develop compact cities include the use of underground place for environmentally unfriendly activities (e.g., tunnels for car traffic),<sup>72</sup> and the construction of high-rise residential buildings (e.g., technique of ‘Vancouverism’<sup>73</sup>). Further spatial policies recommend the development of poly-center urban expansion. As such, the Shanghai experience ‘One City, Nine Towns’ consists in the transformation of suburban areas into ecologically-sustainable satellite cities around the megacity.<sup>74</sup> The idea behind this project is to accommodate the growing demand for space and relieve pressure on the center. Simultaneously, such initiatives of decentralization can spread economic vitality, promote social diversity<sup>75</sup> and provide a platform for architectural innovation. However, one must keep in mind that projects creating multi-centric megacities necessitate the abandonment of policies of ‘full-out low-cost housing’ occurring in Western satellite cities, as they often resulted in residential ‘sleeping towns’ or further ‘ghettoization’. The design of satellite towns should therefore

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70 “International Association of Public Transport (IAPT)”, n.d., <http://www.uitp.org/>; *Sustainable and Healthy Urban Transport Patterns and Land-Use Planning*, Introduction Report (World Health Organization, and United Nations Economic Commission for Europe, 2003), <http://www.thepep.org/en/workplan/urban/documents/UITP.pdf>; *World Development Report 2009: Reshaping Economic Geography* (Washington DC: World Bank, World Development Bank, 2008), 211.

71 Sueur, *Villes du Futur, Futur des Villes: Quel Avenir pour les Villes du Monde? - Tome 1: Enjeux*, 109.

72 Planet Earth: Earth Sciences for Society, *Megacities – Our Global Urban Future*, Prospectus for a Key Theme of the International Year of Planet Earth (Leiden: Earth Sciences for Society Foundation, December 2005), 10, <http://yearofplanetearth.org/content/downloads/Megacities.pdf>.

73 “Canadian Geographic Article Index,” *Canadian Geographic Magazine*, n.d., <http://canadiangeographic.ca/magazine>.

74 Susie Gordon, “One City, Nine Towns: Shanghai’s Suburban Wonderland,” *echinacities.com*, April 8, 2011, <http://www.echinacities.com/shanghai/city-life/one-city-nine-towns-shanghai-s-suburban-wonderland.html>.

75 TNO, *Top-sectoren en TNO: Position Papers 2011*, 74.

integrate urban functions, economic activities, social mix, and local culture.<sup>76</sup>

### 6.3 GOVERNING THE MEGACITIES

One of the greatest challenges for the implementation of the proposals for change is the governability of megacities. Traditional forms of centralized governance with top-down strategies are likely to be inefficient within megacities, because of their highly dynamic and complex interactions. For example, both the lack of resources and the difficult coordination among the different levels of authorities are a real obstacle to the improvement of transportation in Mumbai.<sup>77</sup> Therefore, and according to the foresights selected throughout the research, a reassessment of urban governance and new participatory management concepts are required. Beyond the traditional 'horizontal' process, policies can be developed based on the notion of 'polycentricity'<sup>78</sup> which consists of a networked and integrated approach to policy-making. It supports the cooperation, initiatives and participation of all administrative levels and stakeholders in governance, thereby providing an insight into economic, social and ecological dynamics and local experiments.<sup>79</sup> Several types of interactions which aim to build and optimize polycentric governance processes have been identified across the selected literature; they are articulated between the economy (private sector), politics (the government), and the civil society.

#### 6.3.1 GOVERNANCE AND CITIZENSHIP

Due to the increased accessibility to information and the growing distrust of the established political leadership, there have been pressures for increased transparency in the policy-making process, between city leaders

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76 Sueur, *Villes du Futur, Futur des Villes: Quel Avenir pour les Villes du Monde? - Tome 1: Enjeux*, 17.

77 The Cities Alliance, *Slum Upgrading Up Close, Experiences of Six Cities* (The Cities Alliance, 2008), 47, [http://www.citiesalliance.org/ca/sites/citiesalliance.org/files/su-up-close\\_0.pdf](http://www.citiesalliance.org/ca/sites/citiesalliance.org/files/su-up-close_0.pdf).

78 Andreas Faludi, *Territorial Cohesion: a Polycentric Process for a Polycentric Europe*, Working Paper (Nijmegen: GAP-Research Team Governance and Places, University of Nijmegen, 2004).

79 Anna Geppert, "Polycentricity: Can we make it Happen? From a Concept to its Implementation," *Urban Research and Practice Journal* 2, no. 3 (November 2009): 251-268.

and citizens. In order to enhance their political accountability and reinvigorate public interest for the local political process, megacities can directly initiate trust-building dialogue and involve citizens and associations in the creation of major policies.<sup>80</sup> Participatory budgeting is not only feasible in small cities: it is also being implemented in Mexico City and São Paulo. Lessons learned suggest that megacities should focus more on their citizens, through the consultation of the community and civil society at every stage of urban projects; consultative forums composed of specific categories of citizens can improve infrastructure and social policies by giving more voice to the disabled, the underprivileged and foreigners.

Direct contributions can be greatly facilitated by the use of new communication channels and interfaces. For example, electronic voting was introduced in Mumbai in 2010, with devices available in public places. In addition, spatial data infrastructures deliver citywide, actionable urban intelligence that can improve the efficiency of decision-making, the delivery of services and renovation projects;<sup>81</sup> in Lagos, the objectives of a new land policy initiated in 2008 include the development of institutional efficacy in land documentation and the creation of a modern registry of lands.<sup>82</sup>

### 6.3.2 GOVERNANCE AND PARTNERSHIPS

Keeping megacities abreast of demand and guaranteeing spatial quality – more generally, the move towards the livable and sustainable megacity – will require huge investments and increasingly pressure urban budgets. Nevertheless, the cost of not meeting future challenges may well be even greater. Megacities must then find new revenue streams and appropriate financial arrangements in order to invest efficiently for their future vitality.<sup>83</sup> The emergent trend among city authorities is to outsource infrastructure provision; for example, Delhi has privatized its electricity service and part of its urban bus services to increase the supply of buses in the city. However, private players may give greater priority to short-term profitability

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80 PriceWaterhouseCoopers, *Cities of the Future: Global Competition, Local Leadership*, 46–47.

81 Kelly, *Managing Megacities: A Spatial Solution*, 11.

82 The Cities Alliance, *Slum Upgrading Up Close, Experiences of Six Cities*, 30.

83 TNO, *Top-sectoren en TNO: Position Papers 2011*, 74.

than to long-term sustainability; concerns for safety, equity and fair accessibility have been raised.

Another financing option consists in the establishment of Public-Private Partnerships (PPPs), which, if well-designed, flexible and adapted to the intended objectives, have the potential to capture risk-sharing and transfer technology and management efficiency to public services.<sup>84</sup> Lagos, with its endemic deficits and meager annual budget of \$650 million, actively initiates PPPs for facilities development and urban infrastructures.<sup>85</sup>

Alternative solutions to finance comprehensive renovation projects may lie in the coalition of city governments, NGOs or multi-lateral organizations like UN-HABITAT. This system was used in a slum upgrading program in São Paulo with the cooperation of Cities Alliance, a global association of cities and development partners.<sup>86</sup>

### 6.3.3 GOVERNANCE AND LEADERSHIP

Comprehensive green action plans do not typically deliver results in the short-term; for this reason, they are often outweighed by fragmented policies and the desire for short-term economic growth,<sup>87</sup> or even by government corruption and instability.<sup>88</sup> Therefore, progress towards urban sustainability is likely to require political courage and a strong, consultative environmental governance<sup>89</sup> which can enforce norms and environmental regulations, financial (dis)incentives, awareness campaigns, and implement policies such as green public procurement e.g., through the purchase of energy-saving light bulbs or serving organic food in workplace canteens. It is encouraging to see that many megacities or future megacities like

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84 Alitheia Capital, "Public-Private Partnerships – The Answer to Nigeria's Infrastructure Problems?," *howwemadeitinafrica.com*, December 12, 2010, <http://www.howwemadeitinafrica.com/public-private-partnerships-the-answer-to-nigerias-infrastructure-problems/6254/>.

85 Lanahan, "Megacities by the Numbers: Mega-risks and Mega-rewards."

86 The Cities Alliance, *Slum Upgrading Up Close, Experiences of Six Cities*, 50.

87 UK's National Health Service (NHS): short-term, politically-driven attempts to improve efficiency and sustainability have proved to be largely ineffective and a waste of public funds.

88 Lanahan, "Megacities by the Numbers: Mega-risks and Mega-rewards."

89 ADC Forum, *ADC Cities Report: Enhancing Liveability*, 94–95.

Jakarta are becoming conscious of their vulnerabilities and are anticipating future issues. They are becoming the new initiators of creative actions, international events or summits that help share experiences and bring together potential partners, urban planners, politicians, developers, architects, NGOs, energy experts, the media, and the public.

## 7 CONCLUSION

### LIVABILITY AND SUSTAINABILITY IN MEGACITIES

Livability and sustainability within large, densely populated urban areas need to be addressed, as they are increasingly becoming the conditions for survival in the global knowledge economy – and for human wellbeing.

Megacities do not share the same infrastructure quality, level of economic development or governance structures. Each of them contain distinctive risks of different intensity which they cannot adequately anticipate or deal with: Tokyo's natural disasters, Lagos's corruption and waste generation, São Paulo's criminality and booming car-armoring industry. Yet all are exposed to the global ecological, socio-economic and political changes. Overwhelmed by the demands of growing population, no megacity so far has met society's most pressing challenges – low-carbon energy, sustainable clean water, effective waste management, reduced air pollution, adequate shelters, and resilience to global climate change.

However, cities in general and megacities in particular are places where positive, remarkable changes have already been experienced; they present real opportunities to reduce socio-economic disparities, increase energy efficiency and improve quality of life in general. Although many of the ambitious policies of mid-size cities can be translated within megacities, the gigantism of megacities will necessitate greater innovation, creativity and high-tech approaches along the road to the urban future. Making steps towards a connected, livable and viable megacity calls for holistic, multifaceted and integrated urban policies, for these have proven to be a solid path towards development.<sup>90</sup> Measures for an harmonious and

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<sup>90</sup> United Nations Human Settlements Program, *State of the World's Cities 2008/2009: Harmonious Cities*, sec. Foreword by UN Secretary General Ban Ki-moon.

equitable urbanization include affordable housing, green and safe public places, social integration, accessible and affordable transport modes, and a rich cultural life. Coordinated packages of policies dealing with both infrastructure and traffic management are an example of desired solutions. Actors such as urban planners and architects also have the power to meet growing human needs and bring consistency and quality to the physical environment of citizens. Low carbon or renewable technologies can avoid the continued construction of inefficient infrastructures, thereby allowing cities to quickly shift towards a new energy paradigm with a new generation of transport modes, buildings, water management systems. Finally, as urban transformation requires long-term strategy planning and financial investment, it must also be combined with strengthened governance structures and citizen-focused leadership.

The extraordinary concentration of human needs and functions makes megacities the decisive factor for our climate and the key to a sustainable future. Their ability to enhance urban livability and sustainability for city dwellers will greatly impact the chances of humanity to overcome future threats and make the planet a better place.

## AFTERWORD - FOR EUROPE

### **EUROPEAN 'MEGA-REGIONS'**

In an increasingly borderless world, accounts of new forms of society and economy supported by advances in ICT have identified the growing importance of 'region states' within or across national borders. They would appear to be replacing nation-states as the dominant unit of economic organization and social identification. The 'mega-regional' designation seems especially relevant to the conurbations of Europe. In recent years, the focus has been on the emergence of European spatial planning that have boosted the competitiveness of European urban regions.





FIGURE 9: MEGA-REGIONS OF EUROPE. SOURCE: "WHO'S YOUR CITY?" BY RICHARD FLORIDA.

In Europe, urban areas have evolved through a network of metropolitan centers and their surrounding areas, forming large competitive units sheltering high densities of populations. They represent the new European scale for considering economic strength and growth opportunities. The largest European mega-region spans Amsterdam-Rotterdam, Ruhr-Cologne, Brussels-Antwerp and Lille. This region, sometimes called 'Euro Lowlands', is home to more than 59 million people and produces nearly \$1.5 trillion (€1.1 trillion) in economic output, which exceeds that of Canada, China or Italy.<sup>91</sup> Next in size is the mega-region spanning London, Leeds, Manchester, Liverpool and Birmingham. The German mega-region encompasses Stuttgart, Frankfurt and Mannheim; the Italian mega-region

<sup>91</sup> Florida, Gulden, and Mellander, *The Rise of the Mega Region*, 18.

stretches from Milan through Rome to Turin and is the world's 7<sup>th</sup> largest economic conglomerate in the world.

This afterword emphasizes the urgency to draw more attention on urban Europe in the coming decades. Although large European cities have particular features (e.g., historical buildings) and specific challenges, developed world megacities and European mega-regions share similar issues and opportunities to a certain extent. European cities are becoming aware of their strategic role in livability and sustainability as well, and European planners and policymakers are starting to examine and implement the mega-region as a new framework. However, there has been a slight depreciation in urban livability due to the current crisis in the euro zone, particularly in Greece.<sup>92</sup>

TNO can make use of existing practices, initiatives, knowledge, European instruments and policies, and build on these. Such practices could be streamlined within the experience of TNO in technology, planning and governance. In the context of the Europe 2020 strategy, TNO could incorporate its experience into the development of livable and sustainable mega-regions in Europe by drawing up an own-initiative opinion on the European region.

### **CHALLENGES FOR URBAN REGIONS IN EUROPE: THREE AVENUES FOR RESEARCH AND REFLECTION**

Based on the findings of this Vision Paper, three avenues for reflection and further research are developed to provide a focused discussion on specific issues facing European cities. These avenues outline new related initiatives where TNO could have a role to play, and which constitute an opportunity for further development in the Netherlands.

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92 The Economist Intelligence Unit, *A Summary of the Liveability Ranking and Overview*, White Paper (The Economist Intelligence Unit, August 2011).

## AVENUE 1: ECONOMIC VITALITY, INNOVATION AND ATTRACTIVENESS IN EUROPEAN CITIES

Current policies in European urban regions focus on improving entrepreneurship in creative industries, on building networks, providing space for such activities, and on developing creative hotspots. The Lisbon agenda recognizes innovation as a key driver of urban economic performance of cities in the current knowledge economy. Yet in a context of fierce competition with other growth regions in the world, creative knowledge branches and activities of European mega-regions within the EU area could be further strengthened.<sup>93</sup> For this purpose, and in order to raise awareness about the need for stronger creativity and innovation, transnational projects are organized. For example, the 'Creative City Challenge', which includes activities such as the 'European Creativity and Innovation Day', involves European institutions, organizations and projects.<sup>94</sup> Through this program, an innovation and creativity strategy is implemented with the development of pilot projects in cities across the North Sea region (including Groningen). These contribute to a transnational exchange of learning, materials and best practices, providing a sound basis for future joint initiatives.

In order to enhance their innovative capacity, many cities in Europe are trying to place the Knowledge City concept on their policy agenda. It appears that the improvement of infrastructure, traffic and mobility is central in the endeavor to become a 'creative city'. For example, the vision of Barcelona in 2015 is that of a city characterized by an economy based on the development of an innovative culture, on the growth of new industries such as audio-visual and design, and on new uses of transport aiming to improve mobility.<sup>95</sup> Berlin combines extraordinary research and

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93 Sako Musterd et al., *Making the Creative Knowledge City: a Guide for Policy Makers* (Amsterdam: European Commission, Amsterdam Institute for Social Science Research (AISSR), University of Amsterdam, 2010), [http://ec.europa.eu/research/social-sciences/books38\\_en.html](http://ec.europa.eu/research/social-sciences/books38_en.html).

94 "Events page, European Creativity and Innovation Day 2011," *Creative City Challenge*, May 27, 2011, <http://www.creative-city-challenge.net/en/european-creativity-and-innovation-day-2011.html>.

95 PriceWaterhouseCoopers, *Cities of the Future: Global Competition, Local Leadership*, 20 and 89.

development competence with a strong business potential in the sectors of automotive engineering, railway traffic, aviation and space flight as well as in the interface to ICT in telematics.<sup>96</sup>

Developing innovation in cities implies retaining human capital by focusing on improving the infrastructure within the region and through this, developing and reinforcing the cooperation between the city and the region as well.<sup>97</sup> Liège (Belgium) is strategically located at the crossroads of Belgium, the Netherlands and Germany. In order to inject vitality into the city, boost its attractiveness and bring it closer to its more distant neighboring European countries, Liège is implementing a plan promoting the establishment of modern infrastructure. This will facilitate a move closer to the province, including the Walloon region, and will foster integration in the Euro Lowlands.

European cities are also starting to improve transport systems in order to prevent congestion blocking economic growth. Birmingham has acknowledged the importance of improving transport links to ensure that its accessibility both as a city region and as a hub to other parts of the United Kingdom and Europe.<sup>98</sup> The densely urbanized Randstad (Netherlands) is experiencing traffic congestion. In this context, it appears that cooperation rather than competition between Dutch cities is the more appropriate way to solve the problem of accessibility in the Randstad, and deal with the international competition. This would not hamper the specificities of each city as they could be promoted simultaneously: the major port of Rotterdam, the international and European institutions of The Hague and the cultural assets, knowledge economy and financial centre of Amsterdam.<sup>99</sup>

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96 Ibid., 95.

97 “European Metropolitan Network”, n.d., [http://www.emi-network.eu/What\\_we\\_do/EMI\\_news\\_events/2011/EMI\\_in\\_Munich\\_for\\_its\\_Roundtable\\_Discussion\\_on\\_economic\\_vitality](http://www.emi-network.eu/What_we_do/EMI_news_events/2011/EMI_in_Munich_for_its_Roundtable_Discussion_on_economic_vitality).

98 PriceWaterhouseCoopers, *Cities of the Future: Global Competition, Local Leadership*, 97.

99 Ibid., 86.

TNO's expertise in Transport and Mobility contributes to relieve the environment and create opportunities for Dutch companies. TNO develops smart vehicle technology and transport systems, and provide advice on legislation and policy.

## AVENUE 2: SECURITY AND SAFETY IN EUROPEAN CITIES

**Security of people and infrastructures.** Several major European cities of more than 100 000 inhabitants are potentially exposed to climate change and natural disasters, particularly in the heavily inhabited Randstad.<sup>100</sup> Effective capabilities to predict flooding and manage flood routes can be further developed and mainstreamed in European cities. Potential improvements can be identified in the implementation of new predictive systems to observe disasters, such as communications satellites, GPS, unmanned aircraft. This additional knowledge would allow cities to develop knowledge, responses and a solid understanding of post-disaster situations.

Future vulnerabilities of critical infrastructures in key sectors (e.g., information, food distribution or financial systems, industrial plants, public buildings, transportation, energy, etc) are ever-growing and urgent concerns for the protection of city dwellers.<sup>101</sup> Through the diffusion and increasing affordability of ICT, the use of intelligent transport systems based on telematics as well as video-surveillance systems are expected to become more widespread. The purpose of these tools is to maximize transport and logistics efficiency, and improve transport safety – for example, by reacting in case the performance of the driver of a car or a bus is impaired by fatigue or medication.

Safety and security issues related to crime and urban violence will continue to take centre-stage as well. In Westminster (UK), where there have been increasing levels of antisocial behavior often driven by alcohol abuse, programs dealing with poor environment such as CivicWatch and a new antisocial behavior hotline have been set up to help the city respond to incidents. Westminster also partners with British Telecom, Intel and Cisco

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<sup>100</sup> European Environment Agency, *Ensuring Quality of Life in Europe's Cities and Towns: Tackling the Environmental Challenges Driven by European and Global Change*, 70–71.

<sup>101</sup> *Future Challenge for Europe: Providing Security and Safety to Citizens*, Foresight Brief No. 134 (The European Foresight Monitoring Network, February 2008), [http://www.vditz.de/fileadmin/media/publications/pdf/efmn\\_134.pdf](http://www.vditz.de/fileadmin/media/publications/pdf/efmn_134.pdf).

to create a 'wireless city' with networks allowing for the operation of Closed Circuit Television (CCTV) cameras and noise monitoring equipment.<sup>102</sup> In this respect, it is important to note that with the expansion of CCTV in European cities, it is becoming necessary to discuss the transparency and democratic accountability of urban surveillance systems, and develop common principles for their implementation.<sup>103</sup>

Perceived safety is a major factor of urban attractiveness. Studies have emphasized that, while crime has decreased in some European cities, fear of crime has increased simultaneously.<sup>104</sup> This perception is influenced by the role of the local media, the quality and maintenance of the built environment, socio-economic inequalities, or terrorism. It can be moderated through the improvement of specific knowledge about the actual problems in declining districts; in addition, a sound and consistent communications strategy could contribute to less biased reporting on crime in the (local) media.

TNO has developed a strong expertise in Safety and Security through the program National and Urban Safety and Security. Growing concerns about such issues in European cities constitute a new window of opportunities for TNO.

**Food and water security.** Urban agriculture, defined as food and non-food production dispersed throughout urban areas, is expected to play an important role in the European cities of the future. Major benefits of these activities could be the improvement of the nutritional status of urban

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102 PriceWaterhouseCoopers, *Cities of the Future: Global Competition, Local Leadership*, 124.

103 "Citizens, Cities and Video Surveillance: Towards a Democratic and Responsible use of CCTV," *European Forum for Urban Security*, n.d., <http://www.efus.eu/en/>.

104 "The Safe City - Safety and Urban Development in European Cities" (Studies by the European URBACT Secure City and the European Urban Knowledge Network (EUKN), 2006), [http://www.eukn.org/E\\_library/Security\\_Crime\\_Prevention/Security\\_Crime\\_Prevention/The\\_safe\\_city\\_%E2%80%93\\_safety\\_and\\_urban\\_development\\_in\\_European\\_cities](http://www.eukn.org/E_library/Security_Crime_Prevention/Security_Crime_Prevention/The_safe_city_%E2%80%93_safety_and_urban_development_in_European_cities).

populations and better food security.<sup>105</sup> The European Parliament and the Committee of the Regions have recently recognized the vital importance of agriculture in European peri-urban areas.<sup>106</sup> Highly productive agricultural activities are developing within some European cities, including Paris and London. The European City Farms program operating within the EU is developing small scale activities such as watering plants, compost making, planting and caring for trees or vegetable gardens; through this program, stakeholders become engaged in community, educational work, and become involved in the production of healthy food.

The Netherlands has a long tradition of urban agriculture. In community-based Dutch organizations of producers and consumers, while producers provide the food, city dwellers provide them with direct support in exchange. For example, in Wageningen, a horticulture farm uses biological farming principles that offer consumers the opportunity of deciding when and what to produce, through a commitment to purchasing a share of the production. Initiatives of the institute Wageningen UR also involve researchers in a variety of projects related to urban agriculture.<sup>107</sup>

TNO's expertise in Health Living and TNO's commitment to combining technology and social innovation can enable a more healthy participation of people in urban areas. On the basis of this knowledge, new partnerships could be developed in the area of urban agriculture.

European cities are affected by the disruption of water services and dwindling resources; urban water systems are struggling to cope with pressures associated with more water-intensive lifestyles, a rising demand and aging infrastructures. Ad-hoc water management measures often put

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105 *State of the World 2011: Innovations that Nourish the Planet. Farming the Cities, Feeding an Urban Future* (Worldwatch Institute's Nourishing the Planet, June 16, 2011), <http://www.eurotrib.com/story/2011/6/16/16233/6509>.

106 "Press Release," *Peri-Urban Regions Platform Europe (PURPLE Network)*, June 8, 2010, <http://www.purple-eu.org/PageFiles/41/PURPLE%20Press%20Release%20-%208%20July%202010.pdf>.

107 "Overview of projects related to urban agriculture," *Wageningen UR*, n.d., <http://www.urban-agriculture.wur.nl/UK/projects/>.

into practice (e.g., hosepipe bans in London in 2006), are based on traditional approaches that do not provide a long-term solution.<sup>108</sup> In addition, recent European directives challenge cities to comply with stricter water quality standards.

In this context, holistic approaches towards water management will be required in order to use water efficiently in urban environments. An increasing number of cities are developing projects along this vision: in Rotterdam, the Water Plan and Climate Initiatives are good examples of how the city is rebuilding itself around the interaction of water with urban planning and design, turning the threat of rising sea levels into opportunities.<sup>109</sup> Hamburg has promoted a water sensitive urban design (WSUD) aiming to develop attractive urban landscapes with innovative water management.<sup>110</sup> In a recent report by the European Water Supply and Sanitation Technology Platform,<sup>111</sup> flexible and innovative solutions for water services (e.g., advanced methods, management tools, treatment systems) and R&D topics were suggested to help strike a balance between supply and demand, deal with public health issues, restore the aquatic eco-balance, accommodate with extreme events, and improve the infrastructure. The case of London is used as an example for the development of smart metering, providing real-time data on water consumption and costs for the benefit of operators and city dwellers. R&D topics discussed for the needs of Berlin include the impact of global changes on water cycle, optimized

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108 ICLEI - Local Governments for Sustainability, “European Circular: Cities and Water – The Issues at Stake. Newsletter, Issue N° 36,” Newsletter for ICLEI members, partners and friends, Winter/Spring 2010, [http://www.iclei-europe.org/fileadmin/templates/iclei-europe/files/content/ICLEI\\_IS/Circular/EC-36-www.pdf](http://www.iclei-europe.org/fileadmin/templates/iclei-europe/files/content/ICLEI_IS/Circular/EC-36-www.pdf).

109 One recent example of the vision for Rotterdam, “Watercity 2035,” commissioned by Rotterdam Climate Initiative: Bloemhofplein, slides 17, 18, 19: Rotterdam Climate Initiative and Nico Tillie, “Rotterdamse Energie Aanpak Planning (REAP): Op naar CO2-neutrale stedenbouw”, n.d., <http://www.vitalestad.nl/doc/REAP%20Nico%20TillieNL20090626.pdf>.

110 James Tay, Sarah Walker, and Susan van de Meene, *A Vision for a Water Sensitive City. Inspired by the 2009 Transition to a Water Sensitive City Study Tour* (Transition to a Water Sensitive City Study Tour, 2009), [http://www.watersensitivecities.org.au/wp-content/uploads/WSC09\\_Report1.pdf](http://www.watersensitivecities.org.au/wp-content/uploads/WSC09_Report1.pdf).

111 European Water Supply and Sanitation Technology Platform (WssTP), *WssTP, A Common Vision for Water Innovation*, Strategic Research Agenda (Brussels: The European Water Supply and Sanitation Technology Platform (WssTP), 2010), 21–24, <http://www.wsttp.eu/files/WSSTPX0001/stakeholder%202010/WssTP%20SRA%20version%20final.pdf>.



water services such as energy efficiency, asset management and leakage control, and alternative sanitation systems.

**Healthy and energy efficient solutions.** One major challenge is to achieve the EU energy savings targets and emissions reduction through a greater use of energy saving technologies and smart appliances.<sup>112</sup> The EU air quality standards are not met by many European cities. Emissions of oxides of nitrogen, sulfur and other dangerous airborne particulates from fossil based combustion technologies are posing tremendous health problems. These justify the identification of energy efficiency as one of the principal focal points of energy policies.

Beyond the potential of the sole building sector, attention has been drawn to the *trias energetica* or energy triad model (Figure 10). This integrated approach sets out, in ascending order of importance, three propositions leading to sustainable energy management through:

1. the reduction of energy demand with the implementation of energy-saving measures;
2. the promotion of sustainable sources of energy (wind, solar power and water) for the remaining demand;
3. the optimization of fossil fuel use with cleaner technologies raising carbon efficiency and preventing emissions.

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112 Paul Bevan, General Secretary of Eurocities.

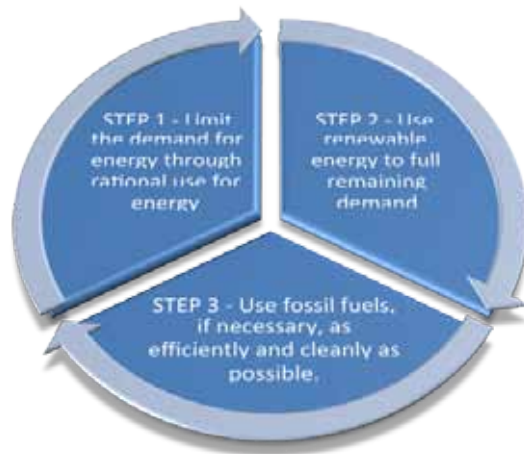


FIGURE 10: TRIAS ENERGETICA. SOURCE: EVEROP, 2011.

In Barcelona, several energy measures have been taken under each proposition of the energy triad: reduction of hot water consumption, limitation of energy wastage (e.g., avoiding stand-by modes of electronic appliances), grouping of functions or areas that have similar heating needs (e.g., archives and computer rooms).<sup>113</sup> Malmö (Sweden) chose to develop a carbon-neutral ecoquarter, called Västra Hamnen/Bo01, on the basis of the trias energetica. First, the lowest possible use of heating was ensured; compact, well-isolated buildings were constructed with a north-south orientation. Other measures included the use of natural light, thermal mass in conjunction with night ventilation, and the avoidance of motorized (fossil fuel) transportation. In this green district, 100% of the energy is derived from renewable energy sources available locally (solar, biomass) or regionally (wind); the heat is extracted from groundwater and sea water.<sup>114</sup>

113 S. Lenferink and P. van Loon, *Energy Cascading as a Spatial Concept: An Analysis of Essential Conditions for Energy Projects and Spatial Concepts* (Groningen: Faculty of Spatial Sciences, University of Groningen, May 2007), [http://www.rug.nl/gradschoolspat/degree/masterprogrammes/Ind\\_Res\\_Pro\\_vanLoon&Lenferink.pdf](http://www.rug.nl/gradschoolspat/degree/masterprogrammes/Ind_Res_Pro_vanLoon&Lenferink.pdf).

114 Eva Heuts and Erik Rombaut, *Duurzame Stedenbouw in Woord en Beeld: Gids met Praktijkvoorbeelden voor de Transitie naar een Ecopolis*, 2009, [http://dubolimborg.be/pdf/Scholencampus\\_Peer/Duurzame\\_stedenbouw\\_in\\_woord\\_en\\_beeld\\_VIBE.pdf](http://dubolimborg.be/pdf/Scholencampus_Peer/Duurzame_stedenbouw_in_woord_en_beeld_VIBE.pdf).

The remainder comes from solar energy and biogas, heat pumps and low-heat heating, wind energy and aquifers. Where fossil fuels could not be replaced, other interventions such as energy-efficient lighting and high-efficiency engines for transportation purposes were implemented.

TNO's innovation in Built Environment and Energy is geared to urban development, the smarter redesign of neighborhoods and the use of methods and materials for sustainable building and construction. For 2015, TNO is working with major municipalities to develop concepts for climate-resistant design of the urban area and infrastructure.

### **AVENUE 3: CULTURAL DIVERSITY AND SOCIAL INTEGRATION IN EUROPEAN CITIES**

A substantial number of people employed in Western Europe come from migrant backgrounds. This is particularly obvious in globalizing cities such as London, Brussels, Amsterdam, Frankfurt and Milan. The European city has become a multicultural melting pot,<sup>115</sup> where socio-cultural diversity contributes to the vitality of cities and creates challenges simultaneously. As the local identity of cities or regions is undergoing a change, one major concern is to find a new common sense of cultural identity emerging out of this diversity.

The future prestige of European cities will probably depend on issues such as the capacity for dialogue and the absorption of immigration and cosmopolitanism.<sup>116</sup> European cities are becoming increasingly aware of the importance of urban social cohesion, which comes close to the concept of social integration. Several cities have adopted several measures focusing on deprived neighborhoods to tackle social exclusion and inequalities, as

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115 Martijn Oosterbaan, *Cultural and Ethnic Diversity in Cities: Challenges and Opportunities*, European Workshop (Barcelona, Spain: Networking European Citizenship Education (NECE), June 24, 2010), <http://www.bpb.de/files/LZOAKN.pdf>.

116 PriceWaterhouseCoopers, *Cities of the Future: Global Competition, Local Leadership*, 20, 88 and 89.

well as local strategies against discrimination and racism.<sup>117</sup> In The Hague, the will to prevent ethnic and socio-economic segregation has enhanced the involvement of both immigrants and natives in policy making, but also in the maintenance of facilities in their own communities.<sup>118</sup> Madrid is improving the territorial balance between boroughs, citizen participation and revitalization of the urban environment through a rehabilitation of the city centre, the improvement of the streets and walks, and the re-balancing of immigration by districts.<sup>119</sup> The *Brückenschlag* association ('Building Bridges') founded by residents of Leipzig supports the integration of migrants into the German society; migrants and their families are attributed small pieces of land where they can grow and harvest food or flowers. They are also offered German language and computer courses.<sup>120</sup>

TNO's proposition on Employability and Social Cohesion is the basis for the development of a method that offers work and improvement for the lower end of the employment market.

Digital infrastructures are as crucial as transportation infrastructures for social inclusiveness and the development of a creative economy in the city. Beyond religion and gender, promoting open-mindedness and tolerance for economic success can be expanded to the development of digital virtual environments. As most migrants have settled down in the form of

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117 Eurocities, *Social Exclusion and Inequalities in European Cities: Challenges and Responses* (Eurocities, 2010), [http://www.eukn.org/E\\_library/Social\\_Inclusion\\_Integration/Social\\_Inclusion/Social\\_Exclusion\\_and\\_Inequalities\\_in\\_European\\_Cities\\_Challenges\\_and\\_Responses](http://www.eukn.org/E_library/Social_Inclusion_Integration/Social_Inclusion/Social_Exclusion_and_Inequalities_in_European_Cities_Challenges_and_Responses).

118 PriceWaterhouseCoopers, *Cities of the Future: Global Competition, Local Leadership*, 113.

119 Ibid., 129.

120 "Local Inclusion Practices, Theme Migration and Integration: Bunte Gärten Leipzig (Colourful Gardens of Leipzig)," *Eurocities, European Union Programme for Employment and Social Solidarity (2007-2013)*, n.d., [http://www.eurocities.eu/minisites/progress/inclusivcities/index.php?option=com\\_content&view=article&id=18:bunte-gaerten-leipzig-colourful-gardens-of-leipzig&catid=20:migration&directory=12](http://www.eurocities.eu/minisites/progress/inclusivcities/index.php?option=com_content&view=article&id=18:bunte-gaerten-leipzig-colourful-gardens-of-leipzig&catid=20:migration&directory=12).

ethnic or socio-cultural clusters in the cities of destination,<sup>121</sup> they make up a virtual community or 'virtual neighborhood' supported by technology and media communication (e.g., diffusion of social networks). For instance, the Somali Afro European Media Project (SAEMP) based in Leicester facilitates online communities of the Somali diaspora. Another example is the process of re-territorialization of Brazilians in Amsterdam and Barcelona: virtual communities are expanding through social network sites (e.g., 'Orkut'). This phenomenon sustains migration and transnational communication.<sup>122</sup>

Some argue that the participation in transnational public spheres through the use of digital media is associated with insular and isolated behaviors, hampering participation in public city life and threatening social cohesion. However, in cities developing knowledge on such issues, social cohesion could benefit from the existence of virtual transnational communities. For example, recent studies have shown that Brazilians migrants in Amsterdam who have no official documents actually feel connected to their city; by using social networks as online meeting points, they also encourage public encounters in the city.<sup>123</sup>

TNO's expertise on Information Society offers several relevant innovation areas, including on Future Internet Use, or on the Societal Impact of ICT. This knowledge could be further implemented within urban areas to increase trust and a sense of security among citizens. In addition, cities supported by TNO's expertise would develop knowledge and an understanding of virtual networks, which could be used to enhance urban social cohesion.

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121 Maggie O'Neill, *Asylum, Migration and Community* (The Policy Press, 2010), 65–66, [http://books.google.nl/books?id=9Xal3O\\_aXPIC&printsec=frontcover&source=gs\\_ge\\_summary\\_r&cad=0#v=onepage&q&f=false](http://books.google.nl/books?id=9Xal3O_aXPIC&printsec=frontcover&source=gs_ge_summary_r&cad=0#v=onepage&q&f=false).

122 Martijn Oosterbaan, "Virtual Migration. Brazilian Diasporic Media and the Reconfigurations of Place and Space," *Européenne des Migrations Internationales*, 2010.

123 Oosterbaan, *Cultural and Ethnic Diversity in Cities: Challenges and Opportunities*.

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