REGIONAL PANORAMA

Latin America

Megacities and Sustainability

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REGIONAL PANORAMA
Latin America
Megacities and Sustainability

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Economic Commission for Latin America and the Caribbean (ECLAC)

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Abstract

The Latin America megacities and sustainability panorama is an effort aimed to understand the complex urban processes and to discuss urban risks under sustainability criteria. In order to define research agendas as well as for policy design purposes, a closer look at the challenges of metropolitan areas in Latin America requires an identification of common urban trends in the region. Although metropolitan cities and regions in LAC present common problems and challenges, the intensity of specific aspects related to sustainability changes from one city to another. The present report discusses the main sustainability issues and challenges that have arisen in six selected Latin American metropolis: Bogotá, Buenos Aires, Lima, Mexico City, Santiago de Chile and São Paulo.

It contains a review of a comprehensive set of indicators in these six selected metropolitan cities. The information was gathered via indicator-based data that was provided by national statistic offices, sub-national governmental institutions, international organization and scientific research publications among others. Comparability of detailed information depends on available data. More than 100 different indicators belonging to the dimensions of "human life", "natural resources" "social resources", "equal opportunities" and "productive potential" were used. Clear differences between the main cities can be identified in most of the different analyzed sustainability indicators.

Based on trends and achievements, in the final part of the report these six cities are discussed as separate cases, focusing on specific challenges for each city, in terms of policy implementation in different aspects of metropolitan development. Environmental, economic, social and governance issues are discussed for these six metropolitan cities in Latin America.

I. Introduction

This report on metropolitan cities sustainability for Latin America and the Caribbean is part of the research initiative "Risk Habitat Megacity" that reflects the joint work of approximately forty natural and social scientists and engineers from five research centers of the German Helmholtz Association –the German Aerospace Centre (DLR), the Karlsruhe Institute of Technology (KIT), the Helmholtz Centre for Infection Research (HZI), the GeoForschungsZentrum Potsdam (GFZ), and the Helmholtz Centre for Environmental Research (UFZ), and five partner organizations in Latin America: Universidad de Chile, Pontificia Universidad Católica de Chile, Pontificia Universidad Católica de Valparaíso, Universidad Alberto Hurtado, and the Economic Commission for Latin America and the Caribbean (ECLAC/CEPAL) in the United Nations.

The overall objective of the research initiative is to deepen the understanding of the complex urban processes, interactions and feedback mechanisms that turn megacities and large agglomerations into risk habitats. It intends to evaluate urban risks under sustainability criteria, to develop analytical tools and instruments for action-oriented knowledge to tackle the risks of mega-urbanization, and to derive paths for a more sustainable development (Helmholtz Association et al., 2007).

The panorama's objective is to understand the main sustainability issues and challenges that have arisen in six Latin American metropolises. Although metropolitan cities and regions in LAC present common problems and challenges, the intensity of specific aspects related to sustainability changes from one city to another. The document then is a first step in a permanent work related to the development of monitoring these issues in the region; in this case urban sustainability. Users will be national and sub national governments and research institutions. Other countries from outside the region and international funding institutions will be able to find the base arguments for the development of international cooperation projects in this work.

The panorama is structured in three main parts:

- First it presents the theoretical background on Metropolitan Cities Sustainability as it is defined in the Risk Habitat Megacities Research Initiative and presents the indicator set as well as the delimitation of the study area of the six selected Metropolitan Cities.
- It is followed by a complete review of a comprehensive indicator set in the six selected Metropolitan Cities. As this report depends on existing data, the newest available data for each Metropolitan Cities is shown. This part includes a brief methodological comment on each of the presented indicators and furthermore a summary analysis of data shown including background information.

- The last main chapter presents six city profiles of sustainability, focusing on different issues of outstanding importance in each of the analyzed cities. The identification of the main issues for each of the cities is based on the results of the comparative data analysis complemented by local experts input. This chapter also incorporates risk and governance issues.

II. Context and methodological approach

A. Urban trends in metropolitan regions of Latin America

Urban development in Latin America and the Caribbean, the most urbanized region in the developing world, is characterized by a high degree of urban primacy, with one fifth of the region's urban residents living in cities with populations of five million or more (UN Habitat, 2008). For policy design purposes, a closer look at the challenges of metropolitan areas in Latin America requires a precise identification of urban trends in the region. In the following the principle trends in the region are highlighted (see Hoornweg et al., 2007: 5-7).

Latin America is a continent of urban primacy. Urban structures in Latin America and the Caribbean are characterized by a high degree of urban primacy based on the historical legacy one city with outstanding political and economic importance, as a result of the colonization process. This structure has been reinforced by the migration waves during the XX century creating several urban megacities in the region (Williams Montoya, 2009). Nowadays the number of "megacities", referring to cities with more than ten million inhabitants, is growing worldwide. Furthermore they tend to concentrate in developing world: by 2020, all but four of the world's largest cities will be in developing countries. Latin America and the Caribbean, the most urbanized region in the developing world, characterized by a high degree of primacy: In 2000 in Latin America around 20% of the total population lived in cities with more than five million inhabitants which is more than in other regions of the world (UN Habitat, 2008: 22).

Pattern of urban growth are changing towards small and intermediate cities. In spite of the dominance of megacities during the last decades of the 1990ies the population growth has been concentrated in large but not primacy cities and the current trend in Latin America is leading towards a growing importance of small and medium size cities. Almost 40% of the regions' urban population lives in intermediate cities (between 100,000 and 500,000 inhabitants) and their economic importance is growing. This trend is reflecting not only a decentralization process (for example in Mexico with the northern frontier area and the so called Bajío) but is also related to suburban growth and the growing importance of secondary centers in proximity to megacities.

Changing demographics have a significant influence on the region's megacities. In demographic terms changing age structure is increasingly challenging Latin American societies as it produces a growing dependency index. Meanwhile the last decades have been dominated by a high percentage in economically active age groups a situation, this "demographic bonus" is likely to be lost

soon (in some countries by 2015-2020) in the most important Latin American countries (CELADE / UNFPA, 2005: 12-14). This means changing requirements for City planning and management.

The old urban-rural dichotomy is increasingly disappearing. In spite of its characteristic as highly urbanized Latin America still is characterized by important rural areas in territorial, economic and social-cultural terms. Nevertheless recent trends are leading towards increased rural specialization and their integration in global production chains increasing their functional links to the dominant cities. Furthermore due to vast areas of peri-urban the clear limits between cities and rural "hinterland" disappear.

In spite of the importance of extractive activities prevails an outstanding level of economic centrality. The main megacities of the region are the dominating economic center in their respective national context and Buenos Aires, Mexico City, Sao Paulo and Santiago are the megacities with major importance regarding economic activities in Latin America and the highest level of interconnectivity being classified as global cities ("alpha" and "alpha –" GaWC, 2010). Almost half of the economic activities is concentrated in the main city in the case of Chile and Peru, around one quarter in Argentina and Colombia. As a certain contrast in Brazil and Mexico the historic legacy is a more polycentric one and there are decentralizing tendencies, for instance related to different gateway cities and decentralized industrial activities. In spite of foreign trade and investment driven decentralization processes more than 57% of the FDI inflows of Mexico are concentrated in the D.F. (further 6% in the Estado de Mexico) between 1996 and 2005 (Delgadillo Macias, 2008: 86).

Growing importance of service and creative industries. Since several decades the advanced services are growing much faster than manufacturing business and industries. They tend to concentrate their activities spatially in international and national centers, conceptualized as global cities and gateway cities which are partially breaking up the primacy structure and are therefore elements of agglomeration and diffusion at the same time (Sassen, 2007; Consoni Rossi / Taylor, 2007). These advanced producer services are regarded as a key link between global cities and globally organized production chains and particularly important in Mexico City, Sao Paulo and Santiago de Chile (Parnreiter et al, 2007).

Increasing informal sector employment and working poor. In the major metropolitan cities in Latin America the informal economy is particularly important –between 1/3 and more than ½ of the labor market is considered to be informal (see table 24). This economic sector is likely to continue growing fast and is nowadays bond to a chain of services and products reaching beyond the city limits. As informal labor is usually characterized by lacking of social and legal protection and low wage levels it is an important part of the challenge facing especially the metropolitan cities with lower income levels like Lima. Working poor is an issue of growing importance in Latin American Cities, being directly linked to the still high income differences but also to some consequences of economic and financial crisis like in Buenos Aires.

Sustainability and urban externalities. In most of the Latin American large urban areas, the coincidence of economic and population growth, frequently inefficient use of resources and energy, and high levels of emissions has generated a mix of negative externalities like congestion, air and water pollution, among others. During the 1990ies some metropolitan areas have realized remarkable reductions of their intensity of emission. Planning for sustainability nevertheless requires a more regional perspective, including not only the urbanized areas, but also the relevant regional context, taking into account e.g., the catchment areas of water supply and other areas which provide environmental services to the metropolis. The metropolitan areas absorb resources from their regional context and use regions as a sink for their increasing amounts of different polluting agents. Urban sustainability is an issue of highest relevance for the future of the whole society (McGranahan et al., 2001) –this statement is even more relevant in Latin America, due to its urbanization which is higher than in other regions.

The challenges of Latin American Cities in confronting Climate Change will be discussed in a detailed manner in a second report on Metropolitan Cities in the region which is currently in preparation.

B. Methodological approach

1. Selection of case studies

The selection of the case studies included in this panorama is focused on those Latin American Cities which already are or will be considered Megacities within a short time period. By the year 2015, Latin America is expected to have the following nine Metropolitan Cities (defined by exceeding five million inhabitants): Mexico City; Sao Paulo; Buenos Aires, Rio de Janeiro; Bogota, Lima, Santiago de Chile, Belo Horizonte and Guatemala City. Due to pragmatic limitations, the number of case studies was limited to a maximum of six metropolitan cities. The following criteria were defined for the selection, following the intent to select case studies in such a way so as to represent different conditions:

a) Socio-economic conditions.

b) Technology level.

c) Structural characteristics and local environmental contexts.

d) Frameworks of urban planning systems.

In accordance with these criteria and data availability, the following case studies were selected: **Mexico City, Sao Paulo, Buenos Aires, Lima, Santiago de Chile** and **Bogota**.

All selected megacities represent the dominating center in their respective country. They show highly different levels of per capita income and varying urban governance models as will be discussed in the City Profile section. Mexico City and Sao Paulo are not only the megacities with major importance regarding population and economic activities in Latin America as will be presented in Table 1 and Table 24; they also stand for deep income disparities, segregation, poverty and criminality risks.

Furthermore, land use structure and the impact on urban transportation demand differs as well as local conditions of geomorphology, climate and environmental risk vulnerability. For instance Mexico City and Santiago de Chile present a special exposure to air pollution concentration due to their geographic location, meanwhile in other cities there are areas of major risk of flood and mud slides (e.g. Sao Paulo and Bogota). Most Latin American large cities can be characterized by a high level of socio-economic segregation, showing important differences in terms of vulnerability of different areas within the cities. Furthermore, some of the selected cases show important growth in terms of land occupation, typically by transforming peri-urban land (e.g. Buenos Aires and Santiago de Chile).

Of special interest is the focus on transport infrastructure problems (e.g. en Sao Paulo, Lima, Mexico City), and the outstanding initiatives to reform public transport systems (Bogota, Santiago and Mexico City). There is also some evidence on decreasing air pollution (e.g. in terms of ozone in Sao Paulo, Mexico and Santiago) and the importance of fuel quality (e.g. in the case of Santiago, Winchester, 2007). Some of the selected case studies also present outstanding Transport Infrastructure Projects with regard to their participation in global transport networks (e.g. Mexico and Sao Paulo Airport enlargements) and important local impacts.

2. Definition of the metropolitan cities areas

One of the most important issues when comparing Megacities is their spatial delimitation and determining which concept of metropolitan area to apply. The importance of this issue results from the different politic-administrative constitution of each Megacity. These specific local administration structures are discussed as an introductive section in each of the six city profiles (chapter IV).

UN Habitat (2004) defines three spatial concepts of relevance for this study: The **city proper** is the single administrative or political jurisdiction, which in some Latin American cities contains only the historical city centre (e.g. Santiago) in other cases almost the whole agglomeration (e.g. Bogota). "*The **metropolitan area** is the set of formal local government areas which are normally taken to comprise the urban area as a whole and its primary commuter areas*". "*The **urban agglomeration** is defined as the*

built-up or densely populated area containing the city proper; suburbs, and continuously settled commuter areas" (UN Habitat, 2004: 5). The presented Panorama uses the concept of officially defined metropolitan areas (composed by different administrative units) as a proxy of urban agglomeration for reasons of data availability. This is nevertheless contrasted with the central area comprised in some cases of the City Proper (Buenos Aires) and in other cases, for reasons of administrative structure, of a set of localities (Bogota, Santiago de Chile).

In table A, three different spatial concepts of the six selected Metropolitan Cities are shown. The first one refers to the wider **regional** context, which is not analyzed in this report in spite of its relevance e.g. on some ecological issues. This approximation to a metropolitan area is not useful for the present comparative purpose as its limits present in some cases large distances to the urban continuum (e.g. State of Sao Paulo, Province of Buenos Aires), meanwhile in other cases the regions limits are rather close to the urban agglomeration (e.g. Metropolitan Region of Santiago). The second and third concept –the Metropolitan Area and the Central Area– include administrative entities of different levels: level 1 being the major scale (States, Capital Districts, Provinces depending on the respective case) meanwhile level 2 comprises the local scale named *comunas*, *municipios*, *partidos* or *localidades* in the different megacities. For each of the six megacities, table A highlights its delimitation as **Metropolitan Area** (summing the named administrative units of level 1 and level 2) which is the most relevant spatial scale for the present report, as it represents an approximation to the continuously urbanized area. Furthermore the table shows a delimitation of the respective **Central Area**, defined as the main city (level 1) or some of its parts (level 2). The Central Area is larger than the historical City Center and stands for a continuous high density built up area. The last one is applied only in the case of a few indicators in order to permit a comparison between the Central Area and the Metropolitan Area or where wider definitions produce distortion.

In general, data are presented on the level of Metropolitan Area. Nevertheless information is not always available on this level, and has to be presented on the level of City proper or regional scale. Furthermore in some issues there are also other reasons responsible for the need to a more flexible vision of spatial limits of the analyzed metropolitan areas. For instance water supply and its price as well as transportation are not defined by the administrative limits but by the areas covered by the respective service corporation. Water pollution instead is presented as concentration of different elements in rivers and therefore representing lines (respectively measuring points) within the area, as is also the case for air contamination.

TABLE A
DEFINITION OF THE METROPOLITAN AREAS AND CENTRAL AREAS

Metropolitan City	*Regional Context of the Urban Agglomeration*	Metropolitan Area		Central Area	
		Level 1	Level 2	Level 1	Level 2
		(e.g. States, Federal Districts)	(e.g. Comunas, Municipios)	(e.g. States, Federal Districts)	(e.g. Comunas, Municipios)
		Bogota D.C.			
Bogota	*Cundinamarca and Bogota D.C.*				Chapinero; Santa Fe; San Cristóbal; Barrios Unidos; Teusaquillo; Los Mártires; Antonio Nariño; Puente Aranda; La Candelaria; Rafael Uribe
		Gran Buenos Aires			
Buenos Aires	*Provincia de Buenos Aires and Ciudad de Buenos Aires*	Capital Federal	24 partidos of the Province of Buenos Aires	Capital Federal	
		Lima Metropolitana			
Lima	*Departamento de Lima*	Province of Lima and Constitutional Province of Callao			Callao, Lima Moderno and Lima Centro
		ZMCM			
Mexico	*Estado de Mexico and D.F.*	D.F.	31 Municipios of the Estado de Mexico, one Municipio of the Estado Hidalgo	D.F.	16 Delegaciones
		Area Metropolitana Santiago			
Santiago	*Región Metropolitana Santiago*	Province of Santiago	Comunas: Puente Alto and San Bernardo		Estación Central; Quinta Normal; Pedro Aguirre Cerda; Santiago; Recoleta; Independencia; Providencia; Ñuñoa; Macul San Joaquín; San Miguel;
		Region Metropolitana Sao Paulo			Municipio de Sao Paulo
Sao Paulo	*Estado de Sao Paulo*	Municipio de Sao Paulo	39 Prefeituras		

Source: Authors' compilation.

3. Indicator set and data presentation

According to the sustainability concept which builds the basis for the RHM Initiative Sustainable development of mega-cities, it is understood as a process based on justice, equity and access to resources in order to satisfy the needs of all of its inhabitants. This process needs social, cultural and economic development according to the potential of human capital and natural resources and environmental services. At the same time, this process must be the result of democratic governance. As large cities are areas of strong human intervention, it could hardly be applied as a sustainable approach oriented primarily towards the preservation of nature. An anthropocentric approach to sustainability is therefore not only practical but essential.

The integrative sustainable development concept defined by the Risk Habitat Megacities Initiative (Helmholtz Association et al., 2007: 25, see also Kopfmüller et al, 2001; Kopfmüller et al., 2005: 3-6; Schultz et al., 2008) integrates the aspect of justice as a key concept in an intragenerational perspective (related to *equity*) as well as in an intergenerational view.

> *"The concept is based on the three constitutive elements of sustainable development mentioned earlier –the postulate of inter- and intragenerational justice, the global perspective, and the anthropocentric view– that are translated into three general goals: to secure human existence, maintain society´s productive potential, and preserve society´s options for development and action."* (Helmholtz Association et al., 2007: 25).

Present generations should not destroy the conditions for their own lives or for those of generations to come by pursuing their own development and seeking to fulfill their own basic needs. The conservation of the social productive potential means that each generation should transfer to future generations its potential comprised of natural capital, physical capital, human capital, intellectual capital and social capital. Preserving society´s options for development and the action of society refers to the maintenance of the intangible requirements of sustainable development, which are essential for ensuring long term development. This includes ensuring equal opportunities, participation in decision making, conservation of cultural heritage and maintenance of social resources as tolerance, solidarity, justice and law, etc. Undoubtedly, it is essential to address the development of large metropolitan areas in each of the three goals and it should be achievable at the same time. Nevertheless one must take into account a certain temporality of the policy practice: public policies in metropolitan cities frequently look primarily for the first goal: to secure human existence.

Consequently, these three values are represented by the five main issues addressed in the comparative data collection and which are used as a structural guideline in the analysis of the obtained data.

- Human life.
- Natural resources.
- Social resources.
- Cultural resources.
- Securing societies productive potential.

The set of indicators discussed in this report analyzes five of these main issues and uses them to organize its structure. The comparative indicator section is organized by these dimensions; each of them contains different aspects represented by various indicators.

The indicator set used (chapter III) is the result of internal discussions of proposals made by different working groups of the RHM Initiative and ECLAC (DSDHS). Furthermore, different methodological papers and proposals on urban sustainability indicator sets (Achkar, 2005; Escobar, 2006; Hoornweg et al, 2007; World Bank, 2008; Winchester, 2007; UN Habitat, 2004b) have been integrated. According to the structure of the proposal presented by the sustainability working group in Karlsruhe, different priorities of the mentioned indicators have been defined. The selection and priority

of these indicators considers the importance of these in terms of sustainability, data availability, reliability and comparability. Furthermore, two main issues of the initial proposal (global stewardship and responsiveness) have been analyzed in terms of data availability but they show a very low number of reliable and available indicators. Therefore, it is not possible to present a complete and comparable data set.

Table B specifies the indicators used for each of the five main chapters and the table in which data are presented. Each table contains for each data a footnote, specifying year, spatial limitation used and the data source. The indicator section in each table is followed by methodological boxes which contain short specifications, justifications and interpretation schemes for each of the indicators presented in the respective table.

TABLE B
INDICATOR LIST

Chapter	Indicator	Table
Human life		
	Nutrition	2
	Extreme poverty	2
	NBI Unsatisfied basic needs	2
	Access to sewage system	3
	Access to piped water	3
	Access to electricity	3
	Affiliation to health insurance	3
	Adult literacy rate	4
	School enrolment	4
	School leavers without graduation	4
	Average study years	4
	Higher education	4
	Public spending on education	4
	Housing affordability (Price to income)	5
	Housing affordability (Rent to income)	5
	Overcrowding	5
	Homeless people	5
	Home ownership	5
	Slum population	5
	Infant mortality rate	6
	Under five mortality rate	6
	Child death rate from respiratory diseases	6
	Child death rate from intestinal infectious diseases	6
	Life expectancy at birth	6
	Noise exposure residential areas (by day)	7
	Noise exposure residential areas (by night)	7
	Noise level main avenues	7

(Continued)

TABLE B (Continued)

Chapter	Indicator	Table
Natural resources		
	Water consumption (total)	8
	Water consumption (domestic use)	8
	Wastewater treatment (installed capacity)	8
	Wastewater treatment (capacity per inhabitants)	8
	Wastewater treatment (coverage)	8
	Price of Water	8
	Total Coliformes	9
	Dissolved O_2	9
	BOD_5	9
	Concentration Hg	9
	Concentration Pb	9
	Concentration Cd	9
	Concentration As	9
	Carbon intensity (production)	10
	Carbon intensity (public transport)	10
	Energy efficiency (public transport)	10
	Energy efficiency (water supply)	10
	Electric Energy Consumption (total)	11
	Electric Energy Consumption (residential)	11
	Electricity efficiency	11
	Price of Electricity	11
	Solid waste production (total)	12
	Solid waste production (domestic)	12
	Solid waste disposal	12
	Uncollected / improperly disposed	12
	CH_4 Emissions of landfills	12
	Motorization rate	13
	Modal split (private automotive)	13
	Modal split (buses & metro)	13
	Modal split (bycicle & walking)	13
	Public Transport Tariff	13
	Travel Time (per trip)	13
	Emissions CO_2	14
	Emissions CO	14
	Emissions SO_2	14
	Emissions NO_x	14
	Emissions VOC	14
	Emissions NH_3	14
	Emissions CH_4	14
	Emissions PM10	14
	Emissions PM2.5	14
	Concentration (CO)	15
	Concentration SO_2	15
	Concentration NO_x	15

(Continued)

TABLE B (Concluded)

Chapter	Indicator	Table
Natural resources		
	Concentration O_3	15
	Concentration PM10	15
	Housing density (Metropolitan Area)	16
	Housing density (in Central Areas)	16
	Public Spaces	16
	Green Spaces (Central Area)	17
	Covering of soil(Central Area)	17
	Protected Area (Metropolitan Area)	17
Social Resources		
	Homicide rate	18
	Criminality Perception (public spaces)	18
	Criminality Perception (at home)	18
	Victimization rate	18
	Voter´s participation	18
	Expenditure for cultural purposes	19
	Landmarked buildings	19
	Landmarked buildings (per km2)	19
	Visitors in museums	19
Equal Opportunities		
	Income inequality (gini)	20
	Income inequality (income quintiles)	20
	Poverty	20
	Unemployment	20
	Internet connection	21
	Working time to earn a basic basket	21
	Gender Empowerment Measure	22
	Gender Income differences	22
	Women's enrolment in labor market	22
	Women's enrolment in tertiary education	22
Productive Potential		
	Student / professor ratio	23
	Publications ISI	23
	High education employment	23
	Gross Domestic Product	24
	GDP / capita	24
	Regional GDP concentration	24
	Informal employment	24
	Local government revenue (total)	25
	Local government revenue (taxes)	25
	Public debt (debt level)	25
	Public debt (dept service)	25
	Investment (FDI)	25
	Investment (public investment)	25

Source: Authors' compilation.

III. Comparative sustainability analysis

As important background information, general data on population and population growth for each megacity is presented in the following section in order to contextualize the sustainability indicators discussed later on.

All of the analyzed metropolitan regions are still continuously growing (table 1). Nevertheless, they show quite different population growth rates and also specific spatial patterns of population growth. Especially the metropolitan areas of Bogota, Mexico and Lima are still growing rapidly at rates of around 2% per year. Santiago de Chile, Buenos Aires and Sao Paulo register a slow population growth around 1% and even less.

Latin American Cities in general, and megacities in an increased manner, are characterized by a distinctive process of urban sprawl and rapid growth of population in peri-urban areas. All of the discussed metropolitan areas show this tendency towards a higher growth rate of the whole region rather than in the central area. For instance Mexico City has shown slight growth in the Central Area (Distrito Federal D.F.) for three decades; whereas, the mentioned strong population growth of the metropolitan area occurs almost completely in the suburban and peri-urban areas located in the Estado de Mexico.

In the case of Buenos Aires, the central area (*Capital Federal*) is characterized by a stagnation in the number of residents, even with some periods of reduction of population; meanwhile the metropolitan region still shows a constant slight population growth. This indicates a recent suburbanization process, with contrasting characteristics occurring simultaneously. On the one hand, in the last decade, Buenos Aires has registered a rapidly growing number of high-class gated communities in the peri-urban area; on the other hand, the city displays a growing suburban area with high density housing areas, especially in low-income sectors. This last dynamic can be observed in all of the metropolitan areas under examination; however, Buenos Aires is an outstanding case as it traditionally presents a high importance of the central area with all the functions of urban centers. The general trend of reduced population growth rate compared with earlier decades is a result of socio-demographic macro trends such as changing gender roles and labor market characteristics among others.

High population growth in the metropolitan area and very slow growth rates in the central area are reported from Bogota. The central areas of Bogota are considered very densely populated (see table 16) and furthermore its growth is in part limited by natural conditions as mountains. Therefore the growth concentrates in larger localities located in the western and southern part of the city where expansion areas are available.

TABLE 1
POPULATION AND POPULATION GROWTH

	Urban agglomeration		Central area	
	Population	Population growth *(10-year average in percentage)*	Population	Population growth *(10-year average in percentage)*
Bogota	6 776 009[a]	1.93[g]	1 866 182[m]	0.05[s]
Buenos Aires	12 828 669[b]	0.64[h]	3 018 102[n]	0.05[t]
Lima	8 482 619[c]	2.10[i]	2 996 042[o]	
Mexico	17 946 313[d]	2.07[j]	8 720 916[p]	0.50[u]
Santiago	5 408 150[e]	1.27[k]	1 179 726[q]	- 0.80[v]
Sao Paulo	19 697 337[f]	1.24[l]	11 091 442[r]	0.60[w]

Source: Authors' compilation, based on:

[a] 2005, Urban Agglomeration is Bogota D.C.; DANE, 2007.
[b] 2001, Metropolitan Area is the Gran Buenos Aires (GBA) formed by the Capital Federal and 24 partidos.
[c] 2007, Lima Metropolitana. Province of Lima and Constitutional Province of Callao. INEI, 2008: 18.
[d] 2000, Total Metropolitan Area: ZMCM Zona Metropolitana Ciudad de Mexico. INEGI, 2005: table 3.1.
[e] 2002, Metropolitan Area: AMS Área Metropolitana Santiago formed by 34 comunas. INE, 2009.
[f] 2008, RMSP; SEADE, 2009: 4.
[g] 1993-2005, Alcaldía Mayor de Bogota SDP, 2008a: 26.
[h] 1991-2001, PNUMA, 2003b: 33.
[i] 1993-2007, INEI, 2008: 21.
[j] 1990-2000, PNUMA, 2003c: 42.
[k] 1992-2002, own calculation based on census data.
[l] 2000-2008, RMSP, SEADE, 2009: 4.
[m] 2005, Central Area includes the municipalities: Chapinero; Santa Fe; San Cristóbal; Barrios Unidos; Teusaquillo; Los Mártires; Antonio Nariño; Puente Aranda; La Candelaria; Rafael Uribe; Alcaldía Mayor de Bogota SDP, 2008a.
[n] 2005, Buenos Aires Central Area is the Capital Federal. GCBA DGEC, 2008 cuadro 1.3.
[o] 2007, Central Area: Callao Lima Moderno and Lima Centro; INEI, 2008: 18.
[p] 2005, Central Area is the Distrito Federal D.F.
[q] 2002, Central Area includes the comunas Estación Central; Quinta Normal; Pedro Aguirre Cerda; Santiago; Recoleta; Independencia; Providencia; Ñuñoa; Macul, San Joaquin; San Miguel. Own calculation based on INE, 2009.
[r] 2007, estimated, Municipio Sao Paulo SEMPLA, 2007: 9.
[s] 1993-2005. Alcaldía Mayor de Bogota SDP, 2008a:26.
[t] 1995-2005. Own calculation based on GCBA DGEC, 2008 cuadro 1.3.
[u] 2000-2010 projection. Mexico D.F.; 2003c:56.
[v] 1992-2002, own calculation based on census data.
[w] 2000-2008, Municipio Sao Paulo SEADE, 2009: 5.

BOX 1
METHODOLOGICAL NOTE TABLE 1: BASIC DEMOGRAPHICAL DATA

The data on population number and growth dynamics is a basic indicator of the level of pressure which is exercised over the natural environment and resources; furthermore, it represents data that is necessary in the context of socio-spatial differentiated expansion processes. As we are using official national data, provided by the respective national statistical bureaus, there are no major availability and reliability issues to consider. Nevertheless, the time period discussed varies according to the national census policy. Therefore, we are standardizing the data on the basis of the last available ten year period.

Contrasting population growth in the central area and in the total metropolitan area is an important first indicator related to the UN Habitat Agenda Goal to promote geographically-balanced settlement structures (UN Habitat, 2004: 20). Population growth is presented as the 10-year annual average (geometrical average) as these periods correspond to the inter-censual period in most of the selected cases.

Source: Authors' compilation.

Divergent tendencies may be observed in Santiago where a rapid reduction of population in the central area coincides with a persistent growth tendency of the urban agglomeration. Nevertheless the Chilean capital shows in the last years a tendency towards higher density within the city center, mostly promoted by new apartment buildings.

This trend is also important in the case of Sao Paulo which is the only metropolitan city in the sample showing high growth rates within the central area. This may be partially explained by the reconstruction programs applied in the decayed city center– nevertheless an important role is playing the central low income sectors. Both issues will be discussed in chapter IV.F.2 addressing housing policies in Sao Paulo.

The **reasons** for these processes of suburbanization, urban sprawl and depopulation of the historical centers has been analyzed deeply and in a comprehensive manner. In sum, the following main causes can be stated.

Migration and a still elevated natural growth rate generate population pressure on the urban agglomeration which directs new citizens towards suburban areas. For example in the case of Colombia, the high number of internally displaced persons, especially refugees of the guerrilla are an important determinant in the growth of Bogota.

Real estate market structures (e.g. price differences) are orienting urbanization trends towards the periphery. For example, in Sao Paulo the relatively low price level of lots in Guarulhos and other peripheral districts are coinciding with high population growth.

Other uses and real estate projects in the central areas, e.g. in the areas of office buildings and retail infrastructure are presenting a pressure factor.

The **form** in which these processes take place is very different and shows a high level of socio-spatial segregation in most of the cases (Prévot-Schapira / Cattaneo, 2008; Sabatini / Brain, 2008; Sabatini / Caceres, 2004). The following elements can be observed in all of the six metropolitan cities.

- Low income, often informal settlements in the periphery.
- Exclusive, high income gated communities in the suburban and peri-urban areas.
- Change of land use in the central areas with a decay of industry and reduction of housing.
- Growing fragmentation of urban spaces, presenting high level of social segregation and contrasting modern, highly globalized and peripheral areas, partially within short distances.

All six of the metropolitan cities are characterized by a high level of socio-spatial segregation concerning housing areas as well as the use of public space, although the patterns show quite different characteristics.

> "*The distribution of risk and vulnerability is an important and growing component of daily urban life. It is often linked to the presence of millions of urban residents in slums, which are environments in which much crime and violence occur, where tenure is least secure, and which are prone to disasters of many kinds*" (UN Habitat, 2007: 10).

A specific condition in Bogota is that areas with a large proportion of high-income residents (Usaquén, Chapinero and Suba) present some social diversity as they include an important number of blocks where lower income groups predominate. Some of the middle-class (e.g. Barrios Unidos and Teusaquillo) and lower-middle-class parts of the Metropolitan Region are the most segregated sectors of Bogota. Usme, San Cristóbal, Bosa, Kennedy, Ciudad Bolivar and Rafael Uribe are considered to be low-class sectors, although they are primarily comprised of significant lower-middle-class sectors (see chapter IV.A.2).

In the case of Lima, socio-economic segregation is clearly visible in spatial terms. While poverty is dispersed and almost omnipresent, the wealthy sectors of society are clearly localized in an area called Lima Moderna, formed by twelve districts. The highest income group of Lima ("A", with an

income of more than 1,390 US$ per month) corresponds to only 8.3% of the population but is concentrated almost completely (96%) in five districts: Surco, La Molina, San Isidro, San Borja y Miraflores (see IV.C.1).

Regarding the **consequences,** it must be noted that by causing urban sprawl, these processes contribute to a loss of green areas and agricultural land in the metropolitan region as well as the need for larger commuting trips and more traffic. Furthermore, due to the social-spatial segregation it can often be observed that the low-income settlements, especially the illegal ones present a major risk exposure in reference to natural hazards.

Some elements of Public Policy must also be regarded as favorable for urban sprawl processes as in the case of Santiago de Chile: some changes of legal issues and the implementation of new planning instruments, such as the possibility of densification on peri-urban lots (*parcelas de agrado*), the implementation of mega-projects in rural areas (*ZODUC*), and the expansion of the legally defined urban limit.

A. Human life

1. Satisfaction of basic needs and extreme poverty

This chapter discusses the satisfaction of basic needs as a central issue of human life, focusing first on poverty issues such as shortcomes in the satisfaction of basic needs in the case of extreme poverty and undernourishment; the composite index of unsatisfied basic needs is a summary indicator (NBI, see methodological note). Afterwards the indicators of access to basic services are presented in table 2.

As shown in table 2, **extreme poverty** strongly affects some sectors of Bogota, Buenos Aires and Sao Paulo. A special case is Lima, presenting in official documents very low level of extreme poverty,[1] which should be questioned as it presents a clear contradiction to the values which Lima shows in the other poverty indicators. The outstanding high value presented is an estimation of a private market analysis consultancy (AOM). Strong spatial contrasts between different areas characterize the occurrence of extreme poverty, for instance the value of the metropolitan area Gran Buenos Aires includes the situation in the City of Buenos Aires (5.2) and the part of the Provincia Buenos Aires (9.1; Indec, 2007: 4). Also in the case of Sao Paulo in some municipalities outside the City of Cao Paulo there can be observed values considerably higher than the shown data which refers to the City. Furthermore there are important short term changes: the INDEC Database states that until 2009 extreme poverty in Gran Buenos Aires fell to only 3.1 (INDEC, 2010). Furthermore there are some problems concerning data comparability, as in the case of Sao Paulo for instance extreme poverty is defined as the percentage of population living with less than 25% of the legal minimum wage.

Serious **nourishment deficiencies** are observed in Bogota and in Lima –considerable improvement is reported in the case of Lima during the last years but the problem still persists (Ministerio de la Mujer y Desarrollo Social 2010, tabla 1.20). By contrast, in the metropolitan cities of Buenos Aires and Santiago nourishment problems have been widely overcome. Nevertheless, there are important spatial patterns within the metropolitan cities showing clear differences between the central areas and high income sectors on the one hand and low income suburban settlements on the other. In the case of Mexico there can be observed low levels in the area of D.F., but high levels of chronic desnutrition in the Estado de Mexico as a whole, which comprises much more than the localities forming part of the metropolitan area.

Comparing the **unsatisfied basic needs indicator (NBI)** in different megacities is limited, as the methodology and definition of the indicator differ among the cities. High levels are observed in the case of Lima and even higher in Mexico and Santiago de Chile. In the case of Buenos Aires, the internal

[1] Extreme poverty in Perú is measured as percentage of inhabitants whose monthly income is less than the value of a basket of basic alimentation (INEI / UNICEF, 2008: 8).

spatial pattern shows an important increase of the indicator NBI with growing distance from the city center, reaching values between 20% and 30% in the so called third ring of municipalities (*partidos de tercera corona*) (Prévot-Schapira / Cattaneo, 2008: 81).

TABLE 2
EXTREME POVERTY AND UNSATISFIED BASIC NEEDS

	Nutrition *(Undernutrition/ underweight in percentages of children under age five)*	Extreme poor *(In percentages of total pop.)*	NBI *(In percentages of households)*
Bogota	9.3[a]	7.2[g]	7.0[m]
Buenos Aires	3.2[b]	8.2 (3.1)[h]	14.5 - 7.1[n]
Lima	9.3[c]	12.3 - 0.9[i]	13.5[o]
Mexico	4.9 - 11.5[d]	3.4[j]	26.8[p]
Santiago	0.8 - 4.1[e]	2.4[k]	22.6[q]
Sao Paulo	0.6 - 5.0[f]	5.6[l]	

Source: Authors' compilation, based on:

[a] 2006, Bogota D.C., global desnutrition in children below five years; Concejo de Bogota 2008: 21.
[b] 2004, Metropolitan Area of Buenos Aires; general desnutrition of children between 6 month and 5 years. Ministerio de Salud de la Argentina, 2007: 109.
[c] 2007, Departamento Lima; Cronic desnutrition, Presidencia del Consejo de Ministros, 2009: 4.
[d] 1999, first number D.F.; second number Estado de Mexico. Cronic desnutrition measured by low size prevalence of students in first year of primary education. Avila / Shamah, 2005: 6.
[e] 2006, Metropolitan area, first number undernutrited, second number underweight; own calculation based on: Mideplan CASEN, 2006.
[f] First number: 2008, Municipio do Sao Paulo, Children younger than two years; Data might be biased as the data collection methodology is not clear. Portal ODM 2009; Second number: 2002; national level. CEPAL STAT, 2010.
[g] 2006, Bogota D.C., Concejo de Bogota, 2008: 20. PNUD, 2008: 128, calculates the same indicator to be 3.4.
[h] 2006, Gran Buenos Aires, INDEC, 2007: 4.
[i] first number: 2001; Lima Metropolitana, Yepes / Ringskoog, 2001: 12; Second number: 2006, Lima Metropolitana, INEI 2007: 422.
[j] 2000, ZMCM; as extreme poor are considered those household which suffer of a lack of three or more basic needs. De Angoitia / Ramírez: 20.
[k] 2006, AMS, Mideplan CASEN, 2006.
[l] 2000, Municipio do Sao Paulo, Portal ODM, 2009.
[m] 2007, Bogota D.C. Percentage of inhabitants, Alcaldía Mayor de Bogota SDP, 2008b: 40.
[n] 2001, first number refers to those localities of Buenos Aires Province which form part of Gran Buenos Aires, CITAB Banco de la Provincia de Buenos Aires 2007. Second number refers to the City of Buenos Aires. GCBA DGEC, 2009.
[o] 2005, Lima Metropolitana; INEI, 2007: 425.
[p] 2000, ZMCM; household which suffer of a lack of at least one basic need. De Angoitia / Ramírez, 2008: 20.
[q] 2003, Region Metropolitana, Mideplan CASEN, 2003.

As a result, it is necessary to highlight the need to discuss these issues in a more detailed manner for the cases of Bogota (IV.A.2) and Lima (IV.C.2) and as a growing challenge in the case of Buenos Aires (IV.B.2).

Regarding access to waste water drainage systems, piped drinking water and electricity, it is necessary to mention the high coverage rate in all of the metropolitan cities analyzed (table 3). This is a result of public policies and infrastructure investment during the last decades. The numbers on electricity refer to the percentage of households making use of electric energy; this is almost 100% in all metropolitan regions. Nevertheless, this number includes clandestine users, which is a highly relevant number in low income and informal settlements. Therefore it should make use of the percentage of households registered as authorized users –an indicator which is currently available only in the case of Bogota. Of major relevance are the differences in coverage rates of the other services. Specifically, Lima demonstrates serious deficiencies in household connections to a drinking water supply and a waste water

treatment system. In the case of sewage systems, Sao Paulo is also still affected by an important lack of services. This lack is of high relevance as missing sanitation services must be regarded as one of the major problems of public health and represents an important cause of infectious diseases.

BOX 2
METHODOLOGICAL NOTE TABLE 2: EXTREME POVERTY AND UNSATISFIED BASIC NEEDS

While the most common indicator of poverty is the "percentage of population living on less than one dollar a day" as defined by UN Millennium Development Goals Program (MDG Target 1A), it is considered to be of reduced relevance in the case of megacities. Even in the case of Lima (lowest per capita income in the sample) the one US$ limit is considered of very limited relevance.

Therefore, we rely on national statistics on **extreme poverty** and their specific definition of people living below the indigence line as proposed by the mentioned UN Program (Source: United Nations Statistic Division http://mdgs.un.org/). As the used concepts of extreme poverty are different in the six metropolitan regions, the comparability of this indicator is also limited.

The proportion of **undernourished** infant population has been selected, as it is considered to be a reliable indicator of extreme poverty and hunger. This indicator is measured as percentage of children under age five who are moderately or severely underweight and is used by the MDG Program (Target 1C, UNSTAT, 2009b). The occurrence of underweight among the infant population is caused almost completely by the lack of income on the household level, meanwhile other indicators (like malnutrition) are influenced by education, food standards etc. Furthermore, the reduction of undernourishment is also a result of public policy campaigns that combat hunger and extreme poverty and therefore reflects important outcomes of these public actions. Its main limitation is caused by the fact that the indicators in some of the analyzed areas are built referring to children aged 0- five and in others up to the age of 7.

The **Index of unsatisfied basic needs NBI** (necesidades básicas insatisfechas), is a composed index defined by CEPAL. It refers to households and integrates different indicators like housing conditions, access to sanitary services, education and economic capacities. Therefore, this indicator represents a comprehensive view on welfare of urban population, conditions and quality of human life in metropolitan areas (Feres / Mancero, 2001). Data presented in the table show the percentage of households which suffer at least one unsatisfied basic need.

Reference values:

- Undernourished: target value is 0% and the worst reported value worldwide on a national level is 48% (UNSTAT, 2009b).
- Extreme poverty: target value is 0%, Latin America has 8.3% in urban areas and the worst reported value worldwide for urban areas is 56% (Source: UNSTAT, 2009b; CEPAL 2009: 52).
- Unsatisfied basic needs (NBI): target value is 0%.

Source: Authors' compilation.

The last indicator of table 3 addresses the issue of **health insurance** coverage, both including private and public health care systems. Especially Mexico and Lima present highly deficient health care coverage as more than 50% of the inhabitants are not affiliated to any insurance system. In Santiago de Chile and Bogota, in a context of highly privatized health insurance systems the public service system still assures elevated coverage rates; nevertheless the quality of these services has to be questioned.

Based on these data, the water management and water treatment issue will be discussed in the case of Lima (IV.C.3) and due to the recent improvement and current programs it is also of high relevance to present the case of Bogota (IV.A.3).

TABLE 3
ACCESS TO BASIC SERVICES

	Access to sewage system *(% of households)*	Access to piped water *(in percentages of households)*	Access to electricity *(in percentages of households)*	Affiliation to health insurance *(in percentages of population)*
Bogota	98.1[a]	98.7[a]	100/78.4[j]	86.6[o]
Buenos Aires	99.1[b]	98.0[g]	100.0[k]	100.0[p]
Lima	80.2[c]	80.7[h]	94.1[l]	40.9[q]
Mexico	96.4[d]	97.2[d]	99.4[d]	48.2[r]
Santiago	97.3[e]	98.7[i]	99.9[m]	92.8[s]
Sao Paulo	90.1[f]	99.2[f]	99.1[n]	100.0[p]

Source: Authors' compilation, based on:

[a] 2007, Bogota D.C.; PNUD, 2008: 128.
[b] 2007, City of Buenos Aires; Dirección General de Estadística y Censos, 2008.
[c] 2006, Lima Metropolitana, INEI, 2007: 155.
[d] 2000, ZMCM. INEGI, 2005: cuadro 4.6.
[e] 2006, Metropolitan Area, own calculation based on Mideplan CASEN, 2006.
[f] 2009, RMSP, IBGE, 2010: 93.
[g] 2001, Atlas Ambiental de Buenos Aires, 2009.
[h] 2006, Lima Metropolitana, INEI, 2007: 137.
[i] 2006, Metropolitan Area, own calculation based on Mideplan CASEN, 2006.
[j] 2007, Bogota D.C. PNUD, 2008: 128. Second number is an estimation of percentage of households paying electricity bills.
[k] 1998, UN Habitat, 2007: 398.
[l] 2006, Lima Metropolitana, INEI, 2007: 156.
[m] 2006, Metropolitan Area, registered users; own calculation based on Mideplan CASEN, 2006.
[n] 2003, UN Habitat, 2009: 398.
[o] 2007, Bogotá, D.C.; Alcaldía Mayor SDP, 2008: 76; 63/64.
[p] Due to the guaranteed health assistance the indicator of Sao Paulo and Buenos Aires can be considered as 100%.
[q] 2006, Departmento Lima including Lima Metropolitana; INEI, 2007: 306.
[r] 2000, ZMCM, own calculations based on INEGI, 2005: table 5.1.
[s] 2006, Metropolitan Area, own calculation based on Mideplan CASEN, 2006.

BOX 3
METHODOLOGICAL NOTE TABLE 3: ACCESS TO BASIC SERVICES

This table presents a series of variables calculated as a percentage of total households which have access to different services. These are used as indicators for living conditions in metropolitan areas affected by extreme poverty and deficiencies of urban planning and informal settlements. Indicators regarding access to basic services are defined in the UN Habitat Program as key indicators (UN Habitat, 2004). They address the actual state of urban systems, the issues of sanity and health conditions and are related to some outcome indicators such as health indicators, like infant mortality issues. Some limitations of these indicators have to be mentioned. First of all, household sizes vary between the metropolitan cities (varying between three and four persons) and even higher differences are observed when comparing different areas within the same metropolitan cities, which means that the number of affected inhabitants differs from the household data shown.

UN Habitat (2004: 13) defines the Indicator **Proportion of the population with sustainable access to an improved water source** as the "percentage of the urban population who use any of the following types of water supply for drinking: piped water, public tap, borehole or pump, protected well, protected spring or rainwater." Due to the focus on metropolitan areas in the table shown above, we use access to piped water as decisive criteria. The criteria that water should be available in sufficient quantity and without excessive physical effort and time should be fulfilled by using the criteria for piped water meanwhile another important issue –the affordable price– will be addressed in the chapter dedicated to consumption (table 21).

(Continued)

Box 3 (concluded)

The indicator **access to sewage system** refers to the proportion of population using an improved sanitation facility, which is defined as "facilities that hygienically separate human excreta from human, animal and insect contact" which must not be shared by more than two households (UN Habitat, 2004: 13).

Access to electricity presents the percentage of households connected to the electrical supply system. As these data are generated from surveys and/or census, the mentioned connection is partially an informal one, which means that their consumption is not billed.

Affiliation to health insurance, both private and public is considered as health coverage services and is considered to be a basic need.

Reference values:

- Access to sewage system: target is 100% coverage; the worst value reported on a national level worldwide is 14%.
- Access to piped water: target is 100% coverage; the worst value reported on a national level worldwide is 37%.
- Access to electricity: target is 100% coverage; the worst value reported on a national level worldwide is 2%.
- Affiliation to health insurance: target is 100%.

Source: Authors' compilation.

2. Education

Education is considered to be a decisive issue in a long term development approach not only from a sustainability point of view; but also as one of the Millennium Development Goals (MDG) defined by the UN. Furthermore these indicators have to be considered as crucial variables of Human Life in Latin American Cities as they reflect social mobility perspectives but also because they represent vulnerability, especially in the context of highly privatized education systems.

There is little variance in **adult literacy rates** as all six countries have had a general school enrollment obligation for several decades. The slight differences of the alphabetization values reflect the age structure of a population rather than the development level. Nevertheless, in the event of a coincidence of low literacy rates with a relatively young population, this variable indicates marginalization of certain social groups from any formal education. This is the case in Lima. There is a remarkable concentration of alphabetism among young people in vulnerable areas of Sao Paulo reaching in some areas more than 5% of the inhabitants aged between 15 and 29 years (Sempla, 2007: 29). Therefore, one can observe a slightly lower level of alphabetization in those megacities which register a high percentage of inhabitants in informal settlements and relatively high low income immigration, such as Sao Paulo, Lima and Mexico.

School enrolment represents an important indicator of institutional failure in the context of education, as there is enrollment obligation. At the same time, this indicator is influenced by socio-spatial marginalization. Mexico, lately Buenos Aires and most of all Lima present relatively high levels of children who are not enrolled in primary education; whereas, Santiago de Chile presents almost complete enrollment, in spite of the socially segregated education system. The value of Sao Paulo is hardly comparable to the others as it includes children until 14 years and not only the first for year as the other does.

TABLE 4
EDUCATION

	Adult literacy rate *(Aged 15 and more. In percentages)*	School enrolment *(Primary education. In percentages)*	School leavers without graduation *(In percentages)*	Average study years *(Aged 24 and more)*	Higher education *(In percentages)*	Public spending on education *(In US$ –ppp-/student)*
Bogota	97.8[a]	98.1[g]	10.9[m]	9.8[s]	21.0[y]	1 584[dd]
Buenos Aires	99.5[b]	97.7[h]	4.7[n]	12.3[t]	30.4[z]	2 757[ee]
Lima	96.2[c]	91.5[i]	2.3[o]	10.7[u]	31.0/14.0[aa]	835[ff]
Mexico	96.3[d]	96.2[j]	*14.3*[p]	10.8-9.2[v]	15.7[bb]	
Santiago	98.0[e]	99.2[k]	3.4[q]	10.9[w]	19.1[w]	1 821[gg]
Sao Paulo	96.3[f]	80.9[l]	3.1[r]	8.2[x]	14.6[cc]	5 697[hh]

Source: Authors' compilation, based on:

[a] 2005, Bogota D.C. DNP, 2008: 42.
[b] 2001, Gran Buenos Aires, Urban Age Program Database.
[c] 2006, Lima Metropolitana, INEI, 2007: 209.
[d] 2000, ZMCM, own calculation based on INEGI, 2005; table 6.2.
[e] 2006, AMS own calculation based on Mideplan CASEN, 2006.
[f] 2006, RMSP Emplasa, 2009: 98.
[g] 2005, Bogota D.C., aged 7-11 years, DNP, 2008: 46.
[h] 2008, Capital Federal; GCBA DGEC, 2010: 55.
[i] 2006, Lima Metropolitana, children aged 6-11 assisting to primary education as percentage of the respective population (year by year); INEI, 2007: 195.
[j] 2003, ZMCM, assistance, "índice de retención" INEGI, 2005; table 6.6.
[k] 2006, AMS, aged between seven and 13 assisting to school, own calculation based on Mideplan CASEN, 2006.
[l] 2000, Municipio do Sao Paulo; refers to participation at school of all children aged between seven and 14; Portal ODM, 2009.
[m] 2003, Bogota D.C.; percentage of population without primary school, Giraldo et al., 2006: 80.
[n] 2008, City of Buenos Aires; percentage of population without primary school, GCBA DGEC, 2010b: 3.
[o] 2006, Lima Metropolitana, percentage of population (above 15 years) without any education level completed, INEI, 2007: 213.
[p] 2000, ZMCM, percentage of population without any education level completed; INEGI, 2005 gráfico 6a.
[q] 2006, AMS, population aged 15-24 years without complete education; own calculation based on Mideplan CASEN, 2006.
[r] 2003, Municipio de Sao Paulo, percentage of students leaving school during the first eight years without graduation. Sempla, 2007: 30.
[s] 2005, Bogota D.C., Secretaría Distrital de Planeación, 2007: 4.
[t] 2008, City of Buenos Aires, GCBA DGEC, 2010: 65.
[u] 2006, Lima Metropolitana, INEI, 2007: 207.
[v] 2006, first number refers to D.F., second to Estado de Mexico; Gobierno de la República 2006 Anexo estadístico.
[w] 2006, AMS; Mideplan CASEN, 2006: 65.
[x] 2009, RMSP, IBGE 2010: 67.
[y] 2005; City of Bogota; higher education. Urban Age Program 2009: 42 (3-17).
[z] 2008, City of Buenos Aires; higher education, GCBA DGEC, 2010b: 3.
[aa] 2006, Lima Metropolitana, population in working age, INEI, 2007: 312; second number: Lima and Callao; Urban Age Program, 2009: 42 (3-17).
[bb] 2000, ZMCM, Urban Age Program, 2009.
[cc] 2009, RMSP, percentage of adult persons with 15 years of study and more, IBGE, 2009: 68.
[dd] 2007, Bogota D.C.; own estimation based on www.bogota.gov.co, Interview with Francisco Cajiuao.
[ee] 2005, average of City of Buenos Aires and Province of Buenos Aires, own estmation base don CIPPEC 2007: 10.
[ff] 2003, Lima Metropolitana, MINEDU, 2004: 143.
[gg] 2007, AMS, own calculation based on SINIM Database 2009.
[hh] 2007, Municipio de Sao Paulo, own calculation based on Secretaría Municipal de Finanças, 2009 and IBGE, 2009. Calculated on the number of students only in municipal schools, total educational spending.

BOX 4
METHODOLOGICAL NOTE TABLE 4: EDUCATION

Achieving universal primary education is one of the Millennium Development Goals (MDG 2) which is represented in the table by school enrollment in primary education and by the adult literacy rate. The adult literacy rate is a ge neral indicator of development level and primary education, related also to the importance given by government to the issue of education. Nevertheless, it is influenced most of all by the development levels and education policies in the last several decades, therefore the MDG program includes the literacy rate of 15-24 year-olds.

Other indicators are aimed at the analysis of education levels, access to education and performance. As there are important early productive activities of children in low-income sectors, this indicator is also influenced by socio-economic status. These indicators also suffer a limitation caused by differences in the education system in each of the six countries. These diverge especially in the number of years of obligatory school attendance, which affects the use of an indicator related to the average number of study years. In some cases, the education system facilitates participation in the skilled labor market before reaching 18 years, while in other cases leaving school before the age of 18 is equivalent to incomplete secondary education. Therefore, only "School leavers without graduation" can be considered as an indicator of performance.

Primary School Enrollment: "number of children of official primary school age who are enrolled in primary education as a percentage of the total children of the official school age population" (UN Stat, 2009b).

Adult Literacy rate: Percentage of the population, male and female, aged 15 years-old and over who can both write and read while understanding a short simple statement on everyday life (UN Habitat, 2004: 18).

School leavers without graduation: Percentage of population aged between 15-24 years old who left school without graduation.

Average Years of Study: Average of effective years of study in an urban population, aged 24 years old and higher. It represents levels of scholarity and development in specific areas. UNESCO uses "School Life Expectancy (SLE), defined as the total number of years of schooling that a child at age four can expect to receive in the future" (UNESCO, 2004: 10)

Percentage of Population with a University Degree: Percentage of the population with universitary level education. The indicator is calculated based solely on the population aged 18 years old and higher.

Public Spending on Education: This indicator is calculated as US$ (ppp) / student as the goal of this variable is to indicate the level of benefits offered to individuals and not the relative weight of education on public spending.

Reference values:

- The adult literacy rates goal is 100%; lowest current value (national level): 86.0%.
- School enrollment goal is 100%; the lowest current value (2007, national level) is 42.8% (UN Stat, 2009b).
- School leavers without graduation goal are 0.0%. On national level are reported the primary completion rate, its worst level worldwide in 2007 was 31%.
- Average Study years: UNESCO indicates that in Latin America 80% of the countries have a school life expectancy between 11 and 13 years, which is high in international comparison (data refer to 2001, UNESCO, 2004: 13).
- Public spending on education reference data is often reported as a percentage of total government expenditure. In this case the reference values are: lowest level 9.0%; highest level 29.8% (UN Stat, 2005).

Source: Authors' compilation.

Special attention should be paid in those cases, which present an alarming lack of school enrollment; this may reflect recent institutional failures. This failure and the growing social dualization and recent exclusion might be reasons for the high percentage of **students leaving schools without graduation**. Although in some cases this level is rather low, one can observe important socio-economic and territorial differences: school leaver's percentage in private schools is almost 0% and students leaving public schools without graduation are concentrated in the most socially vulnerable areas, as shown in the case of Sao Paulo (SEMPLA, 2007: 31). The data concerning Mexico is not comparable, as it refers to the percentage of population without any graduation and is therefore mainly influenced by elderly people.

A rather divergent result is provided by the **higher education** indicator showing a very high level in the case of Buenos Aires followed by Bogota and Santiago de Chile, meanwhile Mexico and Sao Paulo show low levels. This result reveals an important difference to the evidence of a relative concentration of high technology and scientific production in the metropolitan regions of Sao Paulo, Buenos Aires and Santiago (table 23). Referring to Lima there are informed contradictory data locating the Peruvian capital in the top or in the worst position.

All six of the metropolitan cities that are discussed in this report have established important private education mechanisms on a national level. As this private system covers mostly only a wealthier part of the society it is of outstanding importance to address the issue of **public investment in education**. High public spending in education can be observed only in Sao Paulo and in a less outstanding manner in Buenos Aires. Santiago de Chile presents a relative low level of public spending in education (in terms of US$ ppp per student), due to the extreme dominance of private education in terms of quality. Nevertheless in absolute terms public investment is relative high. This may be partially explained by the high and growing importance of the private education establishments receiving public subsidies. As expert estimations of important sustainability issues in Santiago invoke the education system, these will be discussed in City profile chapter (IV.E.3). It is especially useful to examine the case of Santiago de Chile in order to outline risks that exist in the long term despite good output indicators. The lowest public spending on education is reported in Lima.

3. Housing

The topics discussed in this chapter refer to issues of urban planning and investment shortcomings as well as to different Habitat Agenda Goals: "Provide security of tenure" (UN Habitat, 2004: 12) and "Promote the right to adequate housing" (UN Habitat, 2004: 24). Inadequate housing conditions, informal settlements, low tenure security, and shortcomings of housing affordability represent some of the main challenges of sustainable urban growth. They are furthermore directly linked to the issues of risk and vulnerability, and governance of urban areas.

In terms of **home ownership,** there is a remarkable difference between the high levels in Mexico, Sao Paulo, Santiago and Buenos Aires on the one hand, and Bogota and Lima on the other hand (table 5). In part this difference is explained by the public housing policy (e.g. Bogota). During the last several decades most Latin American metropolitan cities have shown a clear trend towards housing tenure and a decline in the percentage of rented flats. For example, in Mexico during the 1950's most of housing spaces were rented meanwhile in 2000 around 70% of the families lived in their own house (Gonzalez, 2006). Within Metropolitan Areas there are important spatial differences, related to price and cultural patterns, e.g. in the city of Buenos Aires ownership rate is only 61.1% (Dirección General de Estadística y Censos, 2008) and living in rented flats can be considered more common as part of the urban culture and a typical lifestyle.

Another major issue relative to explaining housing tenure is **affordability**, namely the relationship between rent level and prices of buying a flat. Buenos Aires, Mexico City and Sao Paulo are dominated by a high level of rent costs in relation to the average income. The price level in metropolitan areas differs in Mexico in an extreme manner: average local flat rent costs are estimated to reach a level of US$ 810 (Urban Age Program Database, 2009). This explains, when combined with easy access to bank credits for several years, the high levels of housing tenure in these metropolitan cities. On the other

hand, it has been demonstrated that during the pre-crisis period in Argentina housing tenure was affordable, requiring little more than five annual average incomes. Nevertheless, international comparison shows, that for example most of North American and also many of the European cities show relative cost levels which are considerably lower.

TABLE 5
HOUSING

	Housing affordability		Overcrowding	Homeless people	Home ownership	Slum population
	Price to income	Rent to income	*(As percentages of households)*	*(Estimation; nr/ 1 000 inhab.)*	*(As percentages of households)*	*(As percentages of inhab.)*
Bogota		17.6[c]	2.5[g]	1.2[m]	52.2[q]	16.8-17.9[w]
Buenos Aires	5.1[a]	24.8[d]	8.1-1.6[h]	0.4[n]	69.0[r]	26.2[x]
Lima	8.7[a]		5.3[i]		60.0[s]	7.3-36.1[y]
Mexico		36.1[e]	14.5[j]		70.0[t]	14.4[x]
Santiago	8.4[b]	14.9[f]	3.2[k]	0.6[o]	77.4[u]	0.5-9.0[z]
Sao Paulo		24.3[a]	13.0[l]	1.1[p]	71.6[v]	19.7-29.0[aa]

Source: Authors' compilation, based on:

[a] 1998-2002, area not specified, UN Habitat, 2003: 276, 277.
[b] 2007, Gran Santiago, INE, 2008e: 4 and Zona Inmobiliaria, 2010.
[c] 2007, Bogota D.C.; percentage of monthly income dedicated to housing (average of income deciles) based on: PNUD, 2008: 129.
[d] 2005-2006, City of Buenos Aires, rent and monthly costs per household income; INDEC, 2006: 5.
[e] 2006, Mexico City, average income and average rent for a low level apartment based on Urban Age Program Database, 2009.
[f] 2006, AMS, own calculation based on Mideplan CASEN, 2006.
[g] 2005, Bogota DC; DANE, 2009c.
[h] 2008, City of Buenos Aires, first number percentage of household with 2-3 persons per room, second number more than three persons per room; Dirección General de Estadística y Censos, 2008.
[i] 2006, Lima Metropolitana, percentage of population living in condition of overcrowding. INEI, 2007: 427.
[j] Year not specified; refers to three municipalities with high percentage of irregular settlements. Connolly 2003: 27.
[k] 2006, Metropolitan Area, Mideplan CASEN, 2006.
[l] 2000, RMSP, Bógus / Pasternak, 2009: 78.
[m] 2008, Bogota D.C., Alcaldía Mayor de Bogota SDIS, 2009.
[n] 2010, City of Buenos Aires, estimation of international organizations, La Nación 2010.
[o] 2005, RMS, Mideplan 2005: 84.
[p] 2007, Municipio Sao Paulo, Sempla, 2007: 50.
[q] 2007, Bogota, Secretaría Distrital de Planeación, 2008.
[r] Year not specified, Gran Buenos Aires; Urban age program database, 2009.
[s] 2006, Lima Metropolitana, INEI, 2007: 132.
[t] 2000, ZMCM, approximation based on González, 2006.
[u] 2006, includes houses owned by relatives; Mideplan CASEN, 2006.
[v] 2009, IBGE, 2010: 89.
[w] 2003, Bogota D.C.; percentage of people with deficient housing condition. Second number: 2005; Slum dwellers as percentage of the urban population in the respective country UN Habitat, 2009: 244.
[x] 2005, Slum dwellers as percentage of the urban population in the respective country UN Habitat, 2009: 244.
[y] 2004, Lima Metropolitana, CIDAP, 2008:3. Second number: 2005; Slum dwellers as percentage of the urban population in the respective country UN Habitat, 2009: 244.
[z] 2006, Metropolitan Area; Mideplan CASEN, 2006; second number is national level 2005; UN Habitat, 2009: 244.
[aa] 2000, The first number refers only to favelas in Municipio Sao Paulo. Own calculation based on Moraes 2008: 87. Second number: 2005; Slum dwellers as percentage of the urban population in the respective country UN Habitat, 2009: 244.

With regard to **overcrowding,** one can observe an outstandingly high level in the case of Sao Paulo and Mexico City. The case of Mexico City should not be directly compared to the others as it refers to three municipalies with dominant irregular settlements (Connolly 2003: 27). The high level in

Sao Paulo is directly linked to the incidence of slums and other deficient housing conditions of low income families. Furthermore, the metropolitan areas of Lima and post-crisis Buenos Aires present relatively high frequencies of overcrowded homes. On the other hand, in Bogota and Santiago de Chile, the overcrowding parameter is very low as they have applied strong public policies towards low income housing for several decades. The good results in combating overcrowding in Bogota and Santiago de Chile are mainly due to public housing policies and this should be contrasted with the predominance of small housing units in the same two cities. As a consequence, the housing policy in these two cases will be discussed additionally in the City Profile section (IV.A.2 and IV.E.2) as well as housing challenges in Sao Paulo (IV.F.2).

BOX 5
METHODOLOGICAL NOTE TABLE 5: HOUSING

Housing affordability is comprised of two indicators: ratio of the median free-market price of a dwelling unit and the median annual household income in the case of tenure. For rented dwellings the percentage of monthly income dedicated on average to housing rental (UN Habitat, 2004: 24) is used.

Overcrowding means "proportion of households with more than three persons per room. A house is considered to provide a sufficient living area for the household members if three or less people share the same room". (UN Habitat, 2004:12) A room includes bedrooms, dining rooms, living rooms, servants' rooms, kitchens etc. if they are larger than 4m2.

Homeless people are expressed in relation to the Metropolitan City's total population, the indicator is presented as number per 100,000 inhabitants due to the very low absolute numbers.

Home ownership is the percentage of households owning or purchasing their home (defined by the right of exclusive occupancy and use). This includes housing units which are totally paid for as well as those purchased with bank credits if mortgage rates are paid on a regular basis.

Slum population: Number or persons living in slum households. "UN HABITAT defines a slum household as a group of individuals living under the same roof who lack one or more (in some cities, two or more) of the following conditions: security of tenure, structural quality and durability of dwellings, access to safe water, access to sanitation facilities and sufficient living area" (UNDG, 2003: 68). "The actual proportion of people living in slums is measured by a proxy, represented by the urban population living in households with at least one of the four characteristics: (a) lack of access to improved water supply; (b) lack of access to improved sanitation; (c) overcrowding (3 or more persons per room); and (d) dwellings made of non-durable material." (UN MDG 2010)

Reference values:

- Housing affordability: there is no target value available.
- Overcrowding: target value is 0%.
- Homeless people: target value is 0%.
- Home ownership: there is no target value defined as it depends on market structure, cultural and historic context.
- Slum population: Latin America: 27% of the urban population; Developing World: 36.5% of the urban population (UN Habitat, 2008: 91). Long term target value is 0%.

Source: Authors' compilation.

Concerning the size of housing spaces, this may be discussed by applying further indicators such as the number of rooms per housing unit, respectively the average number of persons per room. Sao Paulo presents larger flats and houses, as a very low percentage of the units consist of only one or two rooms, while in Bogota more than 1/3 of the households have one or two rooms. On average, Bogota presents a number of 1.2 persons per room, while the same indicator in Sao Paulo is 0.7 (UN Habitat,

2007: 395). The indicator of m^2 housing space per person or per household is another way to discuss the same issue. The average size of new housing spaces for low income groups at national level demonstrates diverging realities within Latin America. The highest values can be observed in Argentina (56 m^2) followed by Mexico (45 m^2) while Chile presents the lowest level of housing space for these income groups (35 m^2). In the case of Brazil, the respective number varies between 28 and 50 m^2.

Data on **slum population** on the national level show the high level of relevance of this phenomenon in Brazil (*favela* and *cortiços*) and in post-crisis Argentina (*villa miseria*) followed by Colombia and Mexico (*ciudad perdida*). Nevertheless, it has to be taken into account that the national level of data is influenced by the deficient housing and basic service conditions in rural areas. On a metropolitan scale, Sao Paulo and Bogota present the highest levels of slum population, followed by Lima (*tugurios*). Due to the outstanding importance of slums in Sao Paulo (almost 20% of the population) and the implementation of several public programs, this issue will be addressed in the City Profile chapter (IV.F.2). In Santiago de Chile, the slum problem has been widely overcome. Nevertheless, the so called *campamentos,* characterized by illegal land occupation with precarious building structures and weak access to basic services, do exist. In most of the cases, these are located in suburban and peri-urban spaces and have a minor impact in terms of population number. Nevertheless, in the Metropolitan Region of Santiago in 2005 there are 122 *campamentos* registered, in which some 5.600 persons are estimated to live. Regarding basic services, these settlements have almost no access to waste water treatment, highly deficient access to drinking water (41%) and deficient access to electricity (60%) (CIS Un Techo para Chile, 2007: 57).

The situation of **homeless** people in urban areas is of rising importance; although the relative frequency is low (around one per 1000 inhabitants), the tendency is rising and the absolute numbers illustrate the need for public action –in Sao Paulo for instance, there are currently around 12,000 homeless (SEMPLA, 2007). Nevertheless in the case of Bogota there has been reported an important reduction of the number of homeless people during the last decade declining from 11,832 in 2001 to 8,385 persons in 2008 (Alcaldía Mayor de Bogota SDIS, 2009).

4. Minimization of environment-caused adverse impacts on health

The indicators included in this table are oriented towards an evaluation of the state and quality of the city's health system and access to health assistance as well as the effects which poverty, segregation and some aspects of environmental pollution produce on public health. As children are the population group most affected by environmental pollution impacts, they are the focus in most of the indicators discussed in this chapter.

The very low levels of **infant mortality** in Buenos Aires and in Santiago de Chile are clearly related to the high levels of income and improved health care. Especially pregnancy and birth assistance and monitoring are completely implemented on a national level in Argentina and Chile. Notably higher levels of infant mortality are registered in Sao Paulo and Bogota and especially in Mexico City and Lima, being caused by income difference, poverty and deficiency in the public health services that are oriented towards low income social groups. Furthermore, in Mexico the air and water contamination is still an important issue in explaining infant mortality, although it has been reduced in a considerable manner (Secretaría de Salud, 2007: 20). In the Municipio Sao Paulo this indicator has been constantly reduced from around 50 per 1000 (1980), to 25 per 1000 (1990) until 13 per 1000 in 2005 (Sempla, 2007: 26). Lima presented in 2000 the worst level among the metropolitan areas with 20 per thousand births (according to Ministerio de la Mujer y Desarrollo Social 2001), a level which was still below the national level in Peru. Since then on a national level this rate has been reduced rapidly from 33 in the year 2000 to 17 per thousand births in 2007 (UN Stat, 2009b) and it in Lima the rate was also considerably reduced: to 10 peer thousand births in 2009. The pace of this reduction, which was already registered during the 1990ies, is higher in rural areas, but also significant in urban areas (INEI / UNICEF, 2008).

By contrast, in Buenos Aires, although socio-spatial differentiation of infant mortality can be observed, the areas with the lowest income present an infant mortality rate which is below the average

level of Mexico City, Lima and Bogota. The problem in Buenos Aires has administrative reasons, as the inhabitants of low income areas in the south and west of the metropolitan area (AMBA) are forced to travel to the city of Buenos Aires to be attended (PNUMA, 2003b: 50).

TABLE 6
CHILD MORTALITY

	Infant mortality rate *(Per 1 000)*	Under five mortality rate *(Per 1 000)*	Child death rate from respiratory diseases *(Per 100 000)*	Child death rate from intestinal infectious diseases *(Per 100 000)*	Life expectancy at birth *(In years)*
Bogota	13.5[a]	20.6[g]	15.9[l]	10.0[o]	77.1[q]
Buenos Aires	7.9[b]	8.2[h]	140-50[m]	13.4-7.1[p]	75.9[r]
Lima	10.0[c]	14.0[c]	20.3[i]	9.9[i]	77.7[s]
Mexico	17.8[d]	4.4[j]	37.6[j]	9.9[j]	76.1[t]
Santiago	7.6[e]	8.9[e]	25.6[n]	3.5[n]	78.1[u]
Sao Paulo	13.3[f]	15.2[k]			71.8[v]

Source: Authors' compilation, based on:

[a] 2005, Bogota, D.C., Concejo de Bogota, 2008: 21.
[b] 2007, City of Buenos Aires, GCBA DGEC, 2008: cuadro 5.27.
[c] 2009, Department of Lima, Ministerio de la Mujer y Desarrollo Social, 2010, tabla 1.28.
[d] 2003, ZMCM;, INEGI, 2005: table 3.5.
[e] 2005, RMS, INE, 2008: 25.
[f] 2006, RMSP, EMPLASA, 2009: 98.
[g] 2005, Bogota D.C., Giraldo et al, 2006: 82.
[h] 2007, City of Buenos Aires, GCBA DGEC, 2008: cuadro 5.27.
[i] 2000, Department of Lima, Ministerio de la Mujer y Desarrollo Social, 2001
[j] 2001, Data on Mexico D.F. Comisión de Derechos Humanos, 2003: 8.
[k] 2006, Municipio Sao Paulo; Portal ODM, 2009.
[l] 2005, Bogota D.C., mortality of children under five years, only pneumonia; Source: Concejo de Bogota, 2008: 21.
[m] Average 2004-2005, the first number refers to the Province, the second to the City of Buenos Aires. Ministerio de Salud de la Argentina, 2007: 75.
[n] 2000, INE and Mönckeberg, 2003.
[o] 2000, Bogota D.C. Cámara de Comercio de Bogota, 2004: 2.
[p] Average 2003-2005, the first number refers to the Province, the second to the City of Buenos Aires. Ministerio de Salud de la Argentina, 2007: 67.
[q] Projection 2005-2010 Bogota D.C., SDP, 2007: 3.
[r] 2001 City of Buenos Aires, GCBA DGEC, 2008, cuadro 1.42.
[s] 2000-2005, Departmento de Lima, INEI, 2007.
[t] 2008 Distrito Federal. INEGI, 2008.
[u] 2001-2005, Region Metropolitana, Mideplan / INE, 2006: 6.
[v] 2003, RMSP, Emplasa 2007: 18.

With regard to the **under five mortality** rate, as one might expect, Lima presents a high level as also does Bogota, meanwhile Sao Paulo shows intermediate level due to the high income disparities and the importance of extreme poverty in these metropolitan cities. Coherent with the above presented data on infant mortality is the low level that Santiago de Chile and Buenos Aires presents (see also the poverty indicators in chapter III.A.2). Somewhat surprisingly low is the level in Mexico City. This indicator has been remarkably reduced in Lima from 23 as an average of the decade 1990-2000 (Lima Metropolitana, COSUDE, 2005: 3) to the current 14 percent (see table 6).

BOX 6
METHODOLOGICAL NOTE: TABLE 6 CHILD MORTALITY

The table includes two age-specific mortality rates, both expressed in relation to 1.000 live births: Infant mortality rate (0-1 year) and under five mortality rate (0-5 years), which are both MDG indicators (Target 4) and considered by WHO as leading indicators of child health and aspects of overall development of a region, but they address slightly different issues. **Infant mortality** provides information most of all on quality of health systems and assistance during pregnancy and birth. On the other hand, the **mortality rate of children aged less than five** is influenced, apart from health systems' quality and access, by the socio-economic level and environmental conditions in which a child is growing up.

Furthermore, the table gives evidence of the relative frequency of **child death due to respiratory diseases** and **intestinal diseases**, expressed as number per 100,000 children under five year age. This age group is considered as the most vulnerable part of society (also elderly people are highly vulnerable to these influences). These indicators are aimed directly at the analysis of sanitary conditions and the quality of air. The major challenge in using this indicator is the lack of reliable and comparable official statistics, which is why different individual reports about health conditions are used in each of the metropolitan regions. This is an important restriction for data comparability.

Definitions:

Infant mortality rate: Probability of a child born in a specific year or period dying before reaching the age of one, if subject to age-specific mortality rates of that period. Expressed as number per 1,000 birth.

Under five mortality rate: Probability of a child born in a specific year or period dying before reaching the age of five, if subject to age-specific mortality rates of that period (WHO, 2009).

Child death rate from respiratory disease: respiratory diseases means "disease that is generally transmitted by nasopharyngeal discharges and by respiratory secretions, through coughing and sneezing, though it may also be contracted through close contact" (UN Stat, 2009). The indicator considers people aged five years old and under and is influenced by the air quality conditions.

Child intestinal infectious disease: Considers children aged 1-4 years old, and represents mainly water quality and efficient sewage systems.

Life expectancy at birth: "The number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life" (UN Stat, 2009).

Reference values:

- Infant mortality rate: worst current level (in 2007) on national scale is 165 /1000 (in UN Stat, 2009b).
- Under five mortality rate: worst current level (in 2007) on national scale is 262/1,000 (in UN Stat, 2009b).
- Child death rate from respiratory disease (only pneumonia, national scale): 67 (own calculation based on data from WHO 2010)
- Child intestinal infectious disease (only diarrhea, national scale): 75 (own calculation based on data from WHO 2010) Life expectancy at birth: lowest level 44; highest level 82 (UN Stat, 2010).
- Life expectancy at birth: worst current level on national scale is 45 and highest 80 years (in UN Stat, 2010)

Source: Authors' compilation.

As mentioned above, in the case of Mexico air pollution is considered to be an important cause of infant mortality –the Mexican capital shows a high child death rate from **respiratory diseases**. This relationship between pollution levels and respiratory diseases is even more evident in Santiago de Chile, where in the context of a low infant mortality rate, one can still observe a high occurrence of child deaths due to respiratory diseases. Therefore, in these two cases air pollution will be discussed in chapters IV.C.3 and IV.V.4. In spite of continuous reduction during the last 15 years, death rate from respiratory diseases is still a serious problem in Argentina, and Buenos Aires is showing extremely high levels compared to the other metropolitan areas. Nevertheless the fact that it is much higher in the Province than in the city of Buenos Aires suggests that it is influenced rather by poverty factors than by urban air contamination (Ministerio de Salud de la Argentina, 2007: 75). Furthermore, clear differences within the metropolitan cities can be observed. In Bogota researchers from the Universidad Nacional de Colombia showed that the under five year mortality rate caused by acute respiratory infection in four low income locations (Kennedy, Bosa, Ciudad Bolívar and Usme) was 26.3 which is clearly above the average of Bogota. Their study suggests that in those areas with higher air pollution (especially PM10) infant mortality was 86% higher (information provided by local expert).

The indicator of **infant death rate due to inflectious diseases** addresses the effects of general sanitation conditions and water quality on children's health and shows similar levels for Bogota, Lima and Mexico City; while, Santiago de Chile presents a significantly lower value, probably due to improved hygienic standards and relatively good quality of provided piped water. The position of the City of Buenos Aires is an intermediate; meanwhile the province presents the highest value again probably caused by higher poverty and lower water and sanitation coverage. Bogota, Buenos Aires and Lima all present very high levels of biological contamination of water bodies (table 9-A) and relevant deficiencies in housing conditions (table 5).

Total **life expectancy at birth** is used frequently as an overall indicator of human development conditions. In the case of the present studies, it is directly influenced by the above mentioned conditions of child mortality. Particular effects like the influence of criminality on reduced life expectancy in Sao Paulo can be observed. As the murder victims are mostly young men, a statistical effect on lower life expectancy is shown. Nevertheless the differences in this indicator are very limited.

Noise measurement is of relevance for the sustainability of cities due to the health impacts which may be caused by continuous noise exposure as well as short exposure to extreme noise levels. In the urban context, different major sources of noise are identified: road traffic, construction, industrial activities, leisure activities and Airports. In the case of the six metropolitan cities, some important airports are located in densely populated sectors: International Airport of Mexico City, Sao Paulo (Congonhas) and partially the secondary Airports in Buenos Aires (Jorge Newbery), Bogota (El Dorado) and Lima / Callao (Jorge Chávez). Nevertheless, the most important noise source is urban traffic. As table 7 shows, in all of the metropolitan cities discussed the main avenues are emitting noise levels which are far above the WHO limits (see methodological notes). Especially in Lima the acustic contamination is apparently extremely high, due to traffic but also commercial activities and the presence of the mentiones airport (see also PNUMA 2005: 98).

It has to be taken into account that the comparability of the presented data in this section is very limited as methodology is different and the selection the few measuring point has en direct effect on the presented data.

TABLE 7
NOISE EXPOSURE

	Noise exposure residential areas *(by day)*	Noise exposure residential areas *(by night)*	Noise level main avenues
	In dB(A)	dB(A)	dB(A)
Bogota		.	75-90[e]
Buenos Aires	75.0-85.0[a]	75.0-85.0[a]	max.95[f]
Lima	100.3[b]	.	82 / more than 100[g]
Mexico	.	.	78-91[h]
Santiago	73.5[c]	68.4[c]	79-87[i]
Sao Paulo	54.0-69.0[d]	.	70-81[j]

Source: Authors' compilation, based on:

[a] 1998; City of Buenos Aires, almost 85% of measuring points in central areas registered noise levels within the mentioned rank. PNUMA, 2003b: 78-79.
[b] 2004, central zone with a legal limit of 50 dB PNUMA 2005:98.
[c] 2001; AMS, Fuentes, 2008: 3.
[d] 2002; 27 measuring points in restricted area with a limit of 50 dB (A, PNUMA, 2003e: 101.
[e] 2008, main intersections; local experts information based on local studies.
[f] 2006, maximum levels on Avenida Marcelo T. Alvear. BBC Mundo.com.
[g] variability of maximum levels of seven different points; Walsh: 4.2-4. Second number represents maximum level on main avenues according to Comisión Especial de Estudio sobre Discapacidad 2005.
[h] 1998; medium noise levels registered in eight main avenues; Peralta, 1998.
[i] 2006; registered in different points of the Alameda /Santiago; Platzer et al, 2007: 126.
[j] 2002, minimum and maximum at rapid transit avenues, PNUMA, 2003e: 102.

BOX 7
METHODOLOGICAL NOTE TABLE 7: NOISE EXPOSURE

Noise is measured on a logarithmic scale using the unit of decibel (dB). The frequently used dB (A) indicator includes a weighting (filter) which takes into account the human ear's capacity to perceive sounds. All three indicators are calculated based on time-weighted average using the sound pressure level (LAeqT) (WHO 1999).

Definitions:

Noise exposure (by day and night): Represents the exposure to sound level, measured in dB (A). United Nations considers "noise pollution" as: "sound at excessive levels that may be detrimental to human health" (UN Stat 2009).

Noise level main avenues: these are data noise levels registered at specific points mostly located at main avenues or intersections within the central areas of the respective cities.

Reference Values:

Serious annoyance is caused by a prolonged exposure to noise levels above 50 dB; The US Occupational Health and Safety Act (OHSA) defines a time-weighted average exposure limit of 85 dB (A); the WHO considers 85, in some cases 70 dB (A) as a critical value regarding hearing impairment and considers the 50 respectively 55 dB (A) value as relevant in terms of producing annoyance (WHO 1999).

Source: Authors' compilation.

B. Natural resources

The third chapter of the comparative analysis section starts with an input perspective on consumption of natural resources, and afterwards focuses on flow-management data referring to the use and disposal of materials.

1. Water consumption and wastewater treatment

Assuring access to drinking water and wastewater treatment is directly linked to the UN Habitat Agenda Goal to manage supply and demand for water in an effective manner. Nevertheless water is not only necessary for different human purposes. It is also a prerequisite for any ecological system and implicitly for environmental services. Therefore sustainable water management requires a balance of water offer and human water consumption.[2]

Water consumption depends on a combination of income level and the availability of water at a low price. In general, the issues of pricing and management of the water market show quite polarized positions (UNDP, 2006: 51). On the one hand, it is necessary to ensure access to drinking water for poor people; on the other hand, there is the claim that realistic prices are necessary in order to ensure the economic fundament of the services and in the long run one must generate awareness of the price of natural resources. It is a priority to implement water management strategies on a superior scale, oriented towards an integrative planning of river basins under a life-cycle approach (Dourojeanni / Jouravlev, 1999: 12).

An outstandingly high level of **domestic water consumption** can be observed in Buenos Aires and intermediate levels are observed in Mexico, Santiago de Chile and Sao Paulo. In the case of Buenos Aires, this might be explained by the coincidence of relatively high income levels, high water availability and low price levels of water supply services controlled by the government. By contrast, Lima and Bogota present very low levels of water consumption. A remarkable example is the reduction of water consumption in Bogota between 1996 and 2005 of about 20% due to a combination of various influences such as: consumption control, important rise of price level (Ley 142, 1994), a new law on rational use of water (373/1997) and the economic crisis of 1997 (Acueducto, 2006). Bogota has experienced an important and socially differentiated increase in the cost of water reaching a high level which is on average the highest by far among the six metropolitan city sample.

In the case of Sao Paulo, a reduction of water losses has also been reported due to a new program of water loss control, renewal of infrastructure and control of clandestine water consumption (PNUMA, 2003e). Nevertheless, water losses in Sao Paulo (12.3 m^3/s) are still an important issue as they correspond to around 30% of the produced drinking water volume. Furthermore, high consumption disparities between exclusive residential areas (around 500 l/cap an day) and the eastern periphery with little more than 100 l/capita and day (Campanha de olho nos mananciais, 2007) can be observed. Clandestine water connections in precarious housing areas are estimated to count for around 14% of the water, presenting major health risks for consumers (Campanha de olho nos mananciais, 2007). The consumption of water in Sao Paulo showed a slight increase during the late 1990's. Water consumption is also very high in Mexico City, the city is using water reserves of other water basins since several decades, and the infrastructure has severe water loss problems (see also the city profile chapter on Mexico City). The reported very high water prices are a very recent development and not yet reflected in the consumption level.

In the case of Lima, one must acknowledge that this metropolitan city presents the lowest level of connectivity to piped water (see table 3) and many non-registered wells represent an important source

[2] The natural renewing rate of fresh water varies considerabely between different regions in function of e.g. climatological en geological conditions. Therefore the proportion between human water consumption and the regional natural renewal rate is the best indicator of the anthropogenic pressure on this resource in a certain region (RHM expert consultation). Hence not everywhere the data basis for this indicator is given, reason why it could not be applied in this report.

of drinking water, especially in low-income areas corresponding to an estimated 1.1 million inhabitants. Furthermore, in Lima an important percentage of water consumption is not billed by the providing enterprise, due for example to sub registration and water loss caused by a deficient infrastructure.

TABLE 8
WATER CONSUMPTION AND WASTEWATER TREATMENT

	Water consumption		Wastewater treatment			Price of water
	Total *(l/cap/day)*	domestic use *(l/cap/day)*	Inst. Capacity *(m^3/s)*	Capacity/ a million inh. *(m^3/s)*	Coverage *(In percentages)*	*(In US$ ppp/m^3)*
Bogota	181[a]	94[g]	4.0[l]	0.59	34.9[r]	1.67[w]
Buenos Aires	613[b]	378[h]	3.0[m]	0.23	5.3[cc]	0.50[x]
Lima	248[c]	118[i]	2.4[n]	0.28	13.3[s]	0.74-2.22[y]
Mexico	347[d]	289[j]	10.6[o]	0.59	16.1[t]	4.23-9.01[z]
Santiago	302[e]	230[k]	13.2[p]	2.44	72.7[u]	1.63[aa]
Sao Paulo	222[f]	160[f]	13.6[q]	0.69	71.0[v]	1.03[bb]

Source: Authors' compilation, based on:

[a] 2005; Bogota D.C., Acueducto, 2006: 15.
[b] 2008, area served and total water delivered by AySA. AySA, 2009: 19.
[c] 2007; Lima Metropolitan Area covered by SEDAPAL; total water production divided by population of the area; own calculation based on SEDAPAL, 2008: 5.
[d] Year not specified, Metropolitan Area, Del Valle, 2009: 2.
[e] 2007, RMS, total production; information provided by local RHM experts.
[f] 2008, Estado de Sao Paulo, SABESP, 2009: 4 and 7.
[g] 2004, Area covered by EAAB, Acueducto 2006b: 118.
[h] 2000, PNUMA 2003b, 67.
[i] 2007 Lima Metropolitana/Area covered by SEDAPAL, water consumption billed to private households, own calculation based on: SEDAPAL, 2008: 5 and 57.
[j] 2000, ZMCM, own calculation based on PNUMA, 2003c: 42.
[k] 2002, Metropolitan Area, own calculation based on PNUMA, 2003d: 33.
[l] 2004, Acueducto, 2004a.
[m] 2008, Atlas Ambiental de Buenos Aires, 2009b.
[n] 2007, Lima Metropolitana, area covered by SEDAPAL; SEDAPAL, 2008: 49.
[o] 2004; ZMCM, INEGI 2005, table 2.6.
[p] 2008, Local RHM expert information.
[q] 2008, Sabesp, 2009.
[r] 2004, Acueducto, 2004a.
[s] 2007, in SEDAPAL Area, SEDAPAL, 2008: 49.
[t] Year not specified, ZMVM, own estimation based on Table 1 and Romero Lankao, 2010.
[u] 2008, Area covered by Aguas Andinas, SISS, 2009: 7.
[v] 2009, RMSP area attended by Sabesp, Sabesp, 2010.
[w] 2007, Bogotá D.C., average level, own calculation based on El Tiempo 2007.
[x] 2008, area covered by AySA, own calculation.
[y] 2007, the two numbers represent the range of prices (higher consumption corresponds to higher price per m^3); Sedapal, 2008: 37.
[z] 2010, Mexico D.F. the two numbers represent the range of prices (higher income groups pay higher prices). El Universal (2009).
[aa] 2009, area covered by Aguas Andinas. Aguas Andinas, 2009.
[bb] 2002, Median Price, UN Habitat, 2003: 279.
[cc] Year not specified. AMBA, own estimation based on installed capacity of water treatment, average consumption and the population number (table 1).

Wastewater treatment shows huge differences between the situation in Santiago de Chile and the other cities, especially in terms of installed capacity but also regarding the overall coverage (percentage of households). In Santiago, there are two main water treatment plants: *El Trebal* (4.4 m^3/s) and *La Farfana* (8.8 m^3/s) both were put into operation in 2001. An amplification of the treatment

capacity of the plant *El Trebal* to 8.0 m^3/s is planned to start its operation in 2010. A similar magnitude of water treatment is observed in Sao Paulo, which is served primarily by four water treatment plants: *ABC* (1.6 m^3/s); *Barbueri* (9.5 m^3/s), *Parque novo mundo* (2.0 m^3/s) and *Sao Miguel* (0.5 m^3/s) (Sabesp, 2009a). During the last several years, the state government made an outstanding investment in the water sewage area: during the first stage (1992-1998) 1.1 billion US$ was invested and during the second stage (2000-2008) 500 million US$. As a result, around 84% of the waste water is collected and around 70% of the collected sewage is treated.

BOX 8
METHODOLOGICAL NOTE TABLE 8: WATER CONSUMPTION AND WASTEWATER TREATMENT

The table is comprised of two indicators representing consumption per capita and day as a standardized indicator. Both indicators are related to the economic development and general consumption level on the one hand and production activities on the other hand. Therefore, it is relevant to distinguish between domestic use and total consumption. Furthermore, they show a direct relation to the state's availability of natural resources as well as to the price level of related services. The main limitations of these indicators are caused by difficulties in measuring the individual consumption of households as in some cases there are important levels of losses in the water supply system (e.g. Mexico City) causing a distortion of data. Therefore, there are different data on: i) consumption as the sum of billing and ii) consumption as the amount of drinking water supplied to the system.

The indicator of **wastewater treatment** is a direct result of water consumption and the formalization of water supply systems. It represents an important indicator regarding the Habitat Agenda Goal to reduce urban pollution.

Definitions:

Water consumption: Average consumption of water in liters per day and per person making a distinction between the total consumption, which includes e.g. consumption of any industrial and commercial activity, and the domestic use.

Wastewater treatment coverage: Percentage of all wastewater undergoing some form of treatment (primary, secondary or tertiary) (UN Habitat, 2004: 38).

Installed capacity of water treatment: Summing the maximum capacity of water treatment (in m3/second) of public and private treatment infrastructure.

Coverage: this indicator refers to the relation of treated wastewater and the total amount of wastewater within a year period (in percentage).

Price of Water: Official definition is "median price paid per 1000 liters of water in US$, at the time of year when water is most expensive" (UN Habitat, 2004: 36). We use the water price information provided by respective sources.

Reference values:

- Domestic Water consumption (liters/capita/day): UN recommends 110 l per capita daily as an average consumption level to fulfill human needs. Countries with a daily water consumption of less than 50 l per capita is considered water poverty (UNDP, 2006: 34). The United States of America has a consumption of around 580 l/capita/day. (World Bank, 2005. UN Habitat, 2007). On a metropolitan scale: Berlin/Germany: 112 (Amt für Statistik Berlin-Brandenburg 2009: 27).
- Wastewater treatment (installed capacity per 1,000,000 inh.): Goal of 2.3 m3/s corresponds to a complete treatment of a per capita consumption of 200 l/day. Worst value is 0.
- Wastewater treatment coverage: goal is 100%.
- Price of water: there is no goal defined. The indicator is used as a context for the discussion of affordability and socially differentiated water price levels.

Source: Authors' compilation.

The situation in Lima is characterized by the existence of various small scale treatment plants. There are two large projects of waste water treatment plants which are currently in the process of being treated: PTAR *Taboada* and PTAR *La Chira*. They have been designed to treat 13 m^3/s and 5 m^3/s. After starting their operation, they are expected to reach a coverage rate of waste water treatment of 88% in 2011. The water management topic will therefore be discussed in the City Profile section for the case of Lima (IV.C.3) as well as for the other metropolitan cities with important deficiencies and challenges in this matter (Bogota IV.A.3 and Mexico IV.D.2).

2. Water pollution

Contamination of the main bodies of water is presented with reference to its respective biochemical aspects; later on pollution data by main chemical agents, especially heavy metals, are presented. The main cause of problems pertaining to water pollution is the lack of and inefficiency of sewage treatment –an important part of which is generated by private households. For example, in the case of Bogota, it is estimated that 90% of the Bogota river contamination is generated by domestic sewage and only 10% by industrial establishments (PNUMA, 2003a: 44). The use of sewage water for irrigation has shown important effects on agricultural productivity; this practice still exists and is causing important health risks (Dourojeanni / Jouravlev, 1999: 18). In the short term, acute health risks are linked to the presence of coliforms e.g. in vegetables causing infectious diseases. If sewage water polluted by heavy metals is used for irrigation, one can observe long term risks due to the accumulation of heavy metals in the food chain and their toxic effects on human beings.

TABLE 9-A
WATER POLLUTION: BIOLOGICAL INDICATORS

	Total Coliformes *(Nr/100 ml)*	Dissolved O_2 *(mg/l)*	BOD_5 *(mg/l)*
Bogota	4 800 000[a]	0.1 to 7.0[g]	up to 711[j]
Buenos Aires	1.820 000[b]	4.6[b]	38 / up to 611[b]
Lima	125 000[c]	9.5[h]	53[k]
Mexico		1.5[d]	119[d]
Santiago	16 000-35 000[e]	> 3.0-9.0[i]	42-5[l]
Sao Paulo	380 000[f]	0.2[f]	52[f]

Source: Authors' compilation, based on:

[a] 2004, Rio Bogota, only fecal coliforms; Campos, 2007: 8.
[b] 2010, Riachuelo, average of 31 measuring points. Own calculation based on Acumar 2010.
[c] 2006, Rio Rimac, INEI, 2007: 58.
[d] Waste water of the Metropolitan Area is collected en led to the basin of River Tula; data presented refer to the measuring Point El Salto/ Rio Tula. Montelongo et al (2008): 12-16.
[e] 2003, maximum level in Rio Mapocho respectively Rio Maipo, Cade-Idepe, 2004: 96.
[f] 2008, Rio Tietê measuring point TIET04200, CETESB, 2009: 61.
[g] 2006; average level of nine different points in Rio Tunjuelo; Alcaldía Mayor SDA, 2008: 213.
[h] 2007; Rio Rímac, SEDAPAL, 2008.
[i] 2004, the first number refers to the minimum in Rio Mapocho; the second number is the minimum level of Rio Maipo. Cade-Idepe, 2004: 76.
[j] 2006; in Rio Tunjuelo; Alcaldía Mayor SDA, 2008: 207; Uribe Botero, 2005: 5 gives a rank of 60-130.
[k] 2003, maximum level in the lower part of Rio Rimac. MINAM, 2005.
[l] 2003, maximum level in Rio Mapocho respectively Rio Maipo, Cade-Idepe, 2004: 92.

Outstandingly high pollution levels are observed in Bogota and in Buenos Aires –mostly due to untreated domestic waste water. The extremely high level of total coliforms in the main river bodies clearly demonstrates this problem, as does the BOD indicator (Biological Oxygen Demand).

Concerning the **concentration of coliforms** the two rivers of Santiago show the lowest numbers as the Metropolitan area disposes of the best wastewater treatment infrastructure among the discussed cities. Nevertheless it has to be stated that all the Metropolitan Cities of the sample present extreme high levels of biological pollution.

Also the **BOD** is in all the cases far beyond the limit to be considered pristine (= 1 mg/l) and in most of the cases considered not even acceptable. Only the Maipo River in the southern part of Santiago fulfills the requirement (< 20 mg/l) applied to treated waste water.

Concerning the **Dissolved Oxygen**, the Rio Maipo in Santiago and also Rio Rimac in Lima show relatively high levels of oxygen, indicating low levels of biological contamination. Rio Tiete (Sao Paulo) and Rio Tula, a river located close to Mexico City and receiving its waste water, in contrast are in condition of extremely high biological contamination according to this indicator. The data presented for Bogota demonstrate the dramatic change of Rio Tunjuelo from rather good presence of oxygen to a high level of contamination during its passage through the city.

TABLE 9-B
WATER POLLUTION: CHEMICAL INDICATORS

	Hg	Pb	Cd	As
	µg / l	*µg / l*	*µg / l*	*µg / l*
Bogota		157.0[a]	21.0[a]	150.0[a]
Buenos Aires	<1.0[b]	7.0[b]	0.2[b]	16.0[b]
Lima		87.0[c]	4.0[c]	110.0[c]
Mexico	.	<50.0[d]	<10.0[d]	
Santiago	<1.0[e]	20.0 / 13.0[f]	<10.0[e]	9.0[g]
Sao Paulo				

Source: Authors' compilation, based on:

[a] 2006, Maximum level in River Tunjuelo; Alcaldía Mayor SDA, 2008: 230.
[b] 2010, Riachuelo, average of 31 measuring points. Own calculation based on Acumar 2010.
[c] 2006, River Rímac, INEI, 2007: 58.
[d] Waste water of the Metropolitan Area is collected en led to the basin of River Tula; data presented refer to the measuring Point El Salto/ River Tula. Montelongo et al (2008): 13.
[e] Maximum level in the River Maipo basin. Cade-Idepe, 2004.
[f] First number: average maximum level in Maipu River (at Naltahua) second number: average maximum level in Mapocho River (at Pudahuel); Cade-Idepe, 2004: 163.
[g] 2004-2006, average level in Mapocho River; Cade-Idepe, 2007; 3-73.

The chemical pollution indicators present their most dramatic levels in Bogota due to the deficiencies of waste water treatment. In the River Tunjuelo they exceed around ten times the heavy metal and toxic agent limits defined by the WHO (see methodological notes). The defined limit for lead (Pb) and Cadmium (Cd) concentration is also exceeded in the main rivers of Santiago and most of all in Lima. The chemical pollution level of the Rio Rimac in Lima has been considerably reduced since 1990 (see chapter IV.C.4) but still presents in 2006 toxic agents concentrations far beyond the limits. A certain exception referring to the high water pollution level in Buenos Aires, presents the case of the relatively low heavy metal concentration in the Riachuelo River. Contamination of the Riachuelo River is mostly influenced by untreated domestic sewage and shows therefore high biological contamination rather than heavy metals.

BOX 9
METHODOLOGICAL NOTE TABLE 9: WATER POLLUTION AND QUALITY

Definitions:

Total Coliforms is used as an indicator for biological contamination in cities and is mostly generated by domestic sewage. The indicator refers to the number of bacteria per 100 ml of water which are capable of fermenting lactose at a temperature of 35 to 37ºC. Those with the same properties at 44 to 44.5ºC are considered fecal coliforms (OAU, 2009).

Dissolved O_2: "Amount of gaseous oxygen (O_2) present in water expressed in terms of weight relative to the volume of water (milligrams per liter)" (UN Stat, 2009). High levels of oxygen in fresh water indicate a low level of biological contamination.

BOD5: Biochemical Oxygen Demand. "Dissolved oxygen required by organisms for the aerobic decomposition of organic matter present in water" (UN Stat, 2009). Extremely high levels are an indicator for eutrophic situation and very high concentrations of organic material in water bodies.

Heavy Metals and other toxic agents: Potentially toxic metals in water bodies are mostly a product of industrial processes as well as a result of inadequate solid waste disposal. They can also be of natural origin, depending on the geological conditions. Among them are the following elements: cadmium (Cd), lead (Pb) and mercury (Hg). They –as also does the non-metallic arsenic (As)– have toxic characteristics for plants, animals and human life starting from very low concentrations and are especially problematic as they tend to accumulate in the food chain. Their concentration is presented as weight per volume of water μg/l.

Reference values:

- Coliforms: Drinking water norms require a total absence of coliforms.
- BOD5 below one mg/l water bodies are considered pristine, sewage water should leave treatment plants with maximum 20 mg/l.
- Heavy metals: The WHO Guidelines for drinking-water quality define the following maximum levels: Cadmium (Cd) 3 μg/l, Lead (Pb): 10 μg/l.
- Other sources recommend stronger criteria: Cadmium (Cd): 0.2 μg/l; Lead (Pb): one μg/l; Mercury (Hg) 0.1 μg/l; and Arsenic (Ar) 5 μg/l (Malpartida 2003: 86).

Source: Authors' compilation.

In the case of Sao Paulo, the Tietê River is chronically polluted with high concentrations of lead, cadmium and other heavy metals (UNDP, 2006: 143). There are two water treatment plants which belong to the Tietê River Depollution Program: *Barueri* and *Parque Novo Mundo* (Mora / Oliveri, 2006: 25). More detailed information on water management and drinking water contamination in the Tietê River basin will be discussed in chapter IV.F.5.

3. Energy and electricity consumption

The consumption of energy is considered as a sustainability field of high importance, as it mostly stands for i) consumption of fossil, not renewable energy resources and ii) emission of green house gases and other contaminating agents. An issue of importance is energy efficiency or intensity of energy both in households and industrial and commercial purposes. Residential use of electricity on a national level has shown continuous and rapid growth in the Latin American countries since the beginning of the 1990ies not only in absolute but also in per capita terms. In contrast, energy intensity in the respective countries industry has mostly been stable during the 1990ies (Altomonte et al, 2003: 39).

Energy consumption in general is dominated by the consumption of different transport means. Around 50% of the total energy consumption in Latin American metropolitan cities is dedicated to this use (Mexico City in 2004: 53%; Buenos Aires in 2000 49%) (UN Habitat, 2008: 160). This is a

significantly higher proportion than in the most industrialized countries but it is still below the level registered in the largest Asian cities. The reason for this difference is that cities in the developing world show different energy end-use distribution according to their size and stage of economic development.

TABLE 10
CARBON INTENSITY AND ENERGY EFFICIENCY

	Carbon intensity		Energy efficiency	
	Economy *(kg CO_2/1 000 US$ metropolitan GDP)*	Public transport *(kg CO_2/passenger)*	Public transport *(kWh/passenger)*	Water supply *(kWh/m^3)*
Bogota	53[a]	0.97-0.36[b]		
Buenos Aires	460[a]	1.3[c]		
Lima	181[a]	5.1[d]		
Mexico	172[a]		0.65[f]	2.10[h]
Santiago	440[a]	0.6[e]	0.54[g]	0.15[i]
Sao Paulo	330[a]			0.66[j]

Source: Authors' compilation, based on:

[a] Own estimation based on table 14a.
[b] 2006, Bogota D.C., the first number refers to regular busses, the second to Transmilenio; Alcaldía Mayor de Bogota SDA, 2007: 41.
[c] 2003, estimation based on Centro argentino de ingenieros and Atlas ambiental de Buenos Aires.
[d] 2007, estimation based on Paredes et al., 2006 and Chinchay.
[e] 2004, MOPTT and SECTRA.
[f] 2008; only Metro System. Own calculation based on Metro D.F., 2009.
[g] 2007; only Metro System. Own calculation based on Metro S.A., 2008: 5.
[h] 2003 estimated, includes the use of groundwater pumping in the Valle de Mexico and the energy intensive Cutzamala System, Castelán, 2002: 4
[i] 2007, area covered by Aguas Andinas, own calculations based on Aguas Andinas, 2008: 37 and 38.
[j] 2008, area covered by Sabesp, Sabesp, 2009: indicator table.

High carbon efficiency can be observed in the metropolitan cities of Bogota, Lima and Mexico City, while Buenos Aires, Sao Paulo and Santiago de Chile suffer from extremely high CO_2 emissions per US$ generated (GDP). Carbon efficiency of public transport presents a very different picture. It is shown how Transport system in Santiago and Buenos Aires (each with a Metro System) and Bogota (most of all the Transmilenio system) are more energy-efficient. Electricity efficiency of transportation system can be presented only for those cities which have a metropolitan subway or urban train system. These issues will be discussed in the case study sections on urban transport (IV.D.3 and IV.E.6) and in the case of Mexico in the section on Economic Structure.

Another aspect of electricity efficiency is the drinking water supply system. Due to the need of long-distance transportation of water the water supply system in Mexico City and Sao Paulo is highly energy intensive. In terms of electricity efficiency of the economic activities the values of the analyzed cities are quite similar with values between 0.30 and 0.40 kWh/US$ (see table 11). Only Mexico presents a much more efficient economic system in terms of the use of electricity.

In terms of **electric energy consumption** Buenos Aires, Santiago de Chile, Sao Paulo and Bogota present the highest residential as well as total electricity consumption levels, while Lima and Mexico show considerably lower level. A remarkable case is Mexico City with low domestic electricity consumption per capita in spite of low energy price.

TABLE 11
ELECTRIC ENERGY CONSUMPTION

	Electric energy consumption		Electricity efficiency	Price of electricity
	Total *(kwh/cap/year)*	Residential *(kwh/cap/year)*	Total *(kwh/1 US$. GDP)*	*(US$ ppp/ kWh)*
Bogota	885[a]	492[s]	0.32[a]	0.21[n]
Buenos Aires	3 465[b]	1 230[b]	0.21[j]	0.25[o]
Lima	1 067[c]	187[g]	0.35[k]	0.21[p]
Mexico	1 534[d]	277[h]	0.10[l]	0.13[q]
Santiago	2 315[e]	637[e]	0.35[m]	0.50[r]
Sao Paulo	2 388[f]	947[f]	0.31[f]	

Source: Authors' compilation, based on:

[a] 2003, Bogota D.C., own calculation based on Banrep, 2004; SDP 2007c and Table 1.
[b] 2006, City of Buenos Aires, own calculation based on: GCBA DGEC, 2008, cuadro 13.1.
[c] 2003, Departamento Lima Minem, 2004.
[d] 2006, Mexico D.F., SIE, 2010.
[e] 2005, Metropolitan Region, own estimation based on INE, 2006b: 2.
[f] 2008, Municipio de Sao Paulo, Secretaría de Saneamiento e Energia, 2009.
[g] 2007, national level, Minem, 2008: 5 and INEI, 2007: 111.
[h] Mexico: Energy Consumption: DF.
[j] 2006, City of Buenos Aires, own calculation based on GCBA DGEC, 2008, cuadro 13.1 and cuadro 11.2.
[k] 2003, Departamento Lima, own calculation based on Minem, 2004 and INEI, 2007: 799.
[l] 2006, own estimation based on SIE, 2010.
[m] 2005, Metropolitan Region, own estimation based on INE, 2006b: 2 and central bank data base.
[n] 2007, Bogota D.C., El Espectador 2008.
[o] 2008, City of Buenos Aires, Oceba, 2009: 1.
[p] 2010, maximum tariff, Lima, OSINERG 2010.
[q] 2005, national level, only domestic users, CFE, 2010.
[r] 2009, maximum level, metropolitan region, Chilectra 2009.
[r] 2006, Bogota D.C., own calculation based on SDP 2007b: 1.

BOX 10
METHODOLOGICAL NOTE TABLE 10 AND11: ENERGY AND CARBON EFFICIENCY; ELECTRIC ENERGY CONSUMPTION

Table 11 is comprised of indicators representing **electricity consumption** per capita a year as a standardized indicator. The standardization per year is important as this indicator may present important variations according to the characteristics of different seasons in some climatic zones. The electricity consumption indicators are related to economic development and general consumption levels on the one hand and production activities on the other hand. Therefore, it is relevant to distinguish between domestic use and total consumption. Furthermore, they show a direct relation to the availability of natural resources as well as to the price level of related services. The main limitations of these indicators are caused by relevant proportions of clandestine connections to the electricity supply system.

It is important to complement the consumption data with an indicator of **electric energy efficiency**, defined as the relationship between electric energy consumption (as sum of produced electricity) and the total GDP at current prices. Electricity efficiency also depends on the **price level of electricity**, as this presents an important incentive to improve efficient electricity use by private households as well as by different organizations. The price level is presented in US$ / kWh using current exchange rates of the respective year.

Efficiency criteria are crucial in terms of sustainable development, access to resources and mitigation of climate change (Bárcena 2009). They are in the focus of Table 10. **Energy efficiency** is presented for two specific sectors related to public policy in metropolitan areas: public transport and water supply system. **Carbon intensity** is presented as carbon dioxide emission per GDP unit representing thus an

indicator of the environmental impacts of economic activity as a whole and especially the transport sector.

Reference values:

- Electric power consumption (kWh per capita and year): Sub-Saharan Africa: 542; Latin American and Caribbean: 1,715; Euro Area: 6,926; Mozambique; 450; Uruguay; 2,007; Germany; 7,111. This comparison is problematic as the values of electric power consumption date from 1998 (World Bank, 2005; UN Habitat, 2007).
- Electricity Efficiency (kWh/US$ GDP): United States of America: 0.33 (EPRI, 2009)
- Price of Electricity (US$ ppp/ kWh): there is no target value.

Source: Authors' compilation.

Furthermore the use of electricity in Buenos Aires in total terms also shows the highest level of electric energy consumption among the analyzed cities in spite of the domination of service sector activities, requiring a lower energy input than manufacturing industries. Electricity generation in Argentina is dominated (55%) by the use of fossile energy sources (Atlas Ambiental de Buenos Aires).

Santiago de Chile shows ambiguous indicator values: in spite of relatively expensive electricity prices, the use of electric energy is high. The high consumption level in Santiago is furthermore influenced by copper mines like "La disputada de las Condes" which increases the use of energy per capita. Not owning fossil energy resources, the issue has received strategic importance on a national level, presenting a relative low participation of fossile energy resources in the generation of electricity (43%, INE, 2006b) and an important use of hydro-power. Therefore, in the city profile of Santiago, a section on energy issues (see IV.E.5) will be included.

4. Solid waste production and management

This chapter discusses, in a manner similar to that of the case of water and energy consumption, the impact of economic development on the consumption of natural resources. The amount of solid waste produced is related directly to income levels of the urban settlements (Brautigam, 2008: 7), as a higher income level is correlated in general to an increased consumption level, hence producing elevated levels of waste e.g. due to packaging. This relationship between income, consumption, purchasing patterns and lastly waste production is confirmed by an analysis of waste composition in different income groups which shows a clear tendency towards higher percentages of plastics in wealthier areas, meanwhile in low-income sectors biological components dominate by far. Therefore, the production of solid waste is also determined by unsustainable life styles (PNUMA, 2003f: 39). The production of solid waste is represented per capita in order to permit a direct comparison among the presented cases; while, solid waste disposal as tons/year indicates the total amount which is disposed of in the given area and the effects on its respective ecological system. Finally, uncollected solid waste as a percentage of total waste production indicates the effectiveness of the collecting system.

The level of **solid waste production** is directly related to the level of per capita income of the cities (see also table 24). High levels of waste production are registered most of all in Santiago de Chile, Sao Paulo, and Buenos Aires, while Mexico has an intermediate position and Bogota and Lima show the lowest levels of waste production. Such a relationship between high income and high waste production level can also be observed at the local level by analyzing the specific waste production on a socio-economic basis. For example in Buenos Aires the highest income group (socio economic level A) produces an average of 0.96 kg/capita/day. Lower socio economic sectors show gradually decreasing waste production levels: B (0.92) C (0.85) D (0.75) (PNUMA, 2003b: 72).

TABLE 12
DOMESTIC SOLID WASTE PRODUCTION AND DISPOSAL

	Solid waste production *(per capita)*		Solid waste disposal *(Tons/year)*	Uncollected/ improperly disposed *(Estimated, In percentages)*	Emissions of landfills
	Domestic *(Kg/cap/year)*	Total *(Kg/cap/year)*			CH_4 *(Tons/year)*
Bogota	267[a]	442[g]	1 792 211[l]	2-40[q]	25 200[v]
Buenos Aires	281[b]	606[h]	5 300 000[m]	10-27[r]	
Lima	246[c]	310[i]	2 164 893[n]	14-30[n]	
Mexico	210[d]	438[j]	6 518 900[o]	23[s]	168 240[w]
Santiago	462[e]	949[k]	2 578 697[p]	Aprox. 0[t]	60 000[x]
Sao Paulo	380[f]	726[z]	5 235 195	10[u]	176 000[y]

Source: Authors' compilation, based on:

[a] 2002, D.C. PNUMA, 2003a: 82.
[b] 2008, City of Buenos Aires, Cedem, 2009: annex 2.5.3.
[c] 2006, Lima Metropolitana, CONAM, 2009a.
[d] 1997, own calculation based on Mora Reyes, 2004: 12-13.
[e] 2005; RMS, own calculation based on CONAM, 2006.
[f] 2001, Prefeitura de Sao Paulo, PNUMA, 2003e: 54.
[g] 2002, D.C. PNUMA, 2003a: 82.
[h] 2001, City of Buenos Aires, PNUMA, 2003b: 71.
[i] 2006. Area not specified; own calculation based on PNUMA, 2006: 3.
[j] Year not specified, ZMCM, PNUMA, 2003c: 46.
[k] 2005, area not specified, RHM experts information and own calculation.
[l] 2002; Bogota D.C. PNUMA, 2003a: 82.
[m] 2002, Gran Buenos Aires, aproximation based on PNUMA 2003b: 100.
[n] 2007, Lima Metropolitana SINIA, 2010; second number 2006, estimation by CONAM experts, cited in PNUMA, 2006: 3.
[o] 1999; disposal capacity (per year), Mora, 2004: 50.
[p] 2006, Metropolitan Region, INE, 2008b: 161.
[q] First number is estimation of Brautigam, 2008: 18; 2002, D.C. own estimation based on the difference between produced and disposed waste, PNUMA, 2003a: 82.
[r] 2001, Gran Buenos Aires, PNUMA, 2003b: 97 and 100.
[s] 2000, Mexico D.F.; Mora Reyes, 2004.
[t] RHM expert's information.
[u] 2001, Prefeitura de Sao Paulo, not collected domestic waste as percentage of generated domestic waste, PNUMA, 2003e: 54.
[v] Only the Doña Juana landfill. Observatorio DAMA 2009: 3.
[w] 2000, ZMVM; INEGI, 2005b, 156.
[x] 2009, area not specified, RHM experts estimation.
[y] Municipio do Sao Paulo. Secretaría Municipal de Verde e do meio Ambiente de Sao Paulo, 2005: 16.
[z] RMSP. Year not specified. CEPAL, 2010: 115

Waste production dynamic is clearly overpassing GDP growth. In the case of Santiago, throughout 1981-2001, waste production grew at a rate of 5.7% per year (Zurita, 2006), which is significantly higher than the GDP growth rate. Nevertheless, this growth is partially explained by the increase of the collection rate from around 70% to almost 100%. The major part of collected waste corresponds to organic materials. Nevertheless, this has decreased substantially for 30 years from almost 75% to around 40% of the total weight of collected waste (1973-2000). This relative reduction corresponds to an increase of paper (16% to 21%) and most importantly of plastics (2% to 14%) due to the rise of packaging of consumer products. This trend is confirmed by the clear correlation of composition of solid waste with socio-economic level: the highest relative participation of plastics and paper is registered in the highest income areas; while, low socio-economic groups have a higher participation of organic material in solid waste production.

The last indicator – CH4 emissions of landfills is a indicator of options for the generation of energy by incineration of landfill gases. This in area which has been developed in the last years in Latin America: for instance in the metropolitan region of Sao Paulo the Bandeirantes landfill counts with a capacity of 20 MW (CEPAL 2010: 114).

BOX 11
METHODOLOGICAL NOTE TABLE 12: WASTE PRODUCTION AND DISPOSAL

The indicator **solid waste production** refers to municipal solid waste, not including industrial and construction waste and is measured in weight units per capita and year. It refers to the total amount of waste production, and cannot be calculated on the basis of collected waste but is generated by official local estimation. This indicator is oriented to the discussion of consumption of natural resources and the use of the natural environment as a sink.

By contrast, the other indicators (**solid waste disposal** and uncollected **or improperly disposed** and **CH4 emissions of waste disposal**) provide information for the analysis of efficiency and formalization of the waste disposal services, recollection and the technology applied in landfills. Hence, these indicators are related to the Habitat Agenda Goal to reduce urban pollution. Improperly treated solid waste causes serious pollution problems as it affects air quality, soil and aquifers in a short term as well as on a long term basis.

Solid waste disposal refers to the weight of solid waste which is collected and disposed of in landfills and is presented in this table as an absolute number (tons per year) as it is considered in the present context as an indicator of pressure of the metropolis on the natural environment. There are some limitations in terms of reliability of data as it is information reported by licensed enterprises in charge of waste management in the cities and hence, is not official data.

Uncollected or improperly disposed waste is defined as the percentage of solid waste which is not collected and / or not disposed of in sanitary landfill; incinerated in specialized plants or recycled. This fraction is frequently disposed of illegally or burned in an uncontrolled manner.

Reference values:

- Solid waste Production: per capita and year (total): Hanoi 100, San Francisco 100 (aprox.; UN Habitat, 2008: 129). Estimation for Latin American Cities with more than 1 million inhabitants: Domestic 380kg per capita and year, total 845kg per capita and year. OECD countries are reported to produce 730 kg/capita and year (Terraza 2009: 11)
- Uncollected and improperly disposed waste: target is 0%.

Source: Authors' compilation.

In the mid 1990's, the highest waste production per capita was registered in Sao Paulo (482 kg/capita/year) and Mexico D.F. (438); Buenos Aires and Santiago de Chile registered around 320 kg/year and with a clearly lower level of waste production in Bogota (270) and Lima (200) (Acurio et al, 1997).

The value of **solid waste disposal** in absolute terms (metric tons per year) is primarily determined by the size of the metropolitan area and indicates the level of environmental impacts caused by consumption patterns. For instance, in Buenos Aires one can identify a very high level of waste disposal that is even higher than in Sao Paulo and almost as high as in Mexico City in spite of the smaller size in terms of population. This represents a challenge of outstanding importance for the waste management system in Buenos Aires –which is why this will be discussed specifically in the case of the Argentinean capital (IV.B.4). The waste disposal issue is of high relevance as incineration and composting have not been implemented successfully in Latin American Cities so far (Bräutigam, 2008). In the case of Mexico D.F., the Special Program for Climate Action of the Federal District estimates that total amount of waste will increase by 130 tons per day each year, which will exacerbate the situation of deposit and treatment, since all of the entities are currently saturated. Furthermore in the case of Mexico

and Lima there are not only scarce deposition capacities but also existing landfills are in a high percentage of poor or only fair quality (Brautigam, 2008: 18). In Bogota the quality of waste disposal and treatment is questioned by the local expert and the Doña Juana landfill will probably soon reach its maximum capacity.

With regard to the pollutive effects of waste production, of higher importance is the percentage of **uncollected waste** and waste that is not properly disposed, as this provokes direct pollution of water bodies, soil and the global atmosphere. High levels of uncollected waste are due to a lack of appropriate waste management. High levels of uncollected waste are reported from Bogota, Mexico City, where the informal collection has importance and in Lima. In Lima there are still persisting failures of the waste collection and disposal system in the metropolitan region in spite of its regulation and privatization in 2000 (see chapter IV.C.5). High amounts of waste are either burned, disposed of directly into the main river or in illegal dumps.

Concerning Climate Change effects is the **emission of the greenhouse gas CH_4**. Obviously the absolute amount of pressure (emission of tons of CH_4) is directly related to the size of cities. Mexico City and Sao Paulo show the highest amounts. For mitigation, the capture and use of this gas is nowadays an important technical option. In Santiago de Chile around 50% of the landfill gas are captured and flared and therefore do not contribute to climate change as methane (RHM experts information).

Formal **recycling systems** still have a relatively low importance in the cities analyzed and this potential is still not sufficiently used in Latin American Countries in general (CEPAL, 2010: . Nevertheless according to official sources and RHM experts in Santiago 12.6% of solid domestic waste is recovered as material or energy (Krellenberg et al., 2010: 19; Conama, 2006). In the case of Sao Paulo it is estimated that more than 40.000 tons are recycled (Prefeitura da Cidade de Sao Paulo, 2009). According to the cited local governmental institution this corresponds to 7% of the total solid waste – using the values of table 11 it would be 0.76%. A high percentage of informal waste collection is observed in Bogota. It is estimated that around 18,000 families depend on informal waste collectors, which are also the initial point of the chain of recycling which accounts for more than 600 tons/day, summing around 216,000 tons per year (or 8.1% of the total amount of solid waste; PNUD, 2008: 105). Mexico is an example for the economic and social importance of informal waste management system: in the ZMVM an estimated 25,000 to 30,000 persons –known as *pepenadores*– are working in informal waste collection and recycling (Mora Reyes, 2004: 55).

Waste Management in the six Metropolitan Cities is characterized by a high participation of the private sector, primarily organized as subcontracting of private firms by the municipalities frequently dominated "privatization" (Acurio et al, 1997: 34). In the case of Lima up until the end of the 1990's, municipalities organized their waste management in an independent manner. In this system, micro-enterprises of manual waste collection have been important actors in some areas also showing a significant trend towards diversification of their activities, starting from simple recollection towards an integrated service including separating, recycling, disposal etc. (Acurio et al, 1997: 35). Since 2000 a private sewage management system under governmental control has been implemented, which is presented shortly in the City Profile Lima (chapter IV.C.5). In Santiago de Chile this service, like many others, has been completely privatized and is coordinated (as in the case of Lima) by the municipalities. There are three sanitary landfills in Santiago de Chile (Lomas los Colorados; Santa Marta / Talagante and Santiago Poniente) which operate under exclusive contracts with the municipalities of the Metropolitan Region.

5. Motorization and transportation

The following chapter discusses selected issues of transportation and transport infrastructure, including individual and private transport as well as public transport systems. Nevertheless, the emphasis of this section is on persons mobility, omitting here freight transport issues. The latter is difficult to compare as it depends less on the internal structure of metropolitan cities and more on its position in global and

national networks and of material flows. Freight transport affects the use of the urban transport infrastructure in general less than commuting, as the major parts of the carried goods are oriented towards logistic centers outside the cities e.g. in harbours. Nevertheless transport movements resulting from the distribution of goods within the city itself are highly relevant but their origins and destinations are highly dispersed and information rare (consultation of RHM experts).

In spite of freight transport's importance, here we focus on the persons mobility issue. The challenge of public transport is a complex topic of high impact on the governance of megacities due to its direct impact on the opportunities of mobility and communication in large part on the society. Furthermore, it has implicit effects on the economic competitiveness and social cohesion as well as a direct and outstanding impact on quality of life and air pollution.

TABLE 13
TRANSPORTATION

	Motorization rate *(Vehicles/ 1 000 inh.)*	Modal split			Public transport Tariff *(In US$ ppp/trip)*	Travel time per trip *(In minutes)*
		Private automotive *(In percentages of trips)*	Bus & Metro *(In percentages of trips)*	Bicycle & walking *(In percentages of trips)*		
Bogota	141[a]	14.7[e]	57.2[e]	17.3[e]	1.39[h]	37[n]
Buenos Aires	250[a]	36.9[e]	36.0[e]	12.9[e]	0.69[i]	
Lima	93[a]	11.2[e]	55.5[e]	25.4[e]	0.85[j]	45[o]
Mexico	170[b]	18.9[f]	78.6[f]		0.28[k]	75[p]
Santiago	137[c]	25.2[g]	32.4[g]	36.7[g]	1.14[l]	45[q]
Sao Paulo	314[d]	30.2[f]	36.9[f]	32.9[f]	1.58[m]	100[p]

Source: Authors' compilation, based on:

[a] 2001, areas not specified, Figueroa, 2005: 50.
[b] 2004, ZMCM; APERC, 2007: 79.
[c] 2006, Metropolitan Area Gran Santiago, SECTRA 2010.
[d] 2006, RMSP; Emplasa, 2009: 99.
[e] Year and area not specified, Urban Age Program, 2009: 23 (2-9).
[f] 2004, Mexico City, only motorized trips; APERC, 2007: 24.
[g] 2001, Area covered by the origin-destiny survey, slightly larger than AMS, public transportation, SECTRA, 2004; 26.
[h] 2008, only Transmilenio, own calculation based on http://www.transmilenio.gov.co.
[i] 2008, only metro (Subte); own calculation based on http://www.subte.com.ar.
[j] 2004, area not specified, calculation based on Figueroa, 2005: 45.
[k] 2002-2009, Metro only, the tariff has been incremented in 2010 by 50%. http://www.metro.df.gob.mx/ organismo/costoboleto.html
[l] 2008, metro tariff permits free transfer to Transantiago busses. Since 2008 the tariff has been augmented considerably. Own calcultation based on http://www.transantiagoinforma.cl
[m] 2010, metro tariff, permits change to busses with a reduced price http://www.metro.sp.gov.br.
[n] 2004, Bogota D.C., Universidad Nacional de Colombia, 2009.
[o] 2004, Metropolitan Area of Lima and Callao, JICA: 3
[p] Year and area not specified, Vincent, 2008: 5.6.
[q] 2001, Area covered by the origin-destiny survey, slightly larger than AMS, SECTRA, 2004; 45.

As shown in table 13, there is a evident difference between the very high **motorization** level of Sao Paulo and in Buenos Aires on the one hand and Lima on the other hand –Santiago, Mexico City and Bogota being in a intermediate position. These numbers are related to income level not only comparing different cities but also in a long-term analysis. In Santiago for instance there has been registered rapidly growing motorization rate during the 1990ies and the number of registered cars is still growing considerably faster than the GDP. Nevertheless the motorization rate was at the beginning of the new millennium still far below the rate of 250 (per 1,000 inhabitants), which was predicted using a regression model based on income indicators (Echeñique, 2006: 92).

BOX 12
METHODOLOGICAL NOTE TABLE 13: TRANSPORTATION

In accordance with the Habitat Agenda Goal, effective and environmentally sound transportation systems should be promoted. This table presents indicators of sustainability of urban transport systems. The motorization index, defined as the number of registered private cars /1,000 inhabitants, as well as the percentage of daily trips ("modal split", see below) made in private cars may be regarded as pressure indicators (UNEP, 2004 35/36), as the individual motorized mobility is the main source of air pollution and greenhouse gas emissions and an important pressure on the environmental system as well as a cause of economic losses due to traffic jams. It is nevertheless also an indicator of the income level and economic development of a society. The motorization index presents major difficulties as it is not specified in all of the cases which kind of vehicles are included, although it should refer only to private cars. Furthermore, even the concept of private cars includes some deficiencies as these may also be used for labor purposes.

According to UN Habitat modal split refers to the participation of different transport modes in daily commuting: Percentage of total work trips undertaken by: a) private car; b) train, tram or ferry; c) bus or minibus; d) motorcycle; e) bicycle; f) foot; g) other modes. (UN Habitat, 2004: 44). Nevertheless due to data availability, the indicators on Modal Split are shown here as average of all trips, not taking into account the purpose and only regarding private cars, buses and (in those cities where it exists) underground rapid urban transport systems (Metro). They indicate the attractiveness of a public transport system, considering this to be, in general, a more energy efficient and sustainable transport mode than the use of private cars.

Nevertheless, a high percentage of the use of public transport (most of all the metro) may also indicate major problems of vial infrastructure and congestion and it is influenced by the level of income and welfare.

Travel time: Average time in minutes for trips as an average for all modes of transport.

Public Transport Tariff: Represents the cost of a single trip in public transport. The indicator refers to the average cost in different public transport means.

Reference values:

- Motorization index: San Francisco 649; Shanghai 47; Beijing 80; Seoul 205; Bangkok 324 (data from 2004, APERC, 2007: 11 and 14).
- Modal split: Car use as percentage of all passenger trips in the Pacific Area: San Francisco/USA 83.7% Shanghai 16.0%; Beijing 29.8% (data from 2004 and 2005, APERC, 2007: 24).

Source: Authors' compilation.

This pattern is reflected only partially by the use of private automobiles in the **modal split of urban transport trips**. In the case of Sao Paulo and Buenos Aires, the high motorization index corresponds to a relatively high participation of automobile trips. The high percentages of bus trips in Lima and Bogota are a direct consequence of the absence of a metro system. In the same manner the low motorization in Lima causes a low participation in the modal split. By contrast, one can observe a certain deviation from this pattern in Santiago de Chile. The Chilean capital shows a relatively high participation of private cars in daily trips –in spite of the still low motorization rate. Furthermore it is very likely that this participation is today considerably higher due to the persistent growth of urbanization rate (shown data are from the origin-destiny-survey realized in 2001). It has also to be considered that automobile use is socially segregated, presenting an extremely high participation in high income sectors and almost zero in low income sectors (Echeñique, 2006b: 465). The specific pattern of suburban growth implies the necessity of frequent displacements by private cars. In the case of Santiago (Echeñique, 2006b), as well as in the case of Bogota, one can observe a higher number of daily trips in high-income sectors than in low come sectors.

High participation of public transport, for instance in Mexico City, is a combination of income, low public transport tariff, congestion pressure but also the fact, that the city has a large network metro which stands alone for 14% of urban trips. Nevertheless, in most of the Latin American metropolitan cities, one can observe some decay of public transport participation in the long term: for instance in Mexico City, public transport participation decreased from 80% (1984) to 72% (1994); in Sao Paulo the decline started from an already low level in 1977 (46%) to 33% in 1997. The most problematic level can be stated for the case of Sao Paulo, which presents high motorization, intense use of automobiles in daily commuting trips, long travel distances and moreover an expensive public transport tariff.

Average duration of travel in Santiago de Chile, Bogota and Lima is around 45 minutes and in the case of Mexico City and Sao Paulo are clearly above one hour (75 and 100 minutes respectively) reflecting the most urgent congestion issues in the last mentioned metropolitan cities.

The urban transport system will be discussed for each of the six metropolitan cities in the City Profile section as this issue is a crucial one, directly impacting the consumption of resources, pollution levels, spatial structures, and social differentiation among others.

6. Air pollution and emission of green house gases

Air pollution is considered to be one of the most important issues related to the human health in megacities. Due to the high amount of emissions originating from industry, heating, and traffic etc. and high population density many people are suffering from air pollution. In contrast to other risks, options to avoid these risks by individual behavior are very limited even in the indoor environment (Franck et al, 2006). According to experts of the RHM research initiative air pollution is shortening the average life expectancy much more than other risks as crime, floods, and ea rth quakes.

This chapter contains two different perspectives on air pollution: the first one addresses absolute emission of contaminants as an element of pressure on the environment, the second presents concentration values of different contaminants within the urban areas in order to indicate their impact on human health.

The level of **carbon monoxide emissions** in Mexico and in Sao Paulo is around ten times higher than in Santiago. As carbon monoxide emissions are caused mainly by traffic, this is a result of the high absolute number of vehicles in Mexico, the larger distance of trips, and congestion. In absolute terms, in Lima almost 80% of the total emissions of air contaminants are caused by automotive transportation (Ecoamerica, 2008). Buenos Aires presents also a high level as the data shown refer only to the City of Buenos Aires. High emission of carbon monoxide is caused by low technical standard and relative high age of the used vehicles.

Sulfur emissions are caused by transport (diesel consumption) and industrial production processes are their main source. The implementation of fuel standards plays a crucial role in politics aiming to reduce sulfur pollution levels. Legal standards of sulfur concentration in diesel fuels are quite different in the six metropolitan regions: In 2005, the limit in Lima was 3,000 ppm, in Sao Paulo 2,000 ppm, in Buenos Aires 1,500 ppm and in Bogota 1,200 ppm. In Mexico only diesel with 300 ppm sulfur was allowed and Santiago registered the most restrictive norm which permits only 50 ppm. By 2010, all six of the cities will apply legal limits between 15 and 50 ppm (Simioni, 2006: 8). As a result the highest value is observed in Sao Paulo, meanwhile Santiago and Mexico show lower emissions.

TABLE 14-A
EMISSION OF CONTAMINANTS

	CO_2 *(Million t/year)*	CO *(t/year)*	SO_2 *(t/year)*	NO_x *(t/year)*
Bogota	2.3[a]	316 594[a]	7 532[a]	17 808[a]
Buenos Aires	23.0[b]	243 007[k]		57 261[k]
Lima	4.7[c]	329 814[g]	11 261[g]	70 501[g]
Mexico	37.7[d]	1 990 806[h]	6 913[h]	194 689[h]
Santiago	13.9[e]	187 439[i]	9 991[i]	56 921[i]
Sao Paulo	15.7[f]	1 535 100[j]	25 200[j]	353 200[j]

Source: Authors' compilation, based on:

[a] 2006, Bogota D.C. Alcaldía Mayor de Bogota SDA, 2007: 18.
[b] 2005; City of Buenos Aires; Puliafito et al. 2010.
[c] 2000, Lima and Callao, PNUMA 2005: 92.
[d] 2006, ZMVM; Secretaría del Medio Ambiente, 2008b: 25 and local expert information.
[e] 2002, Region Metropolitana Santiago, Barton et al, 2007: 69.
[f] 2003, City of Sao Paulo; Secretaria Municipal do Verde e do Meio Ambiente de Sao Paulo, 2005: 17.
[g] 2000, Lima-Callao, only mobile sources, Korc / Bello, 2000: 3.
[h] 2006, ZMVM; Secretaría del Medio Ambiente, 2008c.
[i] 2000, RMS, Katz, 2006: 352.
[j] 2007, UGRHI Alto Tietê; Governo do Estado do Sao Paulo, 2008: 91.
[k] Year not specified, City of Buenos Aires; Mazzeo 2008.

TABLE 14-B
EMISSION OF CONTAMINANTS

	VOC *(t/year)*	NH_3 *(t/year)*	CH_4 *(t/year)*	PM10 *(t/year)*	PM 2.5 *(t/year)*
Bogota	53 171[a]		48 933[a]		4 569[h]
Buenos Aires	167 568[b]				22 000[i]
Lima	72 512[c]			8 664[l]	
Mexico	566 061[d]	19 936[d]	250 900[f]	23 053[d]	6 191[d]
Santiago	80 091[e]	29 350[e]		2 382[k]	1 630[k]
Sao Paulo			176 390[g]		61 600[j]

Source: Authors' compilation, based on:

[a] 2006, Bogota D.C., Alcaldía Mayor de Bogota SDA, 2007: 18.
[b] 2003, AMBA, VOC not including methan, Secretaría de Ambiente y Desarrollo Sustentable de la Nación, 2009.
[c] 2000, Lima-Callao, only mobile sources, Korc / Bello, 2000: 3.
[d] 2006, ZMVM; SMA, 2008c.
[e] 2000, RMS, Katz, 2006: 352.
[f] 2006, ZMVM, Secretaría del Medio Ambiente, 2008: 25.
[g] 2003, City of Sao Paulo, Secretaria Municipal do Verde e do Meio Ambiente de Sao Paulo, 2005: 16.
[h] 2006, Bogota D.C. The value presents the total amount of all PM fractions. Alcaldía Mayor de Bogota SDA, 2007: 18.
[i] 2000, AMBA, PNUMA, 2003b: 70.
[j] 2007, UGRHI Alto Tietê; Governo do Estado do Sao Paulo, 2008: 91.
[k] 2005, Metropolitan Region, INE 2008b: 111.
[l] 2000, Lima and Callao, includes PM10 and PM2.5, PNUMA 2005: 92..

Among air pollutants, particulate matter (PM2.5, PM10) is playing a very important role having adverse health impacts (Pope et al, 2009). Different sizes of airborne particles mainly come from different sources and need different mitigation strategies. Newer findings suggest that not only particle

mass but particle number is a relevant factor too. Traffic and combustion processes are typical sources for high numbers of airborne particles.

BOX 13
METHODOLOGICAL NOTE TABLE 14: EMISSION OF AIR CONTAMINANTS

The indicators presented in this table are related to the Millennium Development Goal 7, which explicitly addresses environmental sustainability. Total emissions of contaminating gases refer to the impact and pressure which is exercised by the metropolitan cities on the natural environment. The issue of intensity and energy efficiency has been discussed in table 10.

In terms of sustainability, the analysis of these indicators must take into account the level of income and economic activities, as higher production and consumption levels typically cause a rise in pollution. Nevertheless, advanced technology also provides possibilities to fulfill higher emission standards and the implementation of higher efficiency in energy use which may lower CO2 emissions per GDP unit.

The **main sources of emissions** of atmospheric pollution vary in function of local conditions, industrial structure and quality standards; nevertheless, some general characteristics can be identified (percentage of emissions by source refer to Santiago; Katz, 2006: 351).

- Carbon Monoxide emissions in general are produced almost completely (more than 90%) by mobile sources (in Santiago private cars cause almost 50% of total CO emissions).
- NOx: This contaminant is caused mainly by mobile sources (¾ of total emissions; mainly automotives) and industry (around ¼), residential uses are, in a very low proportion, a further source of NOx emissions.
- SO2: Sulfur dioxide is produced mainly by industry (around 1/2) and a further 1/3 is the result of mobile sources.
- Volatile Organic Compounds (VOCs): Are produced mainly through the use of liquid fuels and some chemical products such as paintings, etc. –their emission increases in the case of incomplete combustion. VOCs react with the atmosphere under the influence of solar radiation generating Ozone (O3) (CONAMA, 2009).
- Particulated Material (PM10): refers to material with a diameter below 10 µm contained in the air which enters the respiratory system of human beings as a result of its size. The larger fraction of the PM10 (between 2.5 and 10 µm) consists mainly of antropogene dust. This material is accumulated by the respiratory system (lungs) producing various health risks, among them cancer.
- PM2.5: Corresponds to the finest fraction of the PM10, with a size below 2.5 µm, which presents major health risks. They are formed mainly by acid and highly toxic products of combustion (CONAMA, 2009).

All data presents total emissions in tons per year representing the total pressure on regional environmental / biological system. Relative data on concentration are presented in table 15.

Source: Authors' compilation.

In part, extremely high levels of air pollution are affecting inhabitant's health; increasing car use, inappropriate spatial location patterns, permissive legal frameworks and weak controls may be identified as the main causes (Rivadeneira, 2000: 42). The relevant indicators concerning effects on public health are concentration levels, and not absolute or relative emission indicators.

Table 15 shows the high levels of the primarily traffic caused carbon monoxide concentrations most of all in Lima and Santiago de Chile but also in Bogota and Sao Paulo, meanwhile the other cities present reduced levels of this carbon monoxide pollution. By contrast, the industry related Sulfur Dioxide, NOx and PM10 concentration is highest in Buenos Aires; meanwhile Santiago presents the lowest pollution level by far.

TABLE 15
CONCENTRATION OF MAIN AIR CONTAMINANTS

	CO (mg/m^3)	SO_2 ($\mu g/m^3$)	NO_x ($\mu g/m^3$)	PM10 ($\mu g/m^3$)	O_3 ($\mu g/m^3$)
Bogota	11.6[a]	39.9[g]	26.7[m]	68[q]	319[w]
Buenos Aires	6.1[b]	227.0[h]	272.0[b]	42 - 59 [r]	
Lima	24.9[c]	26.8[i]	79.2[i]	81[s]	
Mexico	2.5 / 7.5[d]	31.9[j]	129.9[n]	56[t]	178 / 360[x]
Santiago	18.1[e]	9.0[k]	39.0[o]	68[u]	337[x]
Sao Paulo	9.7[f]	43.0 / 7.0[l]	83.0[p]	41[v]	285[y]

Source: Authors' compilation, based on:

[a] 2002, Bogota D.C. maximum 8h dynamic average, Veeduría Distrital de Bogota, 2003: 25.
[b] 2003, City of Buenos Aires, PNUMA 2003b: 77.
[c] 2004; four measuring points, average. Walsh 2004; 4.2-2.
[d] 2004, ZMCM, first number: average, second number: maximum; own calculation based on INEGI 2005, table 2.7.
[e] 2004, seven measuring points in AMS (network MACAM 2), max. eight hours dynamic average. SINIA, 2007: 24.
[f] 2007, eleven measuring points in RMSP, maximum eight hours dynamic average; CETESB, 2008: 105.
[g] 2002, annual average of eleven measurement points, Veeduría Distrital de Bogota, 2003: 23.
[h] 2003, City of Buenos Aires, maximum level; own calculation based on PNUMA 2003b: 77.
[i] 2008, Lima Metropolitana, annual average of four measurement points; INEI, 2009.
[j] 2004. ZMCM, own calculation based on INEGI 2005, table 2.7.
[k] 2004, seven measuring points in AMS (network MACAM2), annual average of 24hs concentration, SINIA, 2007: 26.
[l] First number: 1995-2001; World Bank, 2007b: 174; second number UN Habitat, 2008: 167.
[m] 2002, annual average ten measurement points, Veeduría Distrital de Bogota, 2003: 24.
[n] 2004. ZMCM, own calculation based on INEGI 2005, table 2.7.
[o] 2004, seven measuring points in AMS (MACAM2), annual average NO_2, SINIA, 2007: 25.
[p] 1995-2001, World Bank, 2007b: 174.
[q] 2006, Bogota D.C., Alcaldía Mayor de Bogota SDA, 2007: 11.
[r] 2007, estimated range of concentration in different areas of the City of Buenos Aires, Arkouli et al 2010:7.
[s] 2007-2008, average values of four different measure points. Own calculation based on INEI, 2009: 217.
[t] 2004. ZMCM, INEGI 2005, table 2.7.
[u] 2004, seven measuring points in AMS, (MACAM2), annual average, SINIA, 2007: 16.
[v] 2007, annual average of eleven measurement points in RMSP, CETESB, 2008: 98.
[w] 2002, Bogota D.C., an hour maximum. Veeduría Distrital de Bogota, 2003: 26.
[x] 2004, ZMCM, first number: average, own calculation based on INEGI 2005, table 2.7, second number one hour maximum; Simioni, 2006: 14.
[y] 2007, an hour maximum, average of eight measuring points, RMSP, CETESB, 2008: 110.

BOX 14
METHODOLOGICAL NOTE TABLE 15: CONCENTRATION OF AIR CONTAMINANTS

The indicators of this table are directly related to the MDG Goal 7: Ensure environmental sustainability, but in a different manner from the emission quantities shown in table 14. The concentration of contaminating gases provides a panorama of air quality in urban areas focusing on the negative effects on inhabitants' health (especially respiratory diseases) and the quality of life. Therefore, this indicator may be correlated to some indicators of human life discussed above.

As data is provided in different units (ppm, ppb, micrograms/m3) it must be converted in order to make the levels comparable. Furthermore, pollution levels depend on climatic conditions, reason for which in some cities they present an important variation during the year. Therefore, it is necessary to provide a medium term average.

(Continued)

Box 14 (concluded)

Target values:

- MP10 20 µg/m3; MP2.5: 10 µg/m3 annual average, reference value which has been applied recently to European and US legislation (OMS 2005: 9).
- Ozone (O_3): 100 µg/m3 maximum eight hours average (OMS, 2005: 14).
- CO: 10 µg/m3 maximum eight hours dynamic average (SINIA, 2007: 24).
- SO_2: 20 µg/m3 annual average of 24 hours concentration (OMS, 2005: 19) Beijing / China 90; Berlin / Germany 18; Madrid / Spain 24, Milan / Italy 31, Los Angeles / USA 9 (data from 1995-2001; World Bank, 2007b: 147).
- NO_x: 40 µg/m3 annual average (OMS 2005: 17); Beijing / China 122; Berlin / Germany 26; Madrid / Spain 66, Milan / Italy 248, Los Angeles / USA 74 (data from 1995-2001; World Bank, 2007b: 147).

Source: Authors' compilation.

The concentration of contaminants varies in a considerable manner within the cities analyzed. For example, Lima Norte and Lima Este present levels of PM10 concentration values that are nearly twice the values measured in Callao and Lima Sur. The highest monthly average (114 µg/m^3) corresponds to Lima Norte in July 2007; meanwhile the lowest (41 µg/m^3) was registered in Callao in October (INEI, 2009).

7. Land use and green areas

There is strong evidence of higher efficiency in economic and ecological terms in cities with a higher density. Therefore many scholars and urbanists recommend compact urbanization patterns which make infrastructure and services more efficient and furthermore prevent the loss of agricultural areas, namely forests. This issue is directly related to the conservation of areas that are not urban as well as public spaces and green areas within the urban agglomeration.

The existing concepts of density have been criticized as they calculate the built up area as a whole. In the case of Santiago for instance, which presents the lowest density in central areas among the discussed metropolitan cities, the net density (calculation using only residential areas) is 142 inhabitants/ha; a value which is rather high in international comparison.

In the central districts (*comunas*) of Santiago de Chile there is little difference concerning housing density, presenting values in the range of 75-100 inhabitants per ha, which are low in comparison with other metropolitan areas, especially Buenos Aires.

In the Metropolitan Area of Santiago (AMS) there is no protected natural area, but a large urban park: the Parque Metropolitano (including Cerro San Cristobal). Furthermore the Metropolitan Region lies in proximity to: La Reserva Nacional Río Clarillo which covers an area of 10,185 ha, Roblería del Cobre de Loncha R.M, Melipilla Alhué 5,870, National Monument El Morado R.M. Cordillera San José de Maipo 3,009.

The differences in green area per capita within the cities are outstanding. For example in Mexico City, the most central areas (Benito Juarez and Cuauhtémoc) only have 3m²/ capita, but these are mostly covered with trees, while in the low-income densely populated sectors of the eastern part of the city center (Venustiano Carranza, Iztacalco and Iztapalapa) one can observe between five and 12m² per capita of green spaces, but roughly 3m²/capita of green areas with trees. Furthermore, the eastern part of the city, which is dominated by high-income low density housing areas (Alvaro Obregon, Cuajimalpa) presents the highest values of green areas of over 35m²/capita (SMA, 2009).

TABLE 16
HOUSING DENSITY AND BUILT UP AREA EXPANSION

	Housing density (Metropolitan Area) *(pop/ha)*	Housing density (in Central Areas) *(pop/ha)*	Built up area expansion *(ha/year)*
Bogota	194.5-21.6[a]	184.5-218.1[g]	777[j]
Buenos Aires	31.8[b]	150.3[h]	
Lima	30.1[c]	126.2[i]	
Mexico	121.0-37.9[d]	125.4[q]	4.408[k]
Santiago	85.1[e]	84.3[r]	1.487[l]
Sao Paulo	24.7[f]	103.0[i]	

Source: Authors' compilation, based on:

[a] 2002, only urbanized area. Alcaldía Mayor de Bogota D.C., 2004b; Second data refers to metropolitan Regions; Urban Age Program, 2009: 21 (2-8).
[b] Year not specified, metropolitan region; Urban Age Program 21 (2-8).
[c] 2007, Lima Metropolitana; INEI, 2008: 22.
[d] Second data refers to the Metropolitan Region; Urban Age Program, 2009.
[e] 2002, AMS, Galetovic / Jordan, 2006: 28.
[f] 2007, RMSP, Emplasa, 2007: 20.
[g] first number: central area as defined in table A. Alcaldía Mayor de Bogota D.C. 2004b; second data refers to central area within 10km distance from central point, Urban Age Program, 2009: 21 (2-8).
[h] 2008, City of Buenos Aires; GCBA DGEC, 2010: 14.
[i] Year not specified, data refers to central area within 10km distance from central point, Urban Age Program, 2009: 21 (2-8).
[j] 1996-2003, own calculation based on table 27.
[k] 1990-2000, own calculation based on table 43.
[l] 1992-2002, AMS, Galetovic / Jordan, 2006: 28.
[q] Year not specified, inner city (10 km radius); Urban Age Program.
[r] 2002, own calculation based Galetovic / Poduje, 2006: 13.

BOX 15
METHODOLOGICAL NOTE TABLE 16 AND 17: DENSITY, PUBLIC AND GREEN SPACES

The presented table aims to discuss land use from two points of view: the first one refers to pressure on the natural environment and the second to the concept of providing sustainable land use patterns in cities by combining high density zones with important green zones and protected areas.

Housing density is an indicator of pressure on the natural environment as well as on urban infrastructure; nevertheless high density permits higher efficiency. It is defined as the number of inhabitants per ha urbanized area.

The **urban expansion**, in terms of growth of the built up area, refers to changing the land use from non-urban to urban and is considered to be one of the most important pressure factors (UNEP, 2004: 33).

Green areas:

Protected Area: Legally established land or water area under either public or private ownership that is regulated and managed to achieve specific conservation objectives. Considers protected areas in metropolitan area (%) (UNSTAT glosary).

Reference values:

Density: Most of the large German cities present housing densities between 30 and 70 inhabitants per ha in the inner city. In average European urban areas there is a density of about 50 inhabitants per ha, meanwhile US cities reach only ten inhabitants. (Cox, 2000) The WHO recommends a minimum level of 10m^2 per inhabitant and an optimum level 15 m^2 per inhabitant of the urban areas.

Source: Authors' compilation.

TABLE 17
GREEN SPACES AND PROTECTED AREAS

	Green spaces (Central area) *(m²/capita)*	Covering of soil (Metropolitan area) *(In percentages)*	Protected area (Metropolitan area) *(ha/km²)*
Bogota	5.6[a]	23.2[g]	11.0[a]
Buenos Aires	3.1[b]	31.6[h]	
Lima	1.7[c]		
Mexico	5.3[d]	28.4[i]	13.3[l]
Santiago	1.0 / 5.1[e]	40.4[j]	0.0[m]
Sao Paulo	0.8 / 3.5[f]	36.7[k]	5.27[n]

Source: Authors' compilation, based on:

[a] 2004, Bogota D.C. Alcaldía Mayor de Bogota D.C., 2004b: 11.
[b] 2001, City of Buenos Aires, PNUMA, 2003b: 108.
[c] 2004, area not specified, PNUMA, 2006: 4.
[d] 2000, PNUMA, 2003: 128;
[e] The first number refers to the 1990ies according to PNUMA, 2003, the second is result of own calculations.
[f] The first number refers only to public parks; own calculation based on Central Area of Sao Paulo as used in www.prefeitura.sp.gov.br (Se; Butantã, Lapa; Campo Limpo, Pinheiros; Granja Viana – Cotia)
[g] 2000, PNUMA, 2003: 67.
[h] 2005, own estimation based on analysis of Satellite images.
[i] 2000, PNUMA, 2003: 27.
[j] 2004, own estimation based on analysis of Satellite images.
[k] 2005, own estimation based on analysis of Satellite images.
[l] 2007, only D.F.; own estimation based on SMA CORENA, 2009.
[m] 2008, Metropolitan Area, CONAF, 2009.
[n] Municipio de Sao Paulo; Existing Parks on State Level with integral protection. Secretaria Municipal do Verde e do Meio ambiente, 2008: 2.

In the case of Santiago de Chile, there are even more extreme differences in the very central zone. Some of the central localities (the *comunas* Santiago, Providencia and Recoleta) have 11-16m²/capita of green areas in spite of high housing density, mainly due to the existence of three important central park areas (Parque Metropolitano, Parque Forestal, Parque O'Higgins and Cerro Santa Lucia). In contrast the other, rather low income sectors (Estación Central, Pedro Aguirre Cerda, Quinta Normal, San Miguel, and San Joaquin) have barely one m² green area per inhabitant. Due to the central location of some parks and low density but high soil coverage in rather peripheral, low income *comunas* in the case of Santiago the central zone has a higher average green area incidence (7.3 m²/capita) than the whole urbanized area of Greater Santiago (5.1 m²/capita).

In the case of Lima, it must be noted that in spite of the very low level of green spaces per capita, some of the localities (Surco, San Borja, Miraflores, San Isidro, La Molina, La Punta y Santa María) present a level above the internationally recommended 8 m2/ inhabitant.

C. Social resources

1. Social cohesion

The metropolitan area that presents the highest level by far of violent crimes represented here by homicides is Sao Paulo, followed by Bogota and Mexico especially the part of the ZMCM which is situated in the Estado de Mexico. By contrast, with regard to the homicide rate, Santiago de Chile is situated at a relatively low level, similar to that of many European cities. As a consequence the delinquency topic will be discussed particularly in the City Profile of Sao Paulo (IV.F.3).

TABLE 18
CIVIL SOCIETY AND CRIMINALITY

	Homicide rate *(per 100 000)*	Criminality perception *(percentage of persons feeling unsafe)*		Victimization rate *(In percentages of total)*	Voter's participation *(In percentages of total)*
		In public spaces at night	At home		
Bogota	18.7[a]	43[g]		11.8[n]	47.9[t]
Buenos Aires	4.9 / 6.9[b]	66[h]	48[l]	32.0[o]	70.0[u]
Lima	9.4[c]	90[i]	70[l]	21.7[q]	89.0[v]
Mexico	17.6[d]	34[j]	37[p]	30.0[r]	41.2[w]
Santiago	2.1[e]	35[k]	15[m]	40.2[s]	64.5[x]
Sao Paulo	23.0[f]	72[h]	72[l]	22.0[o]	80.0[y]

Source: Authors' compilation, based on:

[a] 2007, Bogota D.C., Veeduria Distrital, 2008: 9.
[b] first number: 2009, City of Buenos Aires, second number: 2008 Province Buenos Aires; Ministerio de Justicia 2010.
[c] 2007, Lima, area not specified, FLACSO Chile, 2008.
[d] 2005, Mexico D.F. Urban Age Database, 2009.
[e] average 2001-2009, Santiago Province, own calculation based on Ministerio del Interior 2010.
[f] 2006, Municipio de Sao Paulo. www.nevusp.org.
[g] 1997, area not specified, Alvazzi del Frate, 2003: 13.
[h] 2004, area not specified, van Dijk et al, 2007: 131.
[i] 2003, area not specified, Gobierno Regional Lima Metropolitana, 2004: 42.
[j] 2004, national level, van Dijk et al, 2007: 131.
[k] 2007, all urban regions of Chile; INE 2008d: 34.
[l] 2004-2005, van Dijk et al., 2007: 128.
[m] 2007, City of Santiago, La Segunda, 2007-06-27.
[n] 2008, Bogota D.C., personal victimization during last 12 months, does not include family members. Fundación Seguridad y Democracia, 2008: 7.
[o] 2004, area not specified, personal victimization during last 12 months; van Dijk et al., 2007: 46.
[p] 2004, national level, van Dijk et al, 2007: 127.
[q] 2005, Lima, area not specified, refers to percentage of households who suffered a robbery of their home during the last five years. FLACSO Chile, 2008.
[r] 2005, ZMCM, ICESI, 2006: 9.
[s] 2007, Data refer to percentage of households in which at least one person has been victimized during last 12 months. Region Metropolitana; INE, 2008d: 13.
[t] 2007, Election of the mayor of Bogota D.C. (alcalde mayor), PNUD, 2008: 170.
[u] 2007, Election of City government first round http://www.buenosaires.gov.ar.
[v] 2006, there is an obligation to vote –the given number represents the valid votes. www.transparencia.org.pe.
[w] 2009, Distrito Federal, Diputados Distritales; www.ife.org.mx.
[x] 2008, AMS, data presents the number of persons registered as percentage of population with right to vote. Mideplan CASEN, 2006.
[y] 2006, Municipalidad Sao Paulo, presidential election. Due to the obligation to vote the number is high – it represents the valid votes, own calculation based on IBGE 2009.

The comparability of the data on victimization of Santiago to the other cases is not given, the Santiago data refers to another entity (households are considered if **one** of the members has been victim of a crime; while in general, victimization is reported on an individual basis) at a different time period (during the last 12 month in difference to the six month time period that is generally used).

The indicator for voter participation is problematic as in some countries voting is obligatory, in other cases, only those who are registered are obligated to vote (as in Chile), and in others non-participation is not sanctioned.

BOX 16
METHODOLOGICAL NOTE TABLE 18: CRIMINALITY AND VIOLENCE

Three types of data are included in this table: first, the homicide rate represents data generated by official sources, especially police statistics, and is considered to be the best indicator of official criminality statistics in terms of reliability and comparability. The second type of indicator addresses the **perception of crime level** in urban areas, represented by the indicators "percentage of population feeling fear at night in public spaces" and "percentage of population feeling fear at night at home", which has been generated by a representative large scale survey. The third sort of data is also based on surveys and is aimed at the victimization showing the percentage of the population that has been victim of a crime out of a predefined set of different crimes, during a defined time period, usually within the last six months (van Dijk et al, 2007).

This issue may be considered as an indicator of living conditions in an urban area while it also indicates social cohesion and the stability of public institutions. In addition to the perception indicators, we address the issue of reconstruction of images and stigmatization. Data reliability is a central issue in this area: although homicides are considered the most reliable data, some differences in registration and data processing in the different countries are reported, which might cause distortion. The **victimization** data aim to eliminate these problems, but partially different time periods or types of crime are included.

Definitions

Homicides: Number of reported homicides annually per 100,000 inhabitants including intentional and non-intentional homicide. "The data may be obtained from the police or other law enforcement agencies. Information may also be checked with security experts and NGOs dealing with human rights" (UN Habitat, 2004: 30).

Feeling unsafe: Result of a questionnaire based survey, a summary of the responses "feeling very unsafe" or "feeling unsafe" on a five scale range is considered.

Victimization: "A crime as it affects one individual person or household. For personal crimes, the number of victimizations is equal to the number of victims involved. The number of victimizations may be greater than the number of incidents because more than one person may be victimized during an incident" (OJP, 2009).

Victimization rate: Measures the occurrence of victimizations among a specific population group. (http://nces.ed.gov/programs/crimeindicators/crimeindicators2007/glossary.asp).

Voters Participation: Voter participation in the last national percentage of a population.

Source: Authors' compilation.

2. Preservation of cultural heritage and diversity

In table 19 there are presented indicators on protection of cultural heritage (landmarked buildings), public policies regarding cultural issues (public expenditure for cultural purposes) and practice (visitors in museums). In terms of public spending the values of Mexico and Buenos Aires are outstanding representing parts of its public policy agenda.

In terms of outstanding heritage only the metropolitan regions of Mexico City and Lima have monuments of world heritage defined by UNESCO (UNESCO, 2009). In the case of Mexico these are i) the historical city center and the southern district of Xochimilco, declared monuments of world heritage in 1987; ii) the house and studio of Luis Barragán (inscripted in 2004), and iii) the Central University City Campus of the Universidad Nacional Autónoma de Mexico (2007). In the case of Lima, the historical center was inscripted as a monument of world heritage in 1988 and atlarge in 1991 (formerly the Convent Ensemble of San Francisco de Lima was the only inscripted monument, which is part of the historical center).

TABLE 19
PRESERVATION OF CULTURAL HERITAGE AND DIVERSITY

	Expenditure for cultural purposes *(US$ ppp/cap.)*	Landmarked buildings *(Number)*	Landmarked buildings *(Nr/km² central area)*	Visitors in museums *(Nr/1 000 inhab.)*
Bogota	3.67[a]	277[f]	0.3[f]	
Buenos Aires	147.00[b]	131	0.6	191[i]
Lima	1.04[c]	1.673[g]	6.2[g]	110[j]
Mexico	23.10[d]			2.158[k]
Santiago	9.80[e]	159[h]	1.1[h]	125[l]
Sao Paulo				

Source: Authors' compilation, based on:

[a] 2008, Bogota D.C. own estimation based on: Bogota D.C. 2008.
[b] 2004, City of Buenos Aires, includes cultural and educational issues: own calculation based on: GCBA, 2008.
[c] 2007, Municipalidad Metropolitana Lima, own calculation based on INC, 2008.
[d] 2008; Mexico D.F., includes sports, own calculation based on Secretaria del Desarrollo Social 2008: 6.
[e] 2008, Metropolitan Region, only Regional Funds (FNDR), education and cultural purposes. Own calculation based on Gobierno Regional Metropolitano Santiago 2008: 9.
[f] Metropolitan Region. Register of National Monuments.
[g] 2009, Provincia Lima and Callao; INC, 2009.
[h] 2008, only Central Area, own calculation based on CMN, 2009: 8-11.
[i] 2008, only City of Buenos Aires; DGM, 2009.
[j] 2006, own estimation based on Congreso de la República, 2009.
[k] 2007, only Mexico D.F.; INEGI, 2009b.
[l] 2007, own estimation based on DIBAM 2009.

BOX 17
METHODOLOGICAL NOTE TABLE 19: PRESERVATION OF CULTURAL HERITAGE

These three indicators aim to discuss the cultural heritage, the relevance which is given to this issue and to public policy response. Therefore, two indicators are included to address public (local) policy and investment, as it is related to public expenditure on cultural purposes with the number of inhabitants and secondly indicates the importance which is assigned to the preservation of cultural heritage by local governments, using landmarked buildings in central areas as an indicator. The third indicator (visitors in museum) is focused on the discussion of the relevance of cultural issues in public life, which may be regarded as the most reliable indicator for this purpose –although it neglects regional differences in cultural activities.

All of the indicators present important shortcomings regarding the comparison of the six metropolitan cities as the legal and institutional context and historical heritage are different, registration of cultural activities in the public households differs and the number of visitors is influenced in an important manner by tourism.

Source: Authors' compilation.

D. Equal Opportunities

1. Income concentration

In general, all of the analyzed metropolitan regions present high levels of income inequality in an international comparison (see also methodological note). The highest income concentrations in terms of Gini Coefficient are observed in Bogota and in Sao Paulo, meanwhile Lima presents the lowest concentration level with a level of slightly below 0.5 as does the City of Buenos Aires. Nevertheless, even this lowest level is clearly above the international alert line (0.4).

An analysis of income concentration shows the highest gap (Q5/Q1) in the city of Bogota: the average income of the highest income quintile is forty times higher than the average of the lowest income quintile. Sao Paulo presents a similar value as Bogota. The same relation in most of the other metropolitan cities is around ten –which is the reason why they might all be considered highly unequal.

TABLE 20
INCOME CONCENTRATION AND CHARACTERISTICS

	Income inequality		Poverty *(percentages of inh. living below poverty line)*	Unemployment *(In percentages)*
	(Gini Coefficient)	*(Ratio Q5/Q1)*		
Bogota	0.61[a]	35 to 40[e]	23.8[j]	11.6[m]
Buenos Aires	0.44[b]	11.4[f]	21.8[k]	8.9[n]
Lima	0.44[c]	9.9[g]	24.2[l]	8.2[o]
Mexico	0.56[a]	13.1[g]	39.2 / 10.6 [s]	4.8[p]
Santiago	0.55[d]	11.5[h]	10.4[h]	7.0[q]
Sao Paulo	0.61[a]	33.0[i]	24.3 [t]	16.9[r]

Source: Authors' compilation, based on:

[a] 2005, area not specified, UN Habitat, 2008: 69.
[b] 2006, City of Buenos Aires; GCBA DGEC, 2007: 7.
[c] 2007, urban ares in Peru, ECLAC Database BADEINSO.
[d] 2006; area not specified, UN Habitat, 2008: 69.
[e] Year not specified, Bogota D.C. PNUMA, 2003: 38.
[f] 2006, only City of Buenos Aires; GCBA DGEC, 2007: 2.
[g] 2008, urban areas in Peru, CEPAL STAT, 2010.
[h] 2006, AMS, own calculations based on Mideplan CASEN, 2006.
[i] Municipio Sao Paulo, Portal ODM.
[j] 2006, Bogota D.C., PNUD, 2008: 128.
[k] 2007, Gran Buenos Aires, INDEC, 2007:4.
[l] 2006, Lima Metropolitana, INEI, 2007: 421.
[m] March-May 2009, Bogota D.C., Bogota trabaja, 2009: 4.
[n] April-June 2009, Gran Buenos Aires, INDEC, 2009.
[o] 2006, Lima Metropolitana, INEI, 2007: 324.
[p] 2004, Mexico City; Urban Age Database, 2009.
[q] 2006, AMS, own calculation based on Mideplan CASEN, 2006.
[r] 2006, RMSP, includes hidden unemployment. Emplasa, 2009: 47.
[s] 2008, all urban areas of Mexico; first number is general poverty line; second number is nutrition poverty line; CONEVAL 2009: 5.
[t] 2008, RMSP, own estimation based on UN Habitat 2010: 4-5.

Regarding aspects of poverty and unemployment as elements of vulnerability and obstacles for reducing inequalities, one can observe a much more differentiated situation. The high proportion of people living below the poverty line is an outstanding issue in Mexico, but also of high relevance in the other metropolitan areas, with the exception of Santiago de Chile. In the last case, more than 25 years of nearly

uninterrupted economic prosperity combined with poverty reducing governmental initiatives for the last two decades has shown clear effects –at least in reducing poverty levels applying the standard approach.

The table on consumption (table 21) reflects the importance of poverty issues in Lima, as the working time to earn a basic basket of goods is extremely high, more than twice as in Mexico, Santiago and Sao Paulo. Buenos Aires reports by far the lowest value. A high participation of private households in global communication with almost 30% of households connected to the World Wide Web for Santiago and around 40% in Sao Paulo, meanwhile the case of Lima shows the lowest indicator value. The value of Buenos Aires refers to the City and seems to be based on different methodology. Of higher interest for the discussion of sustainability is the second indicator addressing the amount of working hours necessary to earn a basic basket for a standard household.

TABLE 21
CONSUMPTION

	Internet connection *(percentages of households)*	Working time to earn a basic *basket of goods (In hours)*
Bogota	21.3[a]	
Buenos Aires	81.4[b]	10.8[f]
Lima	12.4[c]	84.3[g]
Mexico		39.2[h]
Santiago	29.2[d]	34.2[i]
Sao Paulo	41.1[e]	30.2[j]

Source: Authors' compilation, based on:

[a] 2007, Bogota D.C. PNUD, 2008: 126.
[b] 2001, only City of Buenos Aires. Data refers to the relation between number of internet accesses and households. GCBA, 2008.
[c] 2006, Lima Metropolitana, own calculation based on INEI, 2007: 158.
[d] 2006, AMS, own calculations based on Mideplan CASEN, 2006.
[e] 2009, RMSP; IBGE, 2010: 96.
[f] 2008, Defensoría General de la República, 2009.
[g] 2006, Lima Metropolitana, own calculation based on expert consultation and PEEL, 2007. Income values refers only to small and medium enterprises.
[h] 2007, area not specified, own estimation based on http://www.conasami.gob.mx/ and http://www.jornada.unam.mx/2008/01/09/index.php?section=economia&article=023n2eco.
[i] 2007, area not specified, own estimation based on http://www.entermin.cl/content/view/103/17/.
[j] 2008, area not specified. own estimation based on DIEESE, 2009.

BOX 18
METHODOLOGICAL NOTE TABLE 20 AND 21:INCOME, CONCENTRATION AND CONSUMPTION

This set of indicators presents a panorama of social differentiation, especially related to income and other socio-economic aspects in order to discuss social vulnerability and the relevance of certain social risks resulting from a precarious social situation or extreme inequalities.

The Gini coefficient is considered as the most important indicator of income concentration, and furthermore offers the possibility to integrate this data into the interpretation of other indicators. Specifically data on poverty and socio-spatial segregation should be discussed considering income concentration. Also the level of pressure on environment (pollution and use of resources) depends on income concentration (UNEP, 2004: 31).

(Continued)

Box 18 (concluded)

Definitions

Gini Coefficient: shows the relationship between real income distribution and hypothetical distribution in which each person or household receives the same amount. It varies between 0 (completely equal income distribution) and one (total income concentration in one person).

Ratio Q5/Q1: the coefficient of average income of the wealthiest quintil of the population of a given area (top 20% of the household according to their income) in relation to the average income of the population quintil with lowest income level in the same area.

Poverty: this indicator presents the percentage of the population of the given area living below the officially defined poverty line. The national poverty line is defined by governments or statistics office and takes into account country-specific consumption patterns and standards.

Unemployment: "average proportion of unemployed (men and women) during the year, as a fraction of the (formal) workforce" (UN Habitat, 2004: 21).

Internet connection: shows the percentage of households in a given area with internet connection in their home.

Working tima to earn a basket of basic goods: using the average income level of the working population in a given area we calculated how many hours of work are needed to earn the amount of money to purchase the country-specific basic basket of goods according to the definition given by the respective national statistics office.

Values of reference:

- Gini index: The international alert line is defined at 0.4. Values between 0.50 and 0.59 are considered "relatively high levels of inequality, reflecting institutional and structural failures in income distribution" (UN Habitat, 2008: 51). Values above 0.60 correspond to an extremely high level of inequality, with wealth concentration among defined groups, and exclusion of the majority. This means a "high risk of social unrest or civil conflict" (UN Habitat, 2008: 51).
- The ratio of the wealthiest quintil over the poorest quintil was in 2001 below five in Uruguay and Venezuela and above 30 in Bolivia and in Honduras (CEPAL 2009: 59).
- Poverty rate: Latin America reports 27.6% in urban areas (CEPAL 2009: 52).
- Unemployment: an unemployment rate of 2% is considered optimum.

Source: Authors' compilation.

2. Gender issues

As a central aspect of equal opportunities, gender issues must be discussed in terms of empowerment and income disparities. As the gender empowerment measure is constructed on the basis of variables on a national scale, these data are not available for the metropolitan region, with the exception of Mexico. Nevertheless, we report national data considering the importance of the issue.

TABLE 22
GENDER EMPOWERMENT AND LABOUR MARKET

	Gender Empowerment Measure	Gender income differences *(Women's income as percentages of men's income)*	Women's enrollment in labor market *(In relation to men's enrollment)*	Women's enrollment in tertiary education *(In relation to men's enrollment)*
Bogota	0.51[a]	71.0[c]	0.80[g]	1.09[l]
Buenos Aires	0.70[a]	69.0[d]		1.52[l]
Lima	0.64[a]	59.0[c]	0.75[h]	1.06[m]
Mexico	0.61-0.50[b]	42.0[c]	0.50[i]	0.98[l]
Santiago	0.53[a]	77.7-42.0[e]	0.68[j]	0.99[n]
Sao Paulo	0.50[a]	65.0[f]	0.77[k]	1.29[l]

Source: Authors' compilation, based on:

[a] Most recent data available; data refer to country level. UNDP, 2009: 186.
[b] 2003, D.F. / Estado de Mexico. Idovro / Casique, 2006: 34.
[c] Most recent data available; data refer to country level. UNDP, 2009: 186.
[d] 2006, only City of Buenos Aires, only salaries. GCBA DGEC, 2007: 4.
[e] 2006; AMS, full time employees only. Own calculation based on Mideplan CASEN, 2006. Second number refers to country level. UNDP, 2009: 186.
[f] 2005, Municipio de Sao Paulo. Sempla, 2007: 47.
[g] 2005, Bogota D.C. "Tasa Global de Participación" by gender, DANE, 2009d.
[h] 2006, Lima and Callao. INEI, 2007: 315.
[i] 2000, ZMCM. INEGI, 2005: 8.1.
[j] 2006; AMS, all kind of paid activities, inhabitants aged 18-60. Own calculation based on Mideplan CASEN, 2006.
[k] 2005, Municipio de Sao Paulo, Sempla, 2007: 45.
[l] 2007, data on country level, UN Stat 2009b.
[m] 2006, data on country level, UN Stat 2009b.
[n] 2006; AMS, aged 16-24 graduate or currently participating in tertiary education. Own calculation based on Mideplan CASEN, 2006.

Argentina presents by far the highest level of the Gender Empowerment Measure, being ranked 17 in a global comparison. The other countries present rather low values, with Peru in an intermediate position (UNDP, 2009: 186). At least three different dimensions are interfering: access to education, cultural formation and level of income, respectively human development in general. Nevertheless, in various Latin American countries one can observe an important gap between human development and gender empowerment. In Mexico, in long-term perspective GEM is growing quickly and the observed gap between HDI and GEM is decreasing. In spite of this positive trend the metropolitan region of Mexico presents a relatively high GEM in a national comparison, but also a high HDI, therefore the gap between Human Development and Gender Empowerment in the metropolitan region is slightly higher than the national average (Ibarrarán / Robles, 2003: 8).

One of the main goals of human development is to reduce gender specific income differences. These data are reported partially on a national scale (Colombia, Peru and Mexico). On a national scale Mexico and Chile as well as Peru present high income differences, meanwhile Colombia presents the most egalitarian relationship. Nevertheless, the income gap is considerably lower on a metropolitan scale: Santiago de Chile presents the most similar income levels of men and women; in Buenos Aires and Sao Paulo women earn around 2/3 of men's income.

In terms of education, the Millennium Development Goal to ensure equal access to women and men has been mostly fulfilled in Latin America for primary education. Nevertheless, it has been shown (CEPAL, 2007: 100) that the gender gap still persists in secondary and most of all in tertiary education. Therefore, we discuss the situation of tertiary education, where especially Chile and Mexico show predominantly male participation; meanwhile in the other countries women's gross enrollment in tertiary

education is higher than men's enrollment. Especially in Argentina and in Brazil, women show an outstanding involvement in higher (e.g. University) studies.

Women's participation in the labor market is considerably lower than men's participation in all of the analyzed areas due to different gender roles and specific life cycles. Nevertheless the differences are very much higher in Mexico City than in Bogota, Lima, Sao Paulo and even Santiago de Chile. It should be mentioned that among women, the rate of unemployment is very much above the men's unemployment rate (e.g. 18.0% vs. 9.9% in Lima Metropolitana; INEI, 2007: 323).

BOX 19
METHODOLOGICAL NOTE TABLE 22: GENDER EMPOWERMENT AND LABOUR MARKET

As education is one of the most important development issues and one can observe a simultaneously important gender-specific difference in education, the school enrollment of women (in relation to the school enrollment of men) becomes a crucial issue regarding gender equality.

The **Gender Empowerment Measure** (GEM) is a composed index proposed in 1995 by the United Nations Development Program (UNDP) in order to evaluate women's empowerment in different areas of policy and the economy in relation to men's empowerment. The index is composed of three variables indicating women's participation in different fields –each of them representing a dimension: a) Policies: proportion of parliamentarian seats occupied by women, b) professional opportunities measures as women's proportion among high administrative jobs, managers, and technicians, and c) Economic power measured as women's salaries in relation to GDP (Isodrovo / Casique, 2006: 31).

Gender income differences

Women´s enrollment in labor market and in tertiary education

Reference values:

- GEM (national level): best value (Sweden) 0.91; worst value (Yemen) 0.14; Germany: 0.85 (UNDP, 2009: 186).
- Gender income differences (national level): best value (Mozambique) 0.90; Norway 0.77; Germany 0.59, worst value (Saudi Arabia) 0.16.
- Women´s enrollment (expressed in relation to men´s enrollment) in labor market and in tertiary education is aimed to be 1.0.

Source: Authors' compilation.

One can observe very different conditions of unemployment and stability of work contracts between men and women. For example in Bogota, the unemployment rate for women has been clearly higher then the unemployment rate for men (15.1% vs 10.6% in 2005; DANE, 2009). This difference is even more pronounced in the juvenile unemployment rate which reached 28.0% (DANE, 2009d, in the case of young women (18-24 years).

One could summarize that there is an overall low level of equal opportunities in the case of Mexico and apparently contradictory information in the other cases. In Buenos Aires there is higher equity in terms of empowerment and education, which might be explained by cultural patterns, meanwhile the income gap is high. In Santiago de Chile the situation is opposite –possibly because of institutional protection and norms aiming to reduce the income gap.

E. Productive potential

1. Development of human capital and knowledge

This chapter addresses two central issues: the formation of human capital and knowledge and their use. The most relevant indicators of formation of human capital and knowledge are related to the education indicators discussed above. As not all mentioned cities participate in the UNESCO lead education quality evaluation system PISA and the local standards for evaluating student's performance are different, there are no comparable indicators of performance available. Therefore, we use the value of student/professor ratio in secondary education as an indicator –nevertheless, it must be recognized that this value is very similar in the analyzed cities (with the exception of Chile) and it is apparently influenced by ministerial norms. In terms of higher education and research, the total number of ISI publications might be used, an absolute number is presented in order to represent the pool of research capacity present in the respective metropolitan area. The result shows the importance of Sao Paulo, followed by Mexico and Buenos Aires.

TABLE 23
KNOWLEDGE, RESEARCH & DEVELOPMENT

	Student/professor ratio *(Secondary educ.)*	Publications ISI		High education employment *(In percentages of total employment)*
		(Nr., ten years accumulated)	*(Per 1 000 inh)*	
Bogota	16.2[a]	6 553[f]	0.97[f]	
Buenos Aires	13.0[b]	45 492[f]	3.55[f]	
Lima	14.1[c]	2 375[f]	0.28[f]	20.5[g]
Mexico	16.9[d]	53 888[f]	3.00[f]	20.5[h]
Santiago	24.0[b]	22 275[f]	4.13[f]	34.9[i]
Sao Paulo	18.1[e]	118 307[f]	6.61[f]	17.5[j]

Source: Authors' compilation, based on:

[a] 2007, primary and secondary education. Camara de Comercio de Bogota, 2008: 5 and 7.
[b] 2006, national data, CEPAL STAT, 2010.
[c] 2006, Departamento Lima; own calculations based on INEI, 2007: 184 and 227.
[d] 2003, ZMCM, own calculation based on INEGI, 2005: table 6.5.
[e] 2009, Municipio de Sao Paulo, own calculation base don IBGE, 2009.
[f] 1995-2005, Cámara de Comercio de Bogota, 2008: 12 and own calculations.
[g] 2006, Lima Metropolitana, economically active population. INEI, 2007: 320.
[h] 2000, Mexico City, Rodriguez, 2008: 57.
[i] 2002, AMS, Rodriguez, 2008: 57.
[j] 2000, Municipio de Sao Paulo, Rodriguez, 2008: 57.

The efficient use of human capital is another aspect of this chapter; it is presented by the percentage of employees with higher education and the employment in research and development (R&D). Higher education employment in general is about 20%; meanwhile in Santiago de Chile it reaches a value of nearly 35%, which is also a result of the large number of different tertiary education institutions offering a diploma, master's degrees and other courses of tertiary education.

BOX 20
METHODOLOGICAL NOTE TABLE 23: KNOWLEDGE, RESEARCH & DEVELOPMENT

Based on data from this table, we discuss the level of highly-skilled activities and the importance of knowledge and high technology activities in the urban productive system. Two indicators focus on the input of high-level knowledge and formation in the production processes (High education employment and employment in R&D). The interpretation of these is slightly different, as the second also fulfills a function as predictor of future competitiveness of the urban economy. This last issue is addressed further by the investment rate in R&D activities. The last two indicators are used for the discussion of human capital formation regarding the amount and quality of university education.

Definitions:

Higher education employment is calculated as a percentage of persons with a university degree as a percentage of the total, including dependent employees, independent freelancers and entrepreneurs.

Publication ISI: Number of scientific articles published in specialized journals listed in ISI Web of Knowledge, Journal Citation Report®.

Student/Professor Ratio: Number of students registered in secondary education divided by the number of teachers in secondary schools. Data refer primarily to the public education sector.

Reference values:

- Student/Professor Ratio: worst level worldwide (national base) in 2007 was 49 (Eritrea); best level was seven (Portugal; see World Bank Database, 2010).

Source: Authors' compilation.

2. Development of man-made physical capital

This chapter discusses main macroeconomic indicators and their trends. GDP is presented as the central economic indicator but not as a sustainability indicator. In absolute terms, Sao Paulo and Mexico City show a predominant position as economic systems among the six metropolitan cities analyzed (and consequently in Latin America), followed by Buenos Aires, while Santiago de Chile, Bogota and Lima are smaller economies. In **per capita** terms Santiago is very close to the three leading metropolitan areas (Sao Paulo, Mexico and Buenos Aires).

The **GDP** of the metropolitan regions in US$ **purchasing power parity** shows that all the values are significantly higher. The outstanding position of Sao Paulo and Mexico are nevertheless directly related to their size in terms of population and area. In terms of **per capita income calculated using ppp methodology**, Buenos Aires and Sao Paulo show levels similar to Mexico and Santiago de Chile. Lima is lowest. It is also important to address the difference between the central areas and the outskirts. Due to lack of data, such GDP data are not presented. Even so, as an example it may be stated that the city of Buenos Aires alone has a GDP of 50 billion US$; or a per capita GDP of slightly more than 16,000 US$ (GCBA, 2008) compared to 19.000 US$ of the whole metropolitan area.

TABLE 24
BASIC ECONOMIC DATA

	GDP *(In US$ bn, ppp)*	GDP/capita *(In US$, ppp)*	GDP *(In US$ bn)*	GDP/capita *(In US$)*	Regional GDP concentration *(As percentages of national)*	Informal employment *(As percentages of total workforce)*
Bogota	86.0[a]	12 692[a]	49.8[d]	7 355[d]	25[f]	
Buenos Aires	245.0[a]	19 098[a]	129.1[e]	10 414[e]	24[f]	44.0[i]
Lima	67.0[a]	7 899[a]	36.0[e]	4 293[e]	47[f]	53.1[i]
Mexico	315.0[a]	17 552[a]	219.6[e]	10 882[e]	29[g]	45.7[i]
Santiago	91.0[b]	16 826[b]	43.8[b]	8 979[b]	43[h]	34.0[i]
Sao Paulo	366.3[c]	18 617[c]	206.7[c]	10 504 [c]	12[c]	40.8[j]

Source: Authors' compilation, based on:

[a] 2005, spatial limitations not specified by authors, City Mayors, 2007.
[b] 2008, RMS, prices of 2003, own calculation based on Banco Central, 2010.
[c] 2006, RMSP. Own calculation based on SEADAE, 2009: 7.
[d] 2007, own calculation based on DANE 2009e and table 1
[e] Year and area not specified, AméricaEconomia, 2008.
[f] Years and spatial limitations not specified by authors, Urban Age Program, 2009: 24.
[g] 2000, ZMVM, Escobar Delgadillo et al., 2009: 9.
[h] 2006, RMS, Banco Central, 2009 and table 1.
[i] 2002-2003, Metropolitan Region, ILO definition of informal employment, Portes / Roberts, 2005: 52-53.
[j] 2002-2003, Metropolitan Region, alternative definition of informality, Portes / Roberts, 2005: 52-53.

On economic primacy (percentage of the national GDP produced in the metropolitan area) Lima and Santiago are capitals of highly centralized countries producing almost the half of their respective national GDP while the others and most of all Sao Paulo, Brazil show the most decentralized economy. Although this indicator has no reference values in terms of goals or best practice high concentration are frequently criticized.

A different image is provided by the business oriented Stability Index, expressing mainly macroeconomic and political stability on a national level (AméricaEconomía, 2008). This is showing the highest values in Chile, followed at a considerable distance by Mexico and Brazil, meanwhile the other countries present lower levels of stability. This indicator is used by AméricaEconomía as one of different aspects which define the attractivity of the metropolitan cities for doing business.

In terms of **formalization** of economic activities, the best level is in Santiago, while Lima and Mexico City have an important the informal economic sector. This is often related to a high level of precarious income and unprotected conditions and more likely to affect low income sectors (Portes / Roberts, 2005: 14). Informal employment is a haven for workers without formal education and those who are not able to participate in the formal labor market, and there are different types like subsistence self-employment (growing in periods of economic crisis) and the employment in small scale enterprises (Gallart, 2005). The results and challenges of this market segment will be discussed in the City Profile section of Lima (see chapter IV.C.3).

Table 25 reflects local public revenue addressing local finance. Just as the responsibilities of spatial entities are extremely different in the six countries, so is the public finance constitution. In some cases investment is carried out almost completely by government institutions on a national scale (e.g. in Chile), meanwhile in other countries the decentralization of long term decisions as well as investment is advanced (e.g. in Colombia).

Local government revenue per capita is highest in Sao Paulo. Also very high local government incomes are observed in the case of Buenos Aires, Mexico and Bogota where the respective cities (Capital Federal, Distrito Federal and Distrito Capital) are a federal entity, while in Santiago de Chile and in Lima, due to administrative fragmentation and a reduced importance of the city as a legislative

entity, local governments' incomes are extremely reduced. Local investment in per capita terms is by far highest in the case of Bogota where an important number of public programs addressing different urban challenges have been implemented during the last years.

BOX 21
METHODOLOGICAL NOTE TABLE 24: BASIC ECONOMIC DATA

The table on basic economic data includes five different indicators, two of them showing the actual state of economic income level: GDP and GDP per capita. Both are presented in US$ according to the current exchange and in US$ using purchasing power parity (ppp). These indicators present average levels which, being aware of unequal income structures in the analyzed cities, must be combined with the results of the equal opportunities section.

Definition:

Regional GDP concentration: percentage of national GDP produced by the Metropolitan Area.This is an indicator of primacy respectively the spatial diversification of the national economy. Extremely high values indicate a economic dominance of the metropolitan area but also dependency on its economy.

Informal employment: percentage of the employed population, whose activity is part of the informal sector (UN Habitat, 2004). Frequently used is also the definition of informal employment as those economically active people who are not participating in the pension or social insurance system (Perry et al. 2007).

Reference values:

- World Bank indicates the following extreme values for **GDP per capita (ppp)** on national level for 2008: lowest level 314 (Congo) and highest level 58,714 (Norway) (World Bank Database, 2010).
- Informal Employment: almost all developed countries show rates of informal employment below 30%, mostly below 20%. Developing countries range between 40% and nearly 100% (Perry et al., 2007: 2)

Source: Authors' compilation.

Due to spatial and administrative fragmentation, in Santiago are high differences of public local investment within the metropolitan area, predominating high income *comunas*. Nevertheless, the permanent own income of the *comunas* represents only around 35% of the local budgets, showing broad geographical differentiation within the Metropolitan Region: starting from some 10% in one of the *comunas* with the highest proportion of low-income inhabitants (La Pintana) up to 82% in the case of the wealthiest *comuna* (Lo Barnechea). Due to the importance of national governmental institutions, the total investment level shows a very different spatial pattern: high levels of public investment in relation to the total public budget in the metropolitan region can be observed mostly in the zone of peri-urban growth, located outside of the study area. In the urban area, high levels of public investment are observed in areas such as Huechuraba and Maipú where recent population growth and urbanization projects exist. There is high investment dynamic in the low- and middle-income Municipalities, like former industrial locations (San Ramón and San Joaquín) and fast growing *comunas* (Pudahuel and Peñalolén) and some low-income centrally located comunas (Estación Central and La Cisterna).

A further indicator of governmental action is the number of international networks and city partnerships. This indicator varies between three (Bogota) and 59 (Buenos Aires) and is relatively weak, as it doesn't reflect any importance of the level of institutionalization of the mentioned partnerships. Out of the 59 city partnerships of Buenos Aires, 12 are with Spanish cities and six with Cities from Italy. Mexico and Santiago have 14 partnerships, Lima 24 and Sao Paulo 39. Furthermore, all six cities are members of the Unión de Ciudades Capitales Iberoamericanas (UCCI), which integrates 27 capitals of Latin America and the Iberian Peninsula.

TABLE 25
LOCAL PUBLIC FINANCE

	Local government revenue		Public debt		Investment	
	Total *(In US$, ppp/inhabitant)*	Taxes *(As percentages of local government revenue)*	Debt level *(As percentages of local GDP)*	Debt service *(As percentages of local government revenue)*	FDI *(In million US$; three year average)*	Public Investment *(In US$ per inhabitant)*
Bogota	2 753[a]	49.0[g]		6.0[a]	137 0[k]	2 149[a]
Buenos Aires	2 432[b]	92.5[b]	0.23[h]	2.0[j]		366[b]
Lima	70[c]	42.2[c]		8.9[c]		30[c]
Mexico	1 547[d]	19.4[d]	20.1[i]	4.2[i]		302[i]
Santiago	355[e]	50.9[e]			379.8[l]	38[m]
Sao Paulo	4 696[f]	21.2[f]		24.5[f]		131[n]

Source: Authors' compilation, based on:

[a] 2008, Bogota D.C., Alcaldía Bogota, 2008.
[b] 2007, City of Buenos Aires, GCBA DGEC, 2008, cuadro 15.1.
[c] 2007, Municipality of Lima, Municipalidad Metropolitana de Lima, 2007.
[d] 2007, D.F. Gobierno del Distrito Federal, Departamento de Finanzas, 2008.
[e] 2007, AMS, criteria of "Permanent own income" of the Municipalities, SINIM Database, 2009.
[f] 2008, Municipio Sao Paulo, Secretaría Municipal de Finanças, 2009.
[g] 2007, Bogota D.C. PNUD, 2008: 261.
[h] 2007, City of Buenos Aires. GCBA DGEC, 2008; cuadro 15.3; and 11.1.
[i] 2006, D.F. Gobierno de Ciudad de Mexico, 2007: 198, 202.
[j] 2006, City of Buenos Aires. GCBA DGEC, 2008; cuadro 15.2.
[k] Year not specified, Bogota D.C., Concejo de Bogota, 2008: 29.
[l] 2005-2007, average, Region Metropolitana Santiago, Comité de Inversiones Extranjeras, 2008.
[m] 2007, AMS, SINIM Database, 2009
[m] 2008, Minicipio Sao Paulo, own calculation based on IBGE 2009.

BOX 22
METHODOLOGICAL NOTE TABLE 25: LOCAL PUBLIC FINANCE

The table on local public finance includes data on local government revenues, public debt and investment. These indicators show local governments freedom of action from a financial perspective (total revenues, and income from taxes as percentage and to which extent these revenues are dedicated to dept services) on the one hand and on the other, the importance of local public activities with a long term perspective, shown as public investment per inhabitant. Furthermore, Foreign Direct Investment is included.

Definitions

Total **local government revenue** from all sources in US dollars annually, both capital and recurrent, for all local governments in the metropolitan area, averaged over the last three years (2000, 2001, 2003), and divided by the population.

Public debt services refer to annual payment of interest and other credit costs (without amortization).

Foreign Direct Investment is shown as a three-year average (in Million US$) as it shows extreme short-term variation.

Source: Authors' compilation.

IV. City profiles

In this chapter, six city sustainability profiles are presented bared on the indicators in the third chapter to discuss their specific situations in each of the metropolitan cities as well as the systemic characteristics of sustainability and any relevant public policy elements in each of the case studies.

These case studies begin with an analysis of data, then complemented by additional qualitative information, existing detailed studies and official reports which have been discussed with local experts; it is further complemented by the input of local consultants and the aforementioned collaborative authors from each of the metropolitan regions.

Each city profile starts with an introductive section in which a brief overview on the administrative and urban planning system is given. Afterwards, some selected topics are discussed. These topics are identified either:

- by the city's indicator values in chapter III or
- by the local experts recommendation.

The discussion is based on bibliographical review as well as local experts' input and interpretations, which have been developed on the basis of an orienting questionnaire.

A. City profile: Bogota

BOX 23
SUMMARY OF FINDINGS. BOGOTA

- Planning issues are concentrated at regional level (Distrito Capital; Alcaldía Mayor) with high levels of social and civil society participation.
- Bogota presents a "compact" structure with high levels of population density, not only in the central area but also in the periphery, as a result of public housing policy as well as the growth of informal settlements. In spite of extense housing and social policies, the upgrading of slums and reducing poverty are still the most urgent challenges in terms of social issues.

(Continued)

Box 23 (concluded)

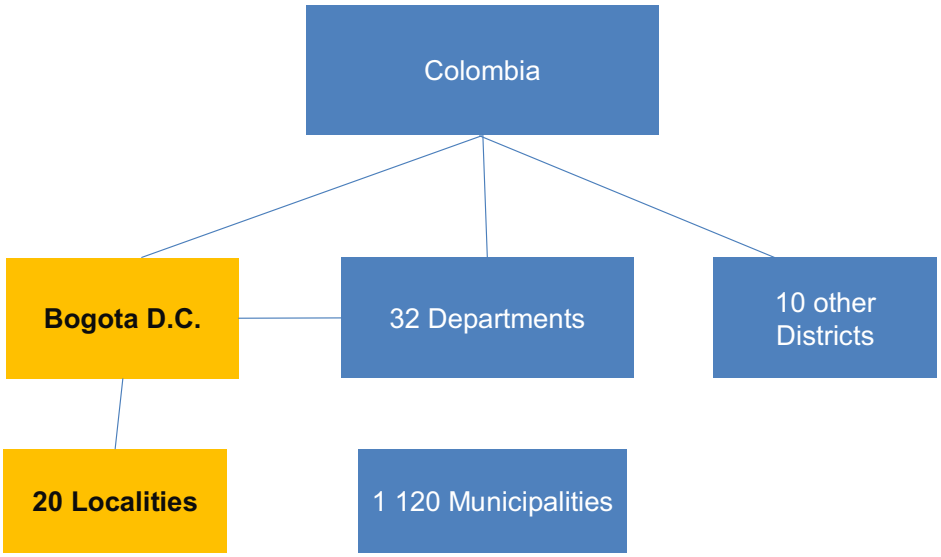
- Pollution of water bodies is one of the main environmental challenges. The development of sewage treatment facilities is slow and the coverage of water treatment continues to be insufficient. Water supply and management has been reformed and pricing policies are socially differentiated.
- The development of the BRT System "Transmilenio" is considered to be one of the most successful examples of public transport system reforms in Latin America.
- Bogota has a large number of green areas, primarily due to the presence of the mountain ranges in the city's immediate surroundings, but also as a result of long term public policies.

Source: Authors' compilation.

1. General data

The territory of the city of Bogota is defined as the Capital District by Constitution (Article 32) –Bogota is the capital of the Departamento Cundinamarca. The *Bogota Distrito Capital* is formed by 20 localities (*localidades*, see table 26), each of them with their own local administration. Localities are governed by a mayor who is named from a list of three proposals given by the respective Local Administrative Assembly.

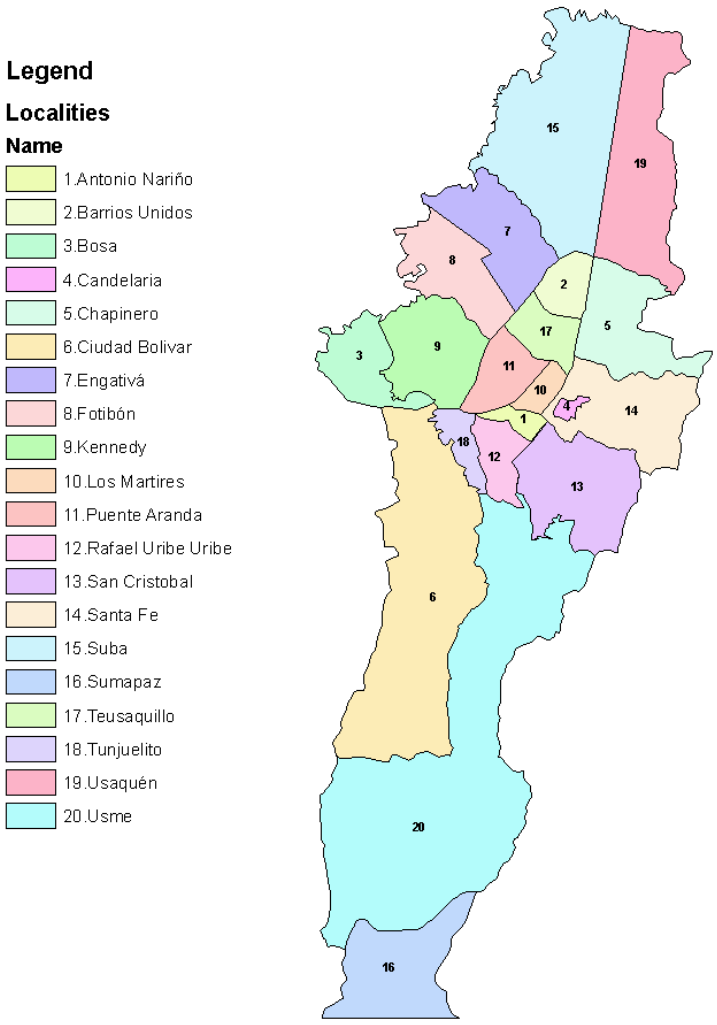
FIGURE 1
ADMINISTRATIVE SYSTEM IN THE REGION OF BOGOTA



Source: Authors' compilation.

Table 26 shows area, population and a brief socio-economic characterization of each locality, according to the predominant socio-economic groups (*estrato* 1 refers to the lowest income groups while *estrato* 6 includes the highest socio-economic groups, see also table 28) and the percentage of each locality suffering from unsatisfied basic needs. It can be assumed that among the largest localities (in terms of population) there are diversified and middle class areas (Kennedy, Suba, Engativá) as well as low-income areas (Ciudad Bolivar, Bosa, Usme).

MAP 1
ADMINISTRATIVE UNITS OF BOGOTA



Source: own elaboration.

Note: The borders shown on this map do not imply endorsement by the United Nations.

Functionally speaking, the **Metropolitan Area of Bogota** includes the following localities: Soacha; Facatativa; Zipaquirá; Chía; Mosquera; Madrid; Funza; Cajicá; Sibaté; Tocancipá; La Calera; Sopó; Tabio; Tenjo; Cota; Gachancipá; Bojacá summing a total of more than 1,000,000 inhabitants (DANE, 2006). Most of them (almost 400,000) live in Soacha which is physically almost part of the urban continuum of Bogota D.C. Due to data availability most of the following information refers to Bogota D.C.

Since November 2007, a common agenda has been formalized by the Mayor of Bogota and the Governor of Cundinamarca on sustainability strategies, climate change, and territorial planning issues on a regional scale (*Region Capital Bogota Cundinamarca*). Common projects deepen the dialogue within the region and strengthen the region's position in its dialogue with national and international institutions.

a) Basic governance structure for Regional Planning in Bogota

The administrative structure of the Distrito Capital is formed by the following three dominant elements (PNUMA, 2003: 30):

- The *Consejo Distrital* is the normative authority of Distrito Capital.
- *Alcalde Mayor de Bogota*: Is the chief of the district's government and legally represents Bogota D.C. The position is elected by popular vote for a period of three years.

TABLE 26
THE LOCALITIES OF BOGOTA D.C.: AREA AND POPULATION, 2005

	Area *(ha)*	Population	Socio-economic characterization	NBI *(percentages of inhabitants)*
Teusaquillo	1 419	137 641	Predominant: 4	0.2
Chapinero	3 846	122 815	Diversified	1.6
Suba	10 055	912 397	Diversified	2.8
Antonio Nariño	493	115 148	Predominant: 3	3.0
Barrios Unidos	1 190	224 654	Predominant: 3	3.5
Puente Aranda	1 724	257 471	Predominant: 3	3.7
Engativá	3 588	795 836	Predominant: 3	3.8
Usaquén	6 543	419 597	Diversified	3.9
Los Mártires	651	95 969	Predominant: 3	5.1
Fontibón	3 327	297 934	Predominant: 3	6.8
Rafael Uribe	1 345	376 148	Predominant: 2 and 3	8.3
La Candelaria	181	23 727	Predominant: 2 and 3	9.0
Kennedy	3 785	938 387	Predominant: 2 and 3	9.1
Tunjuelito	1 061	184 217	Predominant: 2	9.3
Bosa	2 466	501 460	Predominant: 2	9.7
Santa Fe	4 476	97 339	Predominant: 2	12.8
Usme	11 904	294 553	Predominant: 1	14.8
San Cristóbal	4 853	404 809	Predominant: 2	15.8
Ciudad Bolívar	22 908	563 223	Predominant: 1	16.2
Total	84 744	6 763 325		

Source: DANE, 2009, Alcaldía Mayor de Bogota: 24; authors' compilation.

- Local Authorities: At the level of the *localidades* there are two authorities with important power resources. The local mayors are nominated by the *Alcalde Mayor* from a short list of proposals presented by the Local Administrative Assembly, (JAL *Junta Administradora Local*) the local authority scale, comprised of seven to 11 representatives, elected by popular vote. These local governments have autonomy in managing issues of local interest, participation processes, environmental and cultural themes, as well as decisions regarding economic development, industrial policy, and tourism (Alcaldía Mayor de Bogota).

Bogota is frequently regarded as an example of good governance practice in the Latin American context. This metropolitan region may be considered "an ecological leader in Latin America" (Newman & Jennings, 2008: 50). However, this positive evaluation contrasts with some statements by local experts considering political pitfalls like clientelism, bribery, lack of civil society's participation and institutional weakness. The autonomy of Bogota and in the Cundinamarca Capital Region is restricted by the National Environmental System (SINA - *Sistema Nacional Ambiental*) with its powerful position and oversized responsibilities. Simultaneously, diffused competencies, inconsistencies and

contradictions abound. The result is that many sustainability actions are diluted, doubled or may even provoke conflicts between different entities which assume responsibility for specific activities.

The First Plan of Territorial Planning for Bogota (POT = *Plan de Ordenamiento Territorial*) was adopted by the Government of the Distrito Capital in 2000 (Decreto 619) and was amplified in 2004. The POT is primarily oriented towards the development of the Capital District; despite the "regional perspective" applied in the formulation, regional issues are hardly considered. Since then, the planning system has evolved and has adopted a more strategic view. In 2009 a review of the POT began, evaluating its effectiveness and reassessing the potential of the metropolitan area.

In accordance with the concept of sustainability and the challenges of climate change, which require the application of a multidimensional vision, according to the local expert`s evaluation it is necessary to:

- Harmonize the attributions of the Secretaria de Ambiente with those of other planning instruments and with institutions such as the Ministry of Environment, Housing and Territorial Development (MAVDT) and the Autonomous Regional Corporation (CAR). This is necessary as environmental policies applied at both local and regional levels appear to be isolated and disconnected from the actions of main national agents.
- Establish Environmental Management initiatives based on alliances with different governmental levels as well as civil society and international organizations, and reduce the centralization of planning decisions at national level. This centralization of decisions at the national level is considered as a major obstacle of regional development.
- Strengthen the institutional base for risk reduction and disaster management.
- Establish a culture of responsibility and limitations on the consumption of non renewable resources.

The current D.C. government, the *Alcaldía Mayor,* has defined policies of high density as a predominant goal, explicitly mentioning that this does not necessarily mean high rise buildings. For decades, Bogota has applied public housing policies which may be interpreted as instruments of this policy –typically being built up as large scale urban housing projects. Nevertheless, these politics also lead to a concentration of urban and population growth in a few localities. Recent population growth has been registered in predominantly low income, suburban localities like Usme, Bose, Fontibón and Suba and – at a lower rate – in the localities of Chapinero, Teusaquillo and Ciudad Bolivar.

The urban land expansion is estimated in 5,441 ha between 1996 and 2003, or 34.8%, which is above the population growth rate (21.8%), reducing slightly population density (see table 27). Although this territorial expansion is slightly slower than in the case of Santiago de Chile, it still presents an important loss of agricultural, unurbanized land and a profound transformation of the respective communities.

According to local expert consultations several phenomena may be defined which need coordinated action and are seriously affecting the quality of life in the city. These are:

- Degradation of water bodies (especially rivers) and loss of their strategic importance (e.g. wetlands), which increases health risks, threatens ecosystems and limits development options.
- Risk of urban disasters (landslides due to seismic activity and deforestation, partially also caused by the extraction of construction materials) which affects mostly socially vulnerable areas.
- Housing deficit, due to internal migration, refugees and informal settlements in risk areas (especially on slopes) as well as the lack of basic services and public spaces in this type of neighborhood.

- Need to modernize the public transport sector which is not part of the Transmilenio, as vehicles with low standards and high emissions are predominant, thereby negatively affecting public health, especially that of children (Banco Mundial, 2007).
- Lack of solid waste treatment.
- Concentration of main emission sources of air pollution in areas of high social vulnerability.
- Reforestation measures with species that are not able to mitigate pollution.

TABLE 27
BOGOTA: URBAN GROWTH, 1996-2003, BY LOCALITY

	Population growth	Urban land growth (1996-2003)	
	(In percentages)	*(ha)*	*(In percentages)*
Usme	22.6	699.0	93.7
Ciudad Bolívar	3.0	798.4	77.0
Santa Fe	-9.3	153.1	39.1
San Cristóbal	-14.7	343.3	37.7
Kennedy	0.0	711.5	33.8
Rafael Uribe	-13.9	174.5	25.2
Engativá	0.0	522.8	24.0
Fontibón	13.7	337.6	20.4
Usaquén	1.0	492.6	16.5
La Candelaria	-6.6	19.9	16.1
Chapinero	4.1	139.0	15.6
Suba	12.9	784.6	13.5
Tunjuelito	-12.9	74.8	12.7
Bosa	12.1	140.2	12.5
Puente Aranda	-8.0	31.5	2.8
Antonio Nariño	-6.4	5.2	1.6
Teusaquillo	3.7	10.8	1.1
Los Mártires	-6.2	1.3	0.3
Barrios Unidos	0.0	1.2	0.2
Total		5 441.3	34.8

Source: Alcaldía Mayor de Bogota; SDP, 2008b: 3.

These issues have also been identified in the comparative section as areas in which Bogota presents unsatisfying levels of the sustainability indicators. In order to deepen the discussion, the challenges of reducing poverty and segregation through integration programs will be discussed in the following sections.

2. Poverty, social segregation and integration programs

Poverty is of the main challenges for Bogota's sustainable development, comparable to the situation in Sao Paulo and Lima (see also table 2). Nevertheless, in Bogota different programs to reduce poverty have been implemented. Child mortality still presents critical levels which expressess insufficient medical assistance, household poverty (e.g. drinking water access and sewage service) and adverse environmental conditions. Public programs aim to improve the quality and quantity of children's nutrition have shown positive results as did the massive professional assistance given to women during pregnancy and birth.

a) Socio-spatial segregation

The city is experiencing a growing level of inequality which shows a clearly marked stratification of society, potentially deepening the already existing social differences. Nevertheless, Bogota presents an important number of public programs and policies that are designed to change spatial segregation patterns and to implement mechanisms of integration on a local and neighborhood scale. Large strategic projects in Bogota such as investment in the city center, the construction of the integrative housing area Nuevo Usme, the Airport, the Ring of Innovation, and the sanitation of Rio Tunjuelo include social integration and may be regarded as remarkable opportunities to achieve an integrated society (PNUD, 2008: 35). Nevertheless, as in the case of most Latin American metropolis, segregation is still a relevant issue and it challenges sustainable development strategies. In Bogota, six income groups are officially defined and the dominant income group is identified (if possible) for each housing block in the city. Table 28 shows how many blocks are dominated by each income group for each of the localities –it also shows the number of housing blocks that do not permit such identification.

TABLE 28
BOGOTA: NUMBER OF BLOCKS BY INCOME GROUP AND LOCALITY, 2004

	Blocks with no dominating income group	Dominating income group						Total (no. of blocks)	Percentage (of Bogota D.C.)
		1	2	3	4	5	6		
Ciudad Bolivar	720	3 416	1 151	89	0	0	0	5 376	12.07
Suba	926	25	2 156	2 085	389	533	145	5 259	11.81
Kennedy	547	91	2 338	1 884	26	0	0	4 886	10.97
Engativá	577	38	906	2 446	122	0	0	4 089	9.18
Usme	580	1919	1 071	0	0	0	0	3 570	8.02
Bosa	400	358	2 447	75	0	0	0	3 280	7.37
San Cristóbal	429	290	2 053	285	0	0	0	3 057	6.86
Rafael Uribe	274	289	1 131	838	0	0	0	2 532	5.69
Usaquén	372	183	355	549	317	315	414	2 505	5.62
Puente Aranda	401	0	8	1 423	0	0	0	1 832	4.11
Fontibón	396	0	262	731	258	0	0	1 647	3.70
Barrios Unidos	111	0	0	797	263	26	0	1 197	2.69
Chapinero	152	118	155	55	197	124	327	1 128	2.53
Teusaquillo	157	0	0	132	691	39	0	1 019	2.29
Santa Fe	124	64	488	143	32	0	0	851	1.91
Tunjuelito	76	2	529	234	0	0	0	841	1.89
Los Mártires	96	0	48	558	3	0	0	705	1.58
Antonio Nariño	76	0	26	489	0	0	0	591	1.33
La Candelaria	55	0	74	40	0	0	0	169	0.38
Total	6 469	6793	15 198	1 1853	2 298	1 037	886	44 534	100.00
In percentages (of total blocks)	14.53	15.25	34.13	26.62	5.16	2.33	1.99	100.00	

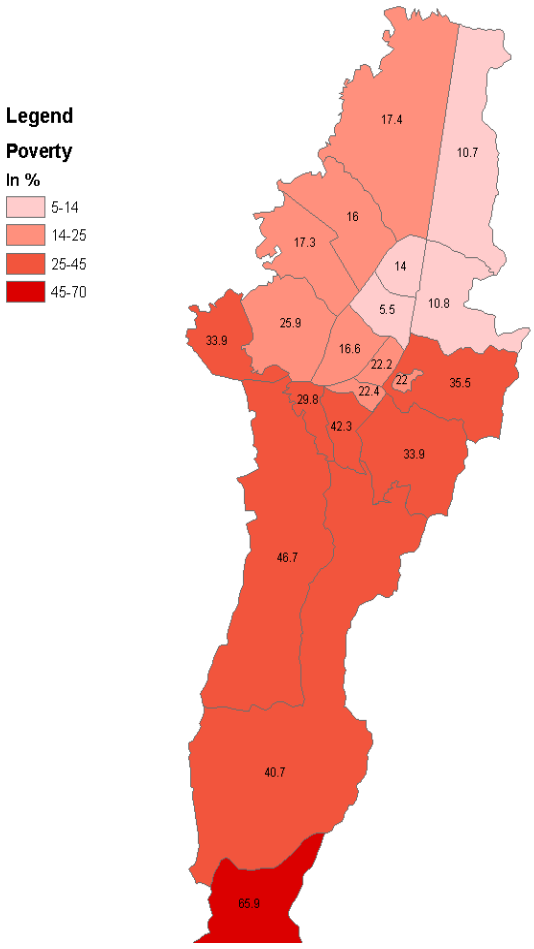
Source: Alcaldía Mayor de Bogota, 2004: 18.

The upper class localities such as Usaquén, Chapinero and Suba show a large number of blocks dominated by the high income group 6, a significant number of blocks dominated by other social classes are also usually present, and therefore at least at this scale there is a lower spatial segregation of high income groups than in other metropolis (see for example Santiago de Chile). By contrast, middle class

localities such as Barrios Unidos and Teusaquillo as well as some of the lower middle class localities present extremely high levels of segregation (Los Martires, Antonio Nariño y Puente Aranda, and Candelaria). Some localities, mostly in the southern part of Bogota D.C. present exclusively low income and lower middle class blocks; most remarkable of all are the localities Usme, Bosa, Kennedy, Ciudad Bolivar and Rafael Uribe.

Poverty is concentrated in the southern part of Bogota D.C. and in some central localities (especially La Candelaria). In the localities with the highest poverty rates like Usme, Ciudad Bolivar and Soacha (located outside of Bogota D.C.) there is a concentration of settlements with high environmental risks in terms of air and water pollution, floods and the risk of landslides. The risk of land slide is especially high in Ciudad Bolivar, Usme, Rafael Uribe, San Cristóbal, Santa Fe, Chapinero, Usaquen and Suba, where some 8,500 households live under conditions of extreme land slide risk with no effective mitigation measure (PNUD, 2008: 147).

MAP 2
BOGOTA: POVERTY BY LOCALITIES, 2007
(Percent of population below poverty line)



Source: own elaboration based on SDP, 2007.
Note: The borders shown on this map do not imply endorsement by the United Nations.

The concentration of low income population in the south of the metropolitan area is also an issue of "environmental justice", as major fixed pollution sources are located in these low-income sectors in the southern and western part of Bogota (see map 2).

In the case of Usme, this is caused primarily by the brick making plants, which are considered to be one of the main priorities in terms of emission control mechanisms. Puente Aranda presents the highest concentration of industrial emissions and is, in overall terms, the most important source of industrial pollution (Fandiño / Behrentz, 2009). Brick making plants are estimated to cause around 50% of the total PM emissions of fixed sources in Bogota. There are also a large number of small scale exploitations of construction materials that cause air pollution and that lack any treatment of waste or sewage, including the locality of Soacha.

Important pollution source is waste disposal in the Doña Juana landfill, generating important emissions and water pollution in general, which affects, most of all, the river Tunjuelo located in the low-income southern part of D.C.

TABLE 29
BOGOTA: SPATIAL CONCENTRATION OF EMISSIONS OF AIR CONTAMINANTS
(In percentages)

PM	NO_x	SO_2
Usme (40)	Puente Aranda (30)	Usme (27)
Puente Arando (17)	Kennedy (17)	Puente Aranda (25)
Fontibón (12)	Bosa (17)	Fontibón (15)
Kennedy (8)	Fontibón (16)	Tunjuelito (15)
Tunjuelito (7)	Tunjuelito (8)	Kennedy (6)
San Cristóbal (4)	Usme (7)	Engativa (5)
Rest (11)	Rest (6)	Rest (8)

Source: Fandiño / Behrentz, 2009.

In the localities of Puente Aranda, Fontibón, Kennedy and Engativá (western part of Bogota) the emissions are related in an important measure to informal production activities (estimated: 35 %).

b) Informal Settlements and Integration Programs

Informal housing, deficient infrastructure of neighborhoods, and precarious, overcrowded housing are relevant challenges of social policies in Bogota. Such settlements are not only characterized by a lack of housing conditions, public space and services, but also by a higher risk level due to exposure to land slides. Two different slums types are identified in the case of Bogota (Rueda-Garcia, 2003):

- Periphery: In the initial stages of the non-planned urban growth, vast informal settlements were constructed in the peripheral and marginal areas which form slum neighborhoods.
- Inner City Slums.

A highly relevant element of housing policies is the legalization of informal settlements. During several decades important efforts have been made to legalize the informal settlements. These have led to the legalization of a large number of neighborhoods including a total of more than 1.3 million inhabitants (see table 30). According to recent information a total number of 1,453 neighbourhoods were legalized and in only 135 neighbourhoods, located mostly in Usme and Ciudad Bolivar, the tenure issue was still unsolved (Saldías Barreneche, 2007: 77).

Since the end of the 1990s, two important programs have been implemented: the "Demarginalisation" Program (1998-2001) and the "Integral Improvement of Neighborhoods" Program (2001-2004) (Rueda-Garcia, 2003: 24).

Through the **Desmarginalización** program, major risk zones have been targeted to improve quality of life, aspects like accessibility, education and housing. Through this primarily publicly financed

program (national level, district government, localities and communities) they have constructed and formalized drinking water supply system, sewage water collection, transport infrastructure, parks and green areas, education and health infrastructure as well as implemented places and organizations of social assistance. All of these measures have been realized by processes which include civil participation in the design of the measures. This is aimed to strengthen community identity (IDU, 2010).

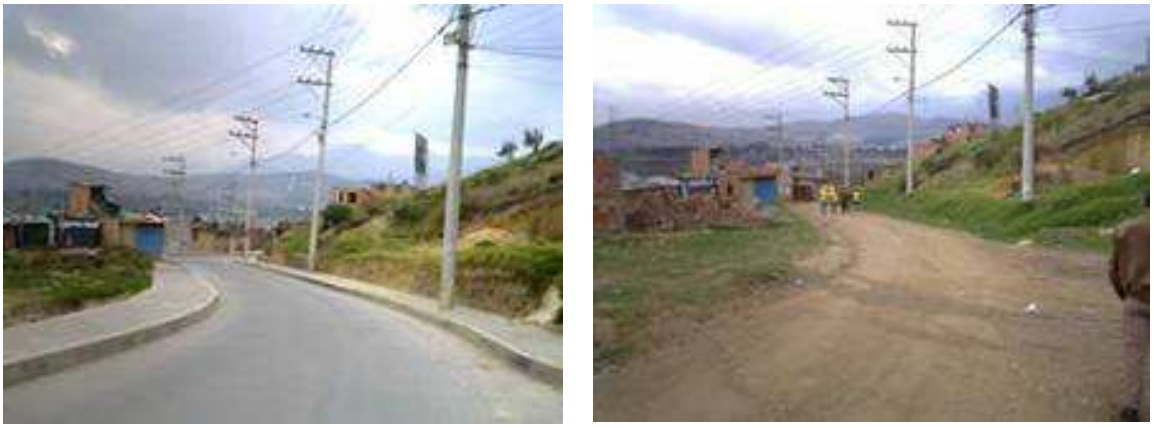
TABLE 30
BOGOTA: LEGALIZATION OF INFORMAL SETTLEMENTS

Locality	Legalized neighborhoods	Area *(ha)*	Population (estimated)
Ciudad Bolívar	146	1 176	234 802
Bosa	238	732	185 347
Kennedy	118	732	181 795
Suba	160	798	169 260
Usme	151	693	152 535
Engativá	83	511	107 519
San Cristóbal	102	686	97 774
Rafael Uribe	81	347	85 235
Usaquén	79	316	42 499
Fontibón	45	159	33 058
Santa Fe	23	168	27 524
Tunjuelito	5	114	25 070
Chapinero	9	33	3 873
Antonio Nariño	3	17	3 151
Puente Aranda	7	16	1 337
Barrios Unidos	2	1	287
Teusaquillo	1	0	104
Los Mártires	1	0	37
Total	1 254	6 499	1 351 205

Source: Alcaldia Mayor de Bogota, 2004b: 16 (based on information from DAPD; as of 2002).

One of these measures is the program **Integral Improvement of Neighborhoods** which basically improves transport and communication networks in the low income sectors of Bogota D.C. The program is part of the *Plan de Ordenamiento Territorial* (POT) and concentrates its activities in those sectors of the city which have the highest level of deficiency and the largest number of informal settlements and unplanned urban growth. The most beneficiated localities are: Usaquén, Chapinero, Santa Fe, San Cristóbal, Usme, Bosa, Kennedy, Suba, Rafael Uribe and Ciudad Bolívar (IDU, 2009).

FIGURE 2
INFRASTRUCTURE UPGRADING IN CIUDAD BOLIVAR / BOGOTA



Source: Registro Fotográfico Programa Mejoramiento Integral de Barrios. Images are from Ciudad Bolivar.

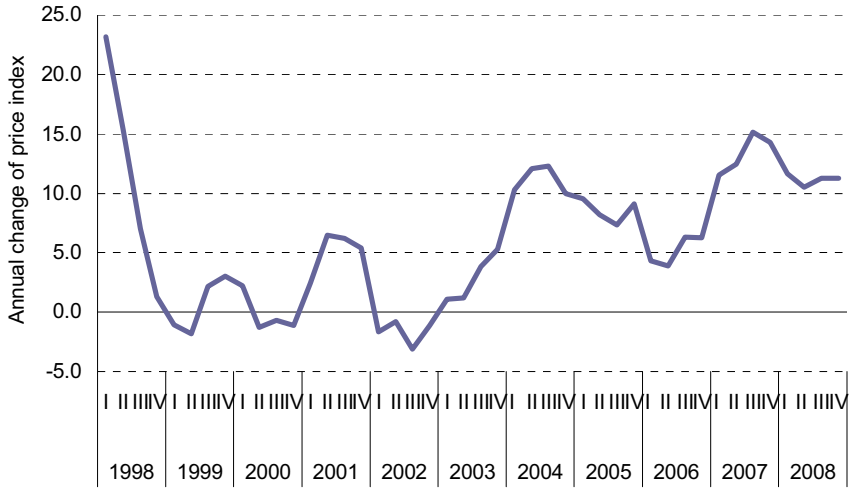
c) Publicly funded housing programs

In combating poverty, upgrading housing and generating an integrative model of urban growth, it is necessary to highlight the role of certain governmental institutions which have a remarkable historic tradition in Colombia, for example the ICT (*Instituto de Crédito Territorial*) founded in 1939; BCH (*Banco Central Hipotecario* founded 1932, the CVP (*Caja de vivienda popular*) and CVM (*Caja de vivienda Militar*) (Sierra, 2007: 37). The first mentioned, ICT, has been a key player in the process of planning and design of large urbanization projects throughout several decades, especially from the 1960's to the end of the 1980's. The most prominent example is Ciudad Kennedy; a project executed primarily from 1961 to 1967 which was built for a projected number of 200,000 inhabitants. Many other large scale projects like Conjunto Banderas Timiza, La Esmeralda, Conjunto Sauzalito (part of the so-called Ciudad Salitre), and El Tunal are examples of these publicly-led urbanization projects in Bogota (Sierra, 2007: 47/60). In the decades of the 1970's and the 1980's, mortgage companies (coorporaciones de ahorro y vivienda) were also of importance as well as (Espinosa, 2007: 76) large privately financed housing projects like Chicó (developer: OSPINAS).

The design of some of the aforementioned projects also follow defined goals of transport flow reduction, such as the *Ciudad Salitre* which was built relatively close to the city center (7 km from Plaza Bolivar) in order to reduce commuter flow and as a contrasting trend to suburban growth. This last project is considered a successful example of modern urban planning, combining principles of density and integration with green spaces and connectivity.

There is a housing subsidy (*Subsidio Distrital de Vivienda*) for social housing in the project "Bogota sin Techo" part of the development plan of Bogota 2004-2008 (Llanos, 2005). It is for informal workers who have an income below two minimum wages and to internally displaced families to acquire housing or to finance housing improvement. Between 2005 and 2010, for instance 9,830 subsidies were approved totaling fiscal investment of 68,906 million pesos (Metrovivienda, 2010b).

FIGURE 3
BOGOTA: HOUSING PRICE LEVEL, 1998-2008
(In percentages)



Source: Authors' compilation, based on Dane, 2009b.

Public housing policy has increased its importance in Bogota in the last several years in a context of positive economic development. After having overcome the crisis of 1998-2002, the real estate market has shown a rapid growth of price levels. During the last two years (2007 and 2008) prices have consistently been more than 10% higher than in the prior year period.

Currently, the most important institution in public housing policies in low income areas is **Metrovivienda**, a publicly funded enterprise, owned by the Alcaldía Mayor de Bogota, which started by implementing urban projects in Ume and Bosa in 1999. This enterprise is constructing and buying housing of social interest with the goal to ensure decent housing conditions to the poorest and most vulnerable sectors of the city's society. This habitat is meant to ensure access to defined public services, recreation zones and urban infrastructure and to assure decent living conditions in general (Metrovivienda, 2010). Metrovivienda is therefore serving as an urban planning organism dedicated to inclusive projects and sustainable development on environmental issues. Projects started in 2004 are not only located in peripheral locations like Usme (*Operación Nueva Usme*), Bosa (*Proyecto El Edén - La Palestina*) but also in the city center (*Proyecto Comuneros - San Bernardo*).

In 2008, the Council of Bogota D.C. confirmed the "right to a roof" as one of the 16 strategic programs in the development plan 2008-2012. This means that the government of Bogota D.C. aims to guarantee, in a progressive manner, access to decent housing and tenure security. The main instruments to achieve these goals are the construction and improvement of housing, subsidies and relocation (Concejo de Bogota, 2008).

In spite of all of the initiatives for integration Bogota is still considered "a segregated city, which doesn't mix rich and poor inhabitants" (PNUD, 2008: 87). This can be observed in quantitative manner as has been shown above (see table 28) but stratification is also a relevant issue in terms of social representation and has clear spatial manifestations (Uribe-Mallarino, Consuelo, 2008).

d) Internal displacement, informal settlements and risk

Colombia presents high levels of violence related to the large number of armed groups in the country caused by years of political violence and organized crime. As a result, Colombia presents a singular case in Latin America in terms of internally displaced persons, with an estimated two million displaced persons in 2005 (UN Habitat, 2007: 367). One must take into account both socio-spatial

patterns and challenges that are present in Bogota, not only in quantitative terms and on issues pertaining to economic needs, but also with regard to the negative psycho-social effects of displacement, e.g. loss of social and family networks and local identity.

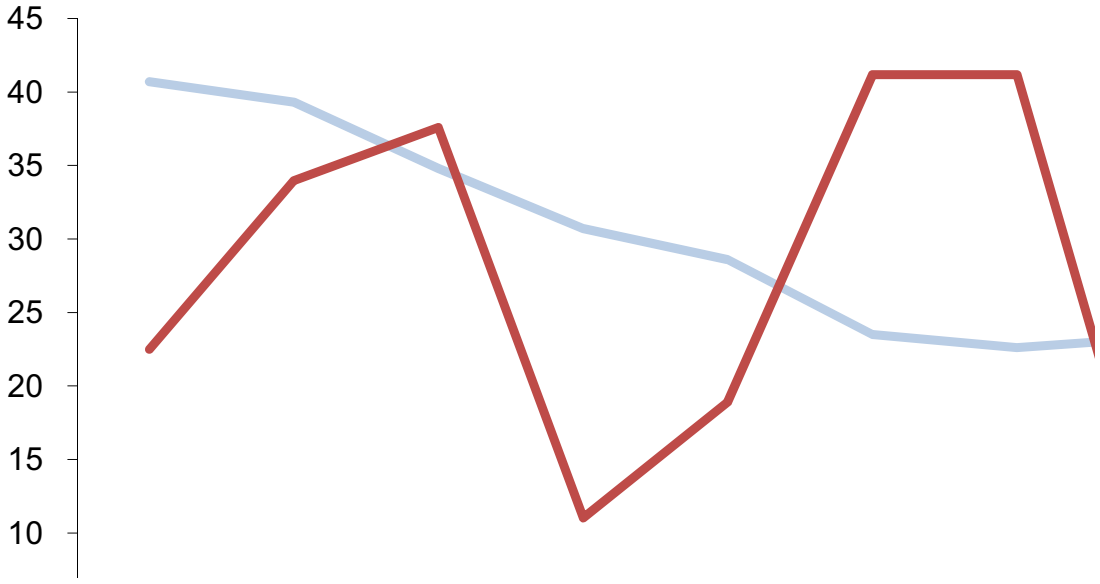
The internally displaced persons have generated new neighborhoods which are often located in areas of risk and which create the need for vast social programs. This is an issue of even higher importance in the context of rising costs of land caused by the emphasis on urban competitiveness policy and the globalization of markets.

The most important part of displaced persons within Colombia has been received by the large urban centers, namely Bogota, which is the main attracting region of internal displacement as it has received almost 12% of the approximately 2,700,000 displaced Colombian citizens between 1999 and 2007 (Moreno Gutierrez 2008, 6). Analyzing their spatial location within the metropolitan area, it is clearly visible that most of them are located in the largest and predominantly low income localities of Ciudad Bolívar, Usme, San Cristóbal, Bosa, Suba, Engativá and Kennedy. Displaced people are located in low income sectors; 50% of the displaced people are considered to live below the poverty limit and almost 20% in conditions of extreme poverty (Moreno Gutierrez 2008, 9 and PNUD).

Therefore, it is of constant political concern to ensure that people affected by political violence have access to improved living conditions and opportunities to redefine their lives. This concern is an issue of spatial planning, due to unplanned growth and the need for refugees to look for low priced spaces; these groups have frequently established housing in high risk areas (mostly land slide or flood risk).

Bogota is still bearing the image of delinquency-related risks, and some numbers seem to sustain a certain level of concern (as shown in the international comparison section): 1.393 homicides were registered in 2007, which corresponds to a rate of 18.7 per 100.000 inhabitants or an average of 3.8 homicides per day. Most of them using fire arms (61%) and most of the victims were 20-29 year old men (34.2%) followed by men aged 30-39 (21.2%) (Veeduria Distrital, 2008: 9). Nevertheless, the homicide rate has been reduced in a significant manner throughout the last ten years –the number of kidnapping cases is much more volatile, yet also reveals a declining trend with a long term perspective (Figure 4).

FIGURE 4
BOGOTA: HOMICIDE RATE AND KIDNAPPING, 1998-2007



Source: Authors' compilation, based on data from Veeduria Distrital, 2008: 9 and 28.

The inner city localities of Martires and Santa Fe as well as the highly populated suburban low income localities Usme, Ciudad Bolivar and Kennedy are considered critical focus of violent crimes (homicides, Veeduria Distrital, 2008: 15).

In Bogota the issue of urban security has been addressed by the "quality of life" campaigns and a policy focus on combating high crime rates is observed. The City is considered a positive example for reducing criminality not only by enforcement of police, increasing its budget, technology and knowledge; and disarming campaigns but mostly by integration strategies and strengthening citizenship and democracy. A special enphasis has been made on social services for the low-income sectors, the role and quality of public space and strengthening a culture of citizenship as main elements of fighting criminality and insecurity.

The impressive reduction of the homicide rate is situated in the context of an initially high level in the second half of the 1980's and the first part of the 1990's, mainly caused by guerrillas, paramilitary action and the influence of drug cartels. Due to their successful reduction on national scale, the main indicators of violence have dropped significantly in the most important cities of Colombia (Casas Dupuy & González Cerero).

3. Water pollution and sewage treatment

The Bogota River is the main water resource for the Sabana de Bogota and suffers waste water discharges of the metropolitan area. Around 90% of its discharges are brought by the three effluents which cross the city of Bogota and the rivers Salitre (or: Juan Amarillo), Fucha y Tunjuelo.

a) Drinking water supply system

The main water source of Bogota is the extraction of ground water which has caused a reduction of the long-term water reserves, especially in the western part of the *sabana*. Due to the degradation of superficial water bodies like rivers and their quantitative insufficiency, the exploitation of subterranean water began some 40 years ago. The recharge of these fresh water bodies has been reduced and ground water pollution has increased (Mendivelso Lopez et al., 2007: 33). The groundwater level has registered a decline of various meters which is an important risk and limitation for future development. The systems providing drinking water offer around 29 m^3/s, coming mostly from the Rio Bogota system (14 m^3/s) and the Chingaza System (12 m^3/s). Characteristic of the water management system is an important level of informality: Of the estimated 6000 wells in use (2004), only 1,600 have been registered as legal exploitations (Mendivelso Lopez et al., 2007).

Around 80% of the water demand in Bogota comes from the household sector including mixed use (Acueducto, 2006b: 118). Water availability is a also central issue in ensuring economic competitiveness; however, more important, securing drinking water supply is a challenge for sustainable urban development.

b) Water management and governance

In Bogota a public enterprise (EAAB - *Empresa de Acueducto y Alcantarillado de Bogota*) is in charge of water distribution and waste water collection. EAAB is considered to provide one of the most efficient and egalitarian services of Colombia, its main concern has been to provide water service to the poorest areas of the city. As a result, in 2001 95% of Bogota's households were connected to the drinking water system; meanwhile 87% counted on waste water collection (Hildebrando Velez, 2006). Nevertheless, EAAB does not manage the water treatment process.

Different policies and measures have been applied in order to amplify coverage. The enlargement of the service network is financed by a differentiated and progressive tariff system, where in high income sectors of the city the water price is 200% above the real value while the water service in the city's poor sectors receives subventions (Hildebrando Velez, 2006).

In terms of governance, there are two institutions in charge of environmental control of the water management system in the area: the *Departamento Administrativo del Medio Ambiente* (DAMA), created in 1996 with jurisdiction in the Capital District and the *Corporación Autónoma Regional* with jurisdiction in the *sabana*. It has been proposed to establish a single governmental authority entitled to manage hydric resources in the *sabana* in order to manage water at regional scale, including the metropolitan area, and the water basin used in Bogota (Mendivelso Lopez et al., 2007).

c) Social issues and price policy

In Colombia there is a tradition of cross-subsidies between customers which means that water tariffs have been differentiated by income groups. In 1994, the Public Service Law was approved, which established the requirement to set tariffs that recover full costs while also limiting the extent of cross-subsidies between customers (Fay / Morrison, 2005: 30). This means that the poorest income group should pay at least 50% of the real water cost. These legal requirements meant a 50% increase on average of tariffs within two years to meet the economic rent goal and considerably higher tariff growth rates for the poorest citizens (around 400%). Because of the social consequences of implementing these policies, the deadlines have been extended twice and the requirement that the poorest households pay at least 50% of the real cost has been reduced to 30% (Fay / Morrison, 2005: 30). Nowadays, the drinking water price level is still differentiated by the officially defined six income levels. As a result of the above mentioned legal framework, in the ten year period 1995-2005, the lowest income group (*Estrato 1*) suffered the highest level of price increases reaching an index value of 1,185 in 2005 (1995=100); in comparison the respective water price index for the highest income group (*Estrato 6*) in 2005 was 202 (Coing, 2005: 161).

Almost 80% of households receive some benefit from the cross-subsidies, but in general low income households are the most favored. In terms of per capita benefit, it must be stated that the poorest 20% of the population receive 25% of subsidies and the middle class (60% of the population) receive 70% of the funds. This can be criticized due to the fact that only 20% of the population is paying the full cost of water, but it is also a considerable result compared to the experiences of some Asian cities, where few poor people are benefitted and the subsidies are mostly recived by high income population (UNDP, 2006: 99).

d) Flood risk

In general, in international comparison the flood risk level in Bogota is considered relatively low in comparison to other Mega-Cities (MunichRe, 2005: 21). Nevertheless, the local expert evaluates the flood risk as high. There is a concentration of areas prone to flood risk in specific zones in the low income localities, mostly along River Tunjuelo, from a local perspective, floods present the second most relevant risk due to the high environmental and health risks caused by extreme pollution of the Rivers Bogota and Tunjuelo, which aggravate the consequences of possible floods (PNUD, 2008: 146). Floods such as that of the River Tunjuelo in May, 1996 and the more recent events in November/December 2008 show, the relevance of this risk for Bogota. In the whole of Colombia occurr 1.14 floods per year, provoking almost 50 deaths annually, UN Habitat, 2007: 370).

An important element related to flood risk and hydrological cycles is the protection of wetlands in the Sabana de Bogota. Among the proposed measures are restoration areas, reforestation in the water basin, and safe-guarding groundwater (Mendivelso Lopez et al., 2007).

e) Pollution and pollution reduction programs

The Bogota River and the Tunjuelo River are considered to be extremely contaminated due to untreated domestic sewage, 90% industrial activities, and leachate (liquid draining from landfills). (PNUD, 2003: 44). Up until the late 1990's there has been almost no waste water treatment in the Bogota River system. Nowadays, the Salitre treatment plant (*PTAR Salitre*), which went into operation

in 2000, continues to be the only operating sewage treatment plant. This means high levels of pollution, affecting drinking water quality, causing infectious diseases, affecting agricultural activities and food quality, damaging the habitat of fauna and river side biotopes. Some parts of the rivers are considered to be dead (no macrobiotic life) and in others they present oxygen deficit.

In 1994, the D.C. of Bogota entitled the French multinational enterprise Suez Lyonnaise des Eaux – Degrémont the concession to construct and maintain the above mentioned first sewage treatment plant located at the river Juan Amarillo (PTAR Salitre) in the northern part of Bogota. This river was chosen as a first step as it serves the wastewater of almost 2,200,000 inhabitants and the pollution is almost completely domestic. Rio Juan Amarillo plant, on the affluent located in the upper part of Rio Bogota within the metropolitan area, started its activities in 2000, with an initial average capacity of 1.8 m^3/s (PNUMA, 2003: 44ff.) and was planned to reach a capacity of 4.0m^3/s. The construction of two more plants to treat domestic wastewater were planned along the rivers Fucha and Tunjuelo.

The limited results of the Salitre Treatment Plant follow design problems and the use of imported treatment technologies which did not show satisfying results in the specific climatic and biological conditions of Bogota (Garcia Durán, 2006).

In 2004, the concession was transferred to the publicly funded Acueducto y Alcantarillado de Bogota an important governmental intervention in the territory. The water treatment development plan has been changed and in the new POT (Programa de Ordenamiento Territorial) 2003, defined new measures. Expansion of the Salitre treatment plant by of 5.6 m^3/s, by reaching a capacity of 7.3 m^3/s, is a priority. The treated water should be usable for (irrigation) in the western zone of the *Sabana*. Plans have been made to develop and improve the sewage system and coverage in the basins of the rivers Fucha, Tunjuelo y Soacha and lead wastewater by a collector to a newly planned treatment plant in the southern part of Bogota (PTAR *Canoas*) with an installed treatment capacity of 17.1 m^3/s. The total costs of these infrastructure investments are estimated to reach one billion US$ and the plants as well as the collectors should operate starting in 2019. The development of these plans requires augmenting water tariffs another 20% (in real terms). Pollution reduction issue still is a persisting challenge and an unsolved problem.

FIGURE 5
THE SALITRE TREATMENT PLANT IN BOGOTA

Source: © Google Earth, 2009.

According to the company Empresa de Acueducto y Alcantarillado de Bogota, during the winter the levels of the River Bogota and the Juan Amarillo increase heavily, reaching a point where the water returns by the city's sewage system, thus creating important socio-environmental problems. Dwellings

have been affected by flooding, causing damage and loss and forcing the evacuation of the community. Since the PTAR Salitre plant began its operation these situations have disappeared.

A campaign of voluntary reduction of domestic water consumption has been implemented, encouraging a civil culture. One can observe an emphasis on collective responsibility and the fear of confronting a new water crisis, potentially caused by climate change effects. The socially differentiated tariff system has served to co-finance the low income sector and to smoothen the water costs.

4. Transport infrastructure and sustainability

For several years, urban planning in Bogota has followed a strategy of reducing car dependency. The increasingly massive use of motorized individual transport is regarded as a threat to urban sustainable development. This includes several infrastructure investments like avenues exclusively for pedestrians and bicycles, the complete renovation of the public transport system measures which are related to the root causes of traffic. They include urban design to achieve high density without creating high-rise buildings. These principles are declared purposes of local planning in Bogota (Newman & Jennings, 2008: 50 /141).

> As declared by a former mayor of Bogota (cited in Newman & Jennings, 2008: 141) *"Humane cities need to be made for walking. We also like to see people, be with people (...) there is a conflict between a city for cars and a city for people. As a city becomes friendlier to motor vehicles, it inevitably becomes less humane"*.

These policies have also been communicated by symbolic actions like closing main roads on Sundays during the morning (up to 14:00 hrs.), car free day in the whole city once a year, etc.

a) Bus rapid transit system: the case of Transmilenio

With the purpose of implementing a sustainable and efficient public transport system, the enterprise TRANSMILENIO S.A (*Empresa de transporte el tercer milenio)* was founded in October 1999 financed primarily by public funds. The BRT system of Bogota was inspired by the experience of the Brazilian city of Curitiba but with considerable changes, especially in the economic model applied. In Curitiba, the project has been primarily financed by the national government and World Bank loans. In the case of Bogota, a major part of the investment has been financed by raising local fuel taxes, 20% by national government loans and only 6% has been borrowed from the World Bank. A considerable part (26%) of the funding has been raised by the privatization of the bus system (UN Habitat ROLAC, 2005: 21).

TABLE 31
TRANSMILENIO: BASIC DATA AND IMPLEMENTATION PHASES

	Phase 1+2	Phase 3
Passengers	1 440 000	520 000
Numbers of stations (including *portales*)	127	25
Trunk lines (nr. of km)	84	20
Feeders (nr. of km)	504	
Buses (trunk lines)	1 054	369
Buses (feeders)	385	

Source: www.transmilenio.gov.co.

The infrastructure has been built up and maintained by government entities, whereas the operation and maintenance of the vehicles has been handled by private transport enterprises. Hence, the infrastructure is public property, as it was built by *Instituto de Desarrollo Urbano* (www.idu.gov.co),

using financial means of the national government and the District of Capital (www.transmilenio.gov.co). This has allowed for the construction of the infrastructure of 84 km trunk lines (exclusive lane) and 127 special bus stations to be undertaken in the first two phases.

Clear and positive effects of the implementation of the BRT system are visible. As table 32 shows, one can easily observe a considerable reduction in the use of private cars. In environmental terms, the new bus system has had direct and positive effects on the reduction of emissions due to a modernization of the bus fleet: 1,500 obsolete buses have been replaced by 705 buses with Euro II standards (Hidalgo, 2005). Energy efficiency has improved and the changes of the modal split have contributed to climate change mitigation. The total reduction of CO_2 emissions has been estimated to be more than 70,000 tons in 2007 (Vincent, 2008: 12). Nevertheless other bus lines, besides the Transmilenio system, persist and are considered to be highly polluting.

The urban transport plan for Bogota's Transmilenio has achieved considerable benefits for clients on the one hand and for the city's environmental quality in general. As polls show, the results are perceived by citizens as being positive: they report for instance a reduction of their travel times by 32%. 83% of passengers identify the travel speed as the main advantage; 37% of the clients report that they can spend more time with their families. More than three of four citizens of Bogota attribute to the Transmilenio their improved access to cultural establishments, recreation and sports infrastructures. Nearly 2/3 (63%) consider Bogota as a safer city since the implementation of Transmilenio.

Transmilenio has implemented polices towards a more balanced and integrative metropolis:

- The mentioned decrease in commute times is even more pronounced in lower income strata.
- Transmilienio has generated an overall daily saving of 1,800 pesos per person, which is 14% of the average daily income of a person belonging to stratum 1 or 10% of stratum 2.
- Infrastructure investment has frequently been accompanied by public space improvements.
- The project has contributed to traffic safety by a 75% reduction of urban accidents (UN Habitat ROLAC, 2005: 21).

TABLE 32
BOGOTA: LONG TERM CHANGING MODAL SPLIT
(In percentages)

	1998	2005
Private Automobile	17	8
Bus rapid transit	0	19
Conventional bus	56	42
Taxi	10	12
Walk	7	12
Bicycle	1	3
Motorcycle	1	3
Others	8	1

Source: Vincent, 2008: 12.

The Transmilenio system has been designed as an integrative urban transport system, aimed to include non-motorized mobility, therefore the stations included the construction of approximately 1,500 bicycle parking spaces.

Critical statements point at the efficiency and future challenges of the Transmilenio (as of 2007; Vincent, 2008: 24): CO_2 reductions were 48% lower than expected (114 million passenger trips vs. 208

million expected) and the effect on car travel reduction has not reached the expected level. The main issue appears to be the reorganization of traditional bus fleets into feeder routes and problems of overcrowding; therefore maintaining service quality will face increasing challenges.

In summary, the new system has implemented a radical turn in the city's urban transportation, generating not only important environmental benefits but also improvements in the citizen's quality of life and for the city's image.

5. Green areas and urban biodiversity

In this field sectorial fragmentation of governmental institutions is severe. Improvement and inter-institutional synergies are deeply needed according to the local expert.

The ecosystem of the Sabana de Bogota includes the Cerros Orientales, and the mountains of Sumapaz and Chingaza (*paramos*), surrounded by cloud forests. The plateau (*altiplano*) is formed by a system of hills, wetlands and agricultural land of high fertility. The peri-urban landscape presents a great number of greenhouses cultivating flowers for export. The western access to the city is being occupied by new industrial zones.

Bogota is also known for its large number and extension of metropolitan parks and green areas in general. The national park, Parque Metropolitano Olaya Herrera, established in 1934, with an area of 283 ha, including sports and entertainment infrastructure is part of the city's territory, located at only four blocks distance from the Transmilenio, at one of the main traffic axes (in the west) and at the eastern limit of the park, there are other important urban highways. Hence, it is of great importance in urban life due to its good connectivity and central location, although its value in terms of environmental preservation is limited.

The Secretariat of Planning of Bogota plans spaces of entertainment, recreation, communication and free movement in order to improve the quality of life for citizens of the Capital District. In the Forum "Public Space and Sustainability" in July 2009, five strategic locations in the city were identified.

- The Environmental Promenade Puente Aranda of about 8 kilometers in a polluted industrial area of Bogota. The government of Bogota plans to improve public transport in an efficient and sustainable manner through the concept of Park Road, a concept which puts emphasis on pedestrian public spaces.
- Camino a Monserrate: the connection to the Avenida Jiménez.
- Parque Metropolitano del Country: the old court of the Country Polo Club opened its doors as a public park on May 1, 2008 with an area of 7.86 ha. This public space was part of the Metropolitan Park Master Plan of the country.
- Parque Bicentenario.
- Plaza San Juan de Ávila y Kennedy.

Metropolitan parks are defined as areas of more than 10 ha that are dedicated to recreational activities and possess environmental values and importance in terms of landscape. There are 21 different parks classified in this category, among them:

- Parque Metropolitano Simón Bolívar: 360 ha is a system of different parks and recreational and cultural establishments.
- El Tunal (Localidad: Tunjuelito): 55 ha.
- Timiza – Villa del Rio (between the localities of Kennedy and Bosa): 60 ha.

In order to compare: New York's central Park covers 341 ha; Bosques de Palermo in Buenos Aires: 25 ha. The Parque Metropolitano in Santiago de Chile: 722 ha.

Parks at local / neighborhood levels (Parques de escala zonal) are defined as free access areas, dedicated to recreational activities for use in different neighborhoods and with an area between one and 10 ha. In Bogota, there are 71 parks of this category, many of which have been opened during the last ten years.

6. Conclusion of Bogota: challenges, risks and obstacles

Main challenges for sustainable development according to the local expert:

According to sustainability principles, development strategies of metropolitan cities must consider a multidimensional and long-term perspective. This requires coordinated action between different entities of environmental protection and territorial planning; multi-scale information flows and cooperation, public policy towards climate change and other future challenges, reduction of centralization and strengthening the institutionalization on a regional scale.

1) Human Development and persisting socio-economic segregation; highly unequal income levels; high dropout rate in primary education level (see table 4) and limited access to public services like water, sewage and health services in the informal settlements. Rural displacement of families and groups; social reinsertion.
2) Need to foster competitivity and address the challenging lack of employment opportunities especially for the female population.
3) Inefficient waste water treatment system; river, wetland and underground water pollution; need for a water management system on a regional basis (Bogota River Basin).
4) Lack of new alternatives for the only existing landfill which is reaching its maximum capacity level. Solid waste reduction is an important challenge.

Main risks:

1) Vulnerability of ecosystems of strategic importance, like the paramos which provide the metropolitan city with natural resources and environmental services.
2) Health risks due to air pollution in industrial and residential areas.
3) Environmental degradation of the Bogota River and its affluents affecting rural areas and the food production in the river's basin.
4) Seismic threats and socio-natural risks (land slides, floods) demand adaptation, and improvement of the existing risk management strategies.
5) Loss of habitat leads to increasing social conflict and urban violence. A harmonious development of habitat leads to the improvement of living conditions, economic productivity, social inclusion and acceptance of individual and collective identities.

Main obstacles:

1) Centralized decision-making.
2) Environmental policies and their implementation at the municipal level are isolated from national policies. There is evidence that local government and mayors are experiencing limited coordination between the Ministry of Environment, Housing and Territorial Development and other national entities.
3) Low incentives for the conservation of strategic ecosystems.
4) Weak institutions for climate change adaptation challenges.

B. City profile: Buenos Aires

BOX 24
SUMMARY OF FINDINGS: BUENOS AIRES

- A lack of regional coordination in planning issues presents a major obstacle for governance in the Buenos Aires Metropolitan Area. The existence of the Autonomous City of Buenos Aires and the Province of Buenos Aires, both with a vast range of competencies in terms of defining laws creates a double institutional structure.
- In spite of a relatively egalitarian society, the Metropolitan Area presents a fast growing level of poverty and poverty-related risks due to the impacts of the economic and financial crisis of 2001/2002.
- In terms of socio-spatial differentiation, the last twenty years have shown a strong suburban and mostly peri-urban growth with precariousness and segregation.
- As a result of this expansion and the lack of public or private investment, the formerly efficient and egalitarian transport system has degraded and nowadays presents important insufficiencies in terms of coverage.
- The most important natural (man made) risk is the environmental degradation of the main water bodies. Implementation of technical solutions is extremely slow.
- Air pollution level is high in terms of emissions. Nevertheless, due to the climatic condition there is little accumulation of contaminants in the Metropolitan Area.

Source: Authors' compilation.

1. General data

The Metropolitan Area of Buenos Aires (*Área Metropolitana de Buenos Aires AMBA)* is comprised of the City of Buenos Aires (*Ciudad Autónoma de Buenos Aires* or *Capital Federal*) and a part of the *Provincia de Buenos Aires*. 24 *partidos* of the Provincia are officially declared as part of Gran Buenos Aires (see table 33). Unofficially, seven further *partidos* may be considered as part of the Metropolitan Area as they are directly connected to the City of Buenos Aires in a functional and physical manner.

MAP 3
METROPOLITAN REGION BUENOS AIRES

Source: own elaboration.
Note: The borders shown on this map do not imply endorsement by the United Nations.

At the moment there is no single regional planning organism on a metropolitan scale. Argentina is as a Federal State, comprised of 23 provinces and an Autonomous City with a similar status (Ciudad Autónoma de Buenos Aires). The provinces are formed by different municipalities (*partidos*). Each province manages, according to its own interests, its respective constitution and laws which consequently apply only within the respective area –the municipalities possess a relative autonomy on administrative issues. In a similar manner, as the City of Buenos Aires is an Autonomous City, it also has its own constitution and laws and acts autonomously in terms of administration and legislation (PNUMA, 2003: 19/20). Therefore, in the Metropolitan Area, issues of inter-local relevance (water bodies for instance) are under the authority of the National Government, the Autonomous City of Buenos, Provincia de Buenos Aires and the *partidos*, which are partially powerful actors due to their population (e.g. the population of the largest *partido* is more than 1.3 million). Nevertheless, on many matters of urban planning, the dominant role is played by the government of the Autonomous City of Buenos Aires (Capital Federal), as it has the largest territorial entity, population and an concentration of economic activities. The city of Buenos Aires is formed by 48 *barrios*.

MAP 4
THE CITY OF BUENOS AIRES

Source: own elaboration.
Note: The borders shown on this map do not imply endorsement by the United Nations.

FIGURE 6
MAIN LEVELS OF GOVERNANCE IN THE REGION BUENOS AIRES

Source: Author`s compilation.

TABLE 33
LOCALITIES OF PROVINCIA DE BUENOS AIRES

Partido	Population	Area (km^2)
Partidos forming part of Gran Buenos Aires		
La Matanza	1 365 244	323
Lomas de Zamora	622 138	89
Almirante Brown	568 548	122
Quilmes	545 846	125
Merlo	527 923	170
Lanús	462 954	45
Moreno	443 096	180
General San Martín	423 209	56
Florencio Varela	406 722	190
Tres de Febrero	345 453	46
Avellaneda	342 598	55
Tigre	337 438	360
Morón	327 568	56
Berazategui	319 416	188
San Isidro	307 637	48
Malvinas argentinas	325 054	63
Vicente López	284 583	39
San Miguel	280 675	83
Esteban Echeverría	272 124	120
José C. Paz	258 812	50
Hurlingham	177 274	36
Ituzaingó	168 418	39
San Fernando	161 945	924
Ezeiza	143 573	223
Partidos which are not part of Gran Buenos Aires		
Pilar	281 496	352
Escobar	207 817	277
General Rodríguez	79 585	360
Presidente Perón	70 884	121
Marcos Paz	51 210	470
San Vicente	50 439	666
Total	10 159 679	5 876

Source: INDEC 2002; Population estimated as of 2008; PNUMA, 2003.

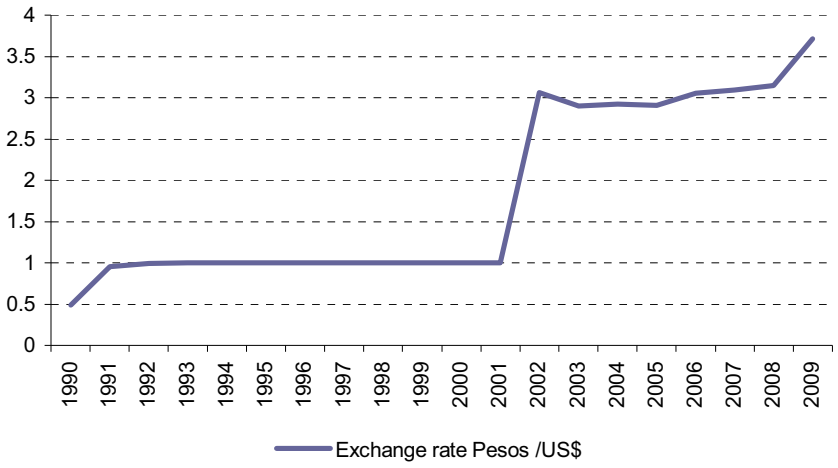
2. Financial crisis and poverty

Argentina is the Latin American country with the worst balance of extreme poverty during the 1990-2002 period (Filgueira / Peri, 2004: 10), with a fast and continuous growth of poverty. This is directly related to the economic and political model applied during the 1990's and to the effects of the financial, fiscal and economic crisis of 2001/2002.

During the 1990's, Argentina experienced a phase of economic growth and high per capita income (Figure 8), which came to a violent end with the default and deep financial, economic and

political crisis in 2001-2002. In social terms, the economic model applied during the 1990's was showing devastating effects even before the financial crisis, with high levels of poverty (more than 30%) in the suburban areas in 1995 (Ciccolella, 2002: 223). In this period, the society suffered a polarization, low income sectors suffered from growing poverty, modernization was showing excluding patterns (socially and spatially) and the traditional middle class was already showing a growing fragmentation (Svampa, 2005). Household income during the 1990's presented a trend of clear concentration – represented by a growing GINI coefficient (Filgueira / Peri, 2004: 16). In the default, the partial loss of dollar-based private capital and the drastic devaluation of the peso in 2002 (see Figure 7) led to an extremely fast growing poverty in all social sectors. The loss of the traditional middle class has been discussed as the most important structural change of the city's society. This is clearly visible in the extremely high poverty rates of 60% in the Provincia de Buenos Aires and 20% in the City of Buenos Aires in the post-crisis year 2003.

FIGURE 7
REAL EXCHANGE RATE ARGENTINEAN PESO, 1990-2005
(Pesos / US$)



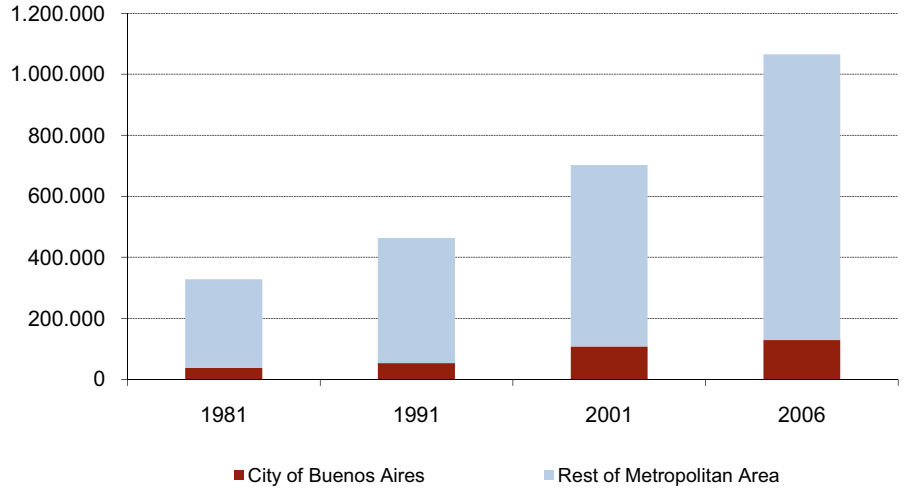
Source: Authors' compilation.

The number of people living in very low income informal settlements increased continuously during the 1990's and grew rapidly in the years of crisis (2001/2002) as it did before in the critical years during the 1980's (Scheinsohn / Cabrera, 2009: 110).

There has been observed continuously growing informal settlements (two different types: *villas* and *asentamientos*) in the City of Buenos Aires as well as the rest of the metropolitan Area. Nevertheless, the growth is concentrated in suburban and periurban areas: in those localities of the Province which form part of the AMBA, aprox. 10% of the inhabitants are living in informal settlements (Cravino et al. 2009, 13).

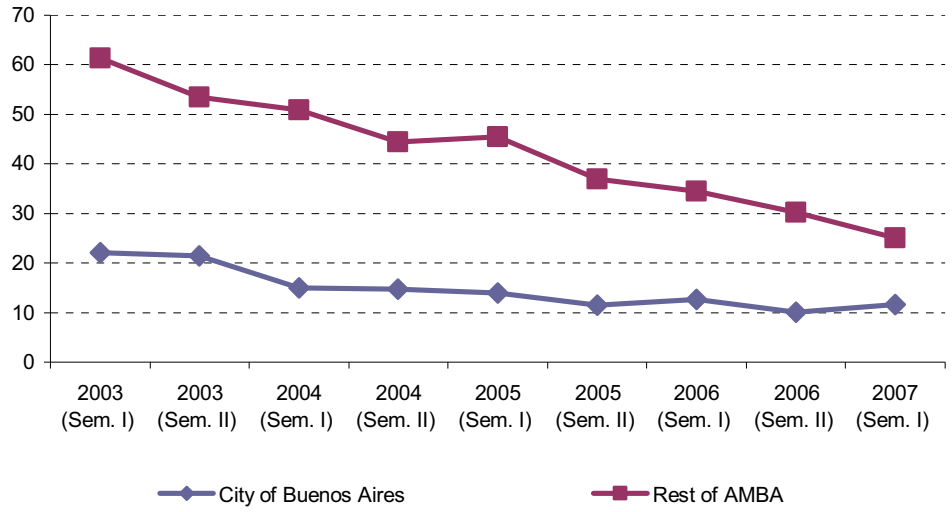
Due to the export-driven economic growth, starting in 2003 one can observe a quick decrease of poverty and extreme poverty. Another characteristic element of the current economic context is the growth of informal employment, especially in small and medium-sized enterprises (Perry et al, 2007: 10).

FIGURE 8
BUENOS AIRES: PERSONS LIVING IN INFORMAL SETTLEMENTS, 1981-2006



Source: Cravino et al., 2009: 5.

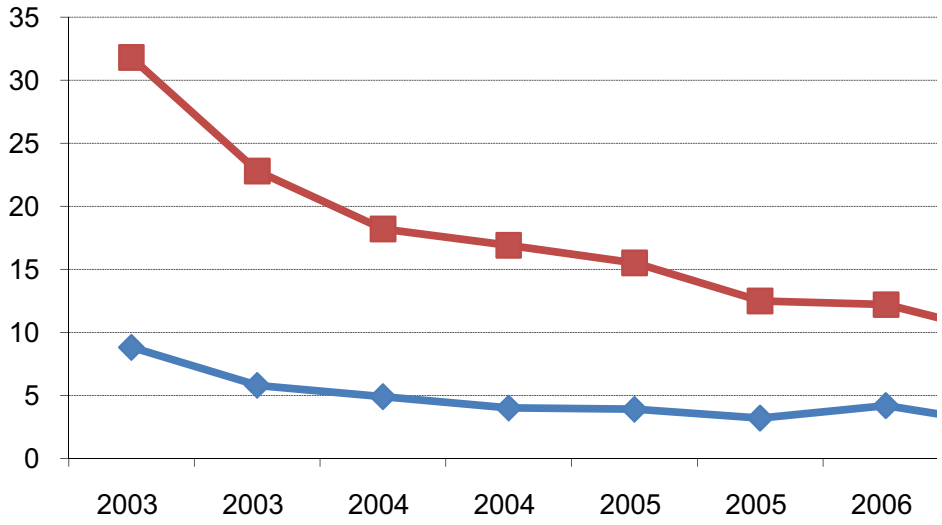
FIGURE 9
BUENOS AIRES: POVERTY RATE, 2003-2007
(In percentage of population)



Source: Authors' compilation based on INDEC, 2007: 5-6.

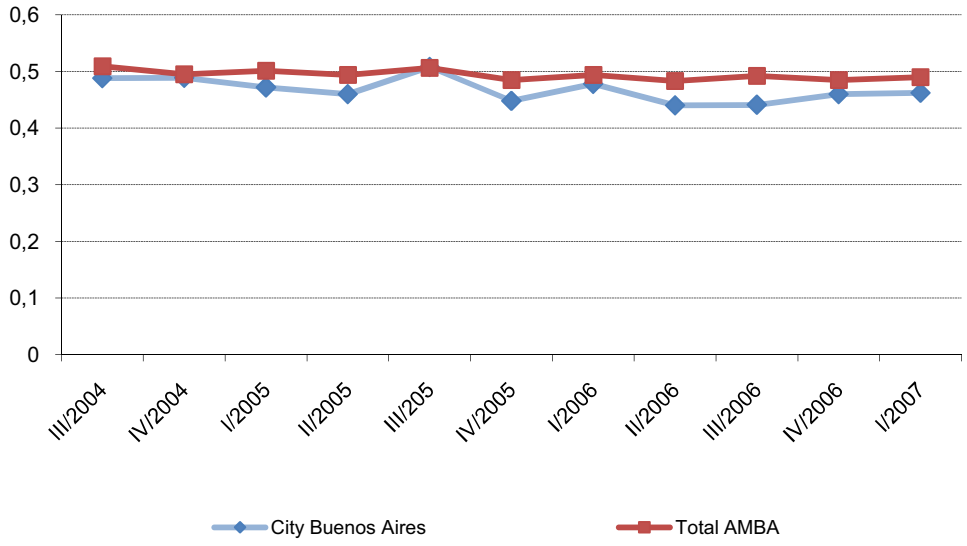
The post-crisis situation also led to a slight reduction of inequality in terms of income distribution, as the Gini-Coefficient in the City of Buenos Aires Figure 10 shows. Nevertheless, the level 0.44 is still above the international alert line (0.4).

FIGURE 10
BUENOS AIRES: RATE OF EXTREME POVERTY, 2003-2007
(In percentage of population)



Source: Authors' compilation, based on GCBA DGEC, 2007: 7 and GCBA DGEC, 2007b: 7.

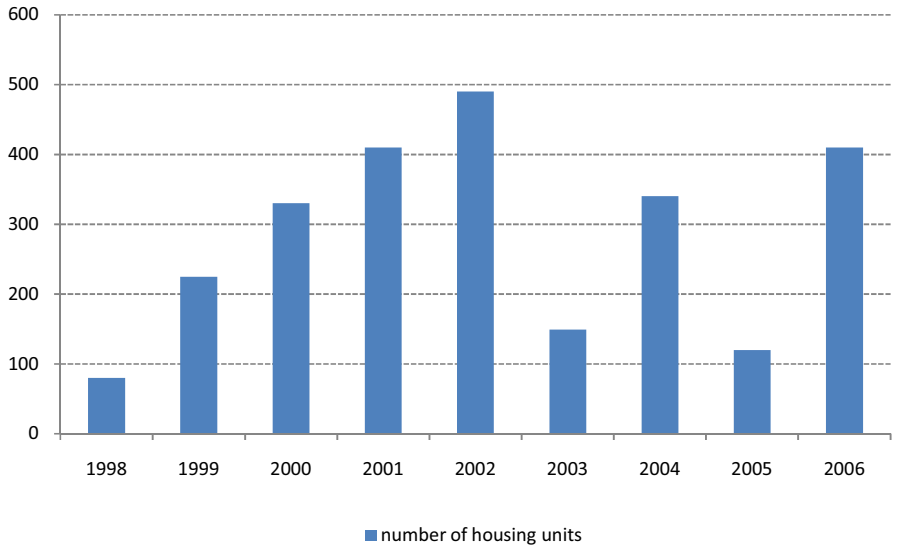
FIGURE 11
BUENOS AIRES: INCOME CONCENTRATION (GINI COEFFICIENT, 2004-2007)



Source: Authors' compilation, based on GCBA DGEC, 2007: 7 and GCBA DGEC, 2007b: 7.

Growing poverty and inequality has generated a need for a social housing policy; this responsibility was abandoned by the government during the 1990's and was basically transferred to private institutions and NGOs, whereby the government assumed its role as "mediator" (Scheinsohn / Cabrera, 2009: 109).

FIGURE 12
BUENOS AIRES: NUMBER OF SOCIAL HOUSING UNITS CONSTRUCTED BY IVC, 1998-2006



Source: Scheinsohn / Cabrera, 2009: 111.

Even if one were to include the important growth of social housing units produced by the local governments' organization IVC (Instituto de Vivienda de la Ciudad), the number of social housing units produced directly by the government is low (in average some 290 units per year) and is clearly surpassed by the output of some NGOs; nevertheless it is important that these NGO-projects are partially funded by IVC and FONAVI (Fondo Nacional de Vivienda, the National Housing Fund) which was established in the 1970's (Scheinsohn / Cabrera, 2009: 111). Some of these initiatives have significant international support as well as national financial means (Almansi / Tammarazio, 2008).

3. Periurban growth and urban infrastructure

As shown in chapter III.A, the central area of Buenos Aires (City of Buenos Aires) has population loss in the last intercensal period, while the peripheral sectors and the suburban areas show rapid growth. This challenges access to basic services, the design of private transport infrastructure and public transport systems.

a) The growing socio-spatial segregation

This suburban and periurban growth is characterized by an increasing socio-spatial segregation and fragmentation of the Metropolitan Area as a whole. As table 34 highlights, the suburban area (Partidos del GBA) suffers from high poverty indices meanwhile the central area (Ciudad de Buenos Aires) presents poverty indices far below the average of all urban agglomerations in Argentina. Furthermore, the suburban areas of Gran Buenos Aires have been hit harder by the effects of the financial and economic crisis.

Buenos Aires' relatively new tendency of building up exclusive and protected neighborhoods for high income groups is of importance in the periurban growth of the 1990's. During the 1990's, in the suburban and periurban areas, many gated communities were established, most of them located in the north-western part of the Metropolitan Area. The number of gated communities is high, but literature reveals different estimations, from 500 (Ciccolella, 2002: 208) to 350 different gated communities

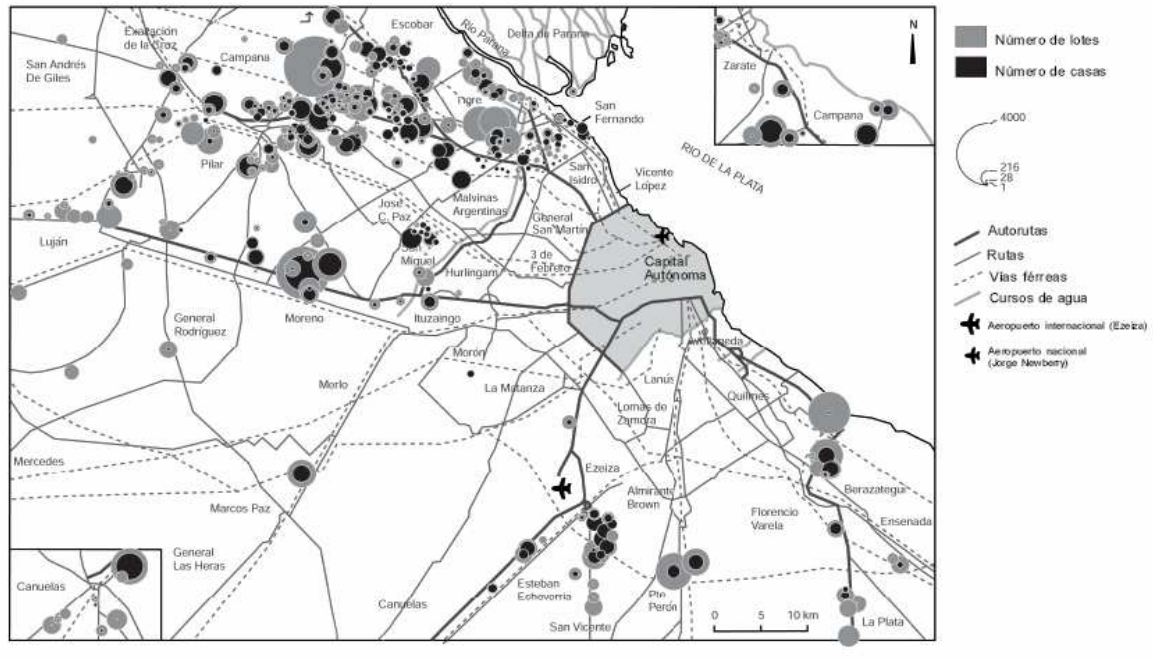
(Thuiller, 2005) –their quantitative relevance is high, some 500.000 citizens (corresponding to about 5% of the Gran Buenos Aires) are living in these highly segregated and exclusive areas (Riwilis, 2008: 121).

TABLE 34
BUENOS AIRES: POVERTY AND EXTREME POVERTY, 2007
(In percentages)

	Poverty		Extreme poverty	
	Households	Population	Households	Population
All Argentinean Urban Agglomerations	16.3	23.4	5.7	8.2
Metropolitan Area of Buenos Aires (AMBA)	15.6	21.8	6.0	8.2
City of Buenos Aires	7.7	11.6	3.7	5.2
Rest of AMBA	18.8	25.0	7.0	9.1

Source: INDEC, 2007: 4.

MAP 5
REGION OF BUENOS AIRES: LOCALIZATION OF GATED COMMUNITIES



Source: Thuiller, 2005: 8.
Note: The borders shown on this map do not imply endorsement by the United Nations.

The impact of this form of auto segregation is the emergence of a fragmentation process of the metropolitan area not only in a quantitative manner, but also in terms of differentiation, exclusion and stigmatization (Janoschka, 2002, Svampa, 2001). This relatively new model of housing also signals a new model of society with changing governance structures (Riwilis, 2008), with a growing role of private organizations as the planning institution, far beyond traditional private-public partnerships. This dominant tendency towards private planning was resumed at the end of the liberalization era:

> *"In the absence of any democratic decision making at the metropolitan level, key decisions are left to market forces, especially to the powerful economic actors, including developers and private companies now controlling privatized "public" services. The only true*

"planning" occurs within large private developments, including the gated communities" (Pirez, 2002: 145).

Other important trends of this fragmentation process are the new complex subcentres that despite their large distance from the city center, show a functional relation to Greater Buenos Aires, and the formation of a corporative belt in the north-western part of the metropolitan area located along transport infrastructure, which lie among the gated communities and the low income sectors of this area.

b) Strategic Plan "San Martín 2010"

The locality (*partido*) General San Martín (450,000 inh.), located in the Provincia de Buenos Aires, forms part of the Metropolitan Region and is an example of the localities in the first suburban ring. Its spatial structure includes industrial and commercial zones as well as residential areas, most of which have serious deficiencies in terms of access to basic services. High levels of unemployment, delinquency, lack of professional education, lack of communication between different actors, both private and public, unplanned urban growth and poverty, among others have been identified as main challenges (Municipalidad de General San Martín, 2007).

In 2004, the municipality formed of a working group that would develop a strategic plan with to overcome the problem of the New Urban Poverty. This initiative had the commitment and participation of 120 multidisciplinary intermediate organizations, which have worked towards the goal of developing a diagnosis of this territory and to build a strategic public-private partnership for long term development. The Strategic Plan includes a wide range of issues affecting urban development: Production, Environment, Institutional, Social / Cultural and Health Education. In order to develop the working group, 15 workshops were convened with the participation of 1549 citizens, resulting in a list of actions for each of the areas considered (Municipalidad de General San Martín, 2007).

The Strategic Plan "Saint Martín 2010" made visible the often hidden problem of new urban poverty. The plan considered specific actions, including the cooperation and commitment of institutions like the Universidad Nacional de San Martín, the National Institute of Industrial Technology, some national agencies, and local and provincial governments. However, as the financial means of the local government are insufficient, initiating action needed economic aid (Municipality of General San Martín, 2007). In September 2010 a new initiative was started aiming to defina a strategy for 2020, based on the experience of the Strategic Plan 2010 and putting enfasis on local identity, social integration and territorial planning (www.sanmartin2010.gov.ar).

c) Metropolitan rail system

The Urban Subway System (*Subte*) of Buenos Aires is one of the oldest in the World. It started its operation in 1913 (line A) and was considerably enlarged during 1930's and 1940's (lines B, C, D and E). In the 1980's the *Subte* suffered an important loss of passengers and was privatized; nowadays it is operated by Metrovias S.A. The most recent enlargement was the incorporation of Line H during 2008. Nowadays the system has six lines and 74 stations (interconnecting stations are counted as different stations of each connecting line). Due to the age of most lines, there are relatively small distances between some stations, covering a total distance of only 52 km. The urban rail transport system is complemented by seven suburban trains which are not interconnected, some of them start from the central Retiro station, others from the Federico Lacroce station, one from the station Once; additionally, there is one suburban train that is integrated with the metro system (Pre-Subte). These services are connected to the Subte stations, but their service has to be paid apart, as they are run by different independent enterprises: Línea Mitre and Línea Sarmiento (operated by TBA) Línea Belgrano Sur and Línea Roca (operated by METROPOLITANO), Línea Belgrano Norte (FERROVIAS) Línea San Martín (UGOFE) and Línea Tren de la Costa (Tren de la Costa) (http://www.urbanrail.net/am/buen/buenos-aires.htm).

In December 2008, a law was approved aiming at the implementation of a Bus Rapid Transport (BRT) System inspired by the successful systems of the Metrobus in Mexico and the Transmilenio in

Bogota. It is planned to be installed on the Juan B. Justo Avenue, thereby implementing another Periphery-Center Connection (East-West) starting at the intersection with the circular urban highway Avenida General Paz and ending near the Río de la Plata. Further enlargement and implementation of a network of this kind of rapid urban transport is planned.

4. Waste collection and treatment

As shown in chapter II.B.3, the situation of waste production and collection in Buenos Aires shows challenging problems like the contamination of water bodies and Green House Gas emissions. The level of waste production in Buenos Aires increased during the 1990's by almost 100%; domestic waste production grew about 50% mostly due to changing consumption patterns. There are important spatial differences between the City of Buenos Aires were each inhabitant produces in average around 530 kg/year and low income outskirts accounting for only aprox. 170 kg/ year (Subsecretaría de Urbanismo y Vivienda, 2005: 120).

The collecting system is still insufficient, with a large number of informal garbage dumps along the main rivers and transport infrastructure (Subsecretaría de Urbanismo y Vivienda: 120). In 2001, a year marked by the deep economic and financial crisis, waste collection in the Argentinean capital decreased considerably, most of all in the sector of commercial and office activities. This can be explained not only by a reduction of material consumption due to the direct effects of crisis, but also by the appearance of informal waste collectors (*cartoneros*). According to unofficial data, in the metropolitan region, there are about 22,000 cartoneros, of which 15,000 concentrate their activities in the city of Buenos Aires collecting more than 750 tons per day (more than 270,000 of paper and plastic), (Movimiento Nacional de Cartoneros). UNICEF estimated in 2004 8,500 cartoneros in the City of Buenos Aires.

The **organization *El Ceibo*** an example for different cooperative initiatives of cooperative waste collection organizations (http://www.buenosaires.gov.ar) and was founded as a cooperative in 1989. Since its inception, it has been dedicated to the development of the neighborhoods (*barrios*) Palermo y Villa Crespo on matters of health protection, housing and the labor market. This organization regards the waste issue as a social problem. An important number of socially vulnerable households informally collect waste –a type of labor which bears not only the deficiencies of any informal work but is dangerous and suffers social stigmatization. The Project "El Ceibo recovering Palermo," implemented in 2002, strives towards the integration of illegal waste collectors into the formal labor market by offering benefits of labor conditions and ways to integrate them into formal recycling networks. The initiative has been supported by the city's government and the cooperative *El Ceibo*, built by 104 families (eco2site, 2009).

In legal terms, any waste that is deposed of in the street is property of the collection companies. Therefore, it has been necessary to do PR work in order to convince the populations of specific *barrios* (Palermo in this case) of the social and environmental benefits of the project in order to persuade them to hand the waste directly to the informal collectors. These collected recyclable materials (plastic, paper, and metals), are separated and sold to recycling enterprises.

El Ceibo may be regarded as an outstanding example of a small scale sustainable development initiative as it combines elements of social integration by formalizing labor, providing environmental benefits through improved recycling mechanisms, and furthermore by generating the positive effects that come from creating conscience within civil society on environmental and social matters (eco2site, 2009).

Due to the success of this initiative, several years after it began, Greenpeace Argentina became interested in it and partnered with El Ceibo to launch the Zero Waste Plan in Palermo in 2004 (Greenpeace 2009). This initiative ultimately led to the law enacted by the government of Buenos Aires in January 2006 known as "**Ley Basura Cero**" (Ley 1,854), which was regulated in May 2007 (GCBA, 2009). It was planned to reduce the solid waste disposal in 50% by 2012 and 70% by 2017 – starting from the 1.5 million metric tons of solid waste stored in 2004 in the city's landfills (GCBA 2009). The promoted timetable is aiming to increase recycling in order to prevent any deposition of recyclable material in

landfills until 2020. Civil society organizations are complaining about the government of the city of Buenos Aires because of not fulfilling this initiative, as there has been observed an increase, rather than a decrease of the generation of solid waste and its disposal in landfills (GAIA, 2008:2). Latest data show that the amount of solid waste is increasing since 2005 and reached more than 1.8 millon metric tons in 2009 (Greenpeace 2010).

5. Water supply, wastewater treatment and river pollution

Pollution of superficial water bodies is considered as the highest environmental risk in the Metropolitan Area. The main fresh water bodies of relevance for the Metropolitan Area of Buenos Aires are the Río de la Plata, the Paraná, forming an extensive river delta in the north of the Metropolitan Region and the rivers of local importance: Luján (5.3 m3/s), Reconquista (3.0 m3/s) and Riachuelo (Suárez / Lombardo, 2004: 184). The Riachuelo River presents outstanding pollution levels. The basins of the rivers Riachuelo and Matanza are considered to be some of the most polluted water bodies worldwide comparison (Blacksmith Institute, 2007). Pollution indices exceed national standards by far. For instance, in the case of Lead, Zinc and Chrome, the Riachuelo has levels approximately 50 times higher than the legal limit in Argentina. Only around 25% of the pollution is caused by industrial sewage and waste; the majority of the pollution is of domestic origin. Water pollution is also a critical issue in terms of groundwater and the impacts on qater quality of wells (Greenpeace 2009b) and concentration of different pollutants in sedimented materials.

The pollution issue presents a serious social risk as most of the inhabitants of the immediate vicinity of the Riachuelo are low income, which aggravates their vulnerability in terms of health. The frequency of children affected by intestinal diseases and the mortality caused by such infections is clearly above average in these zones. In order to reduce pollution in the Riachuelo / Matanza Basin and in the water bodies of the rivers themselves, different programs have been proposed, some of which are related to integrative programs aimed at an improvement of the quality of life in general. These plans, especially of the Autonomous City of Buenos Aires consist of numerous measures, mostly related to the construction and improvement of infrastructure like the construction of additional canals and the amplification of the existing sewage water collection network. Nevertheless, most of these measures have the prevention of flooding as their main purpose (Eco Portal; GCBA). In Argentina as a whole, **flooding** is a relatively high risk; Buenos Aires has a high risk level, situated in an area with low relief energy and also due to high ground water levels as it is situated at the banks of the Rio de la Plata. In the 1970's, as a response to frequent flooding in the northern part of the area (in the vicinity of the river delta) a major spillover channel was constructed from Reconquista to the Lujan river (Suárez / Lombardo, 2004: 187). During a twenty year time-span (1985-2003) 35 floods were reported (Satterthwaite, 2007: 19).

The water management issue is of high relevance not only because of risk prevention (flood and pollution) but also looking towards a more sustainable use of resources. The extremely high water consumption in Buenos Aires is not only caused by consumption patterns of the household, it is also a product of infrastructure failure. Programs to improve the efficiency of the water supply system have been considered.

The water supply and management system in Buenos Aires is organized by concessions, which means that property is public but rights of use are ceded in the long term (30 years) to private firms who are in charge of the investment and management and are responsible for taking economic risks related to supply activities (UNDP, 2006: 91). This mechanism is attractive as it permits for the rapid expansion of service networks. Nevertheless, in the case of Buenos Aires, the growth of service networks have been lower than planned, affecting especially low income sectors of the city, thereby causing public opinion criticism towards the system. Statements by Aguas Argentinas regarding the positive impacts made on combating extreme poverty through improvement in water infrastructure have been questioned primarily due to goals that remain unfulfilled, but also because of actions that led to disconnecting low income households from the supply service because of payment problems and rising prices (Loftus / McDonald, 2001: 197). Also spatial inequalities in terms of high pollution and flood risk in the poorest parts of GBA

have been criticized. High levels of social conflicts have been provoked by repeatedly increased tariffs (almost 100% in real terms between 1993 and 2002; contrasting with the promised 29% reduction) and after the default the concession contract came to an end. As there were no adjustments of the collapsed exchange rate offered by the government, the private consortium led by Suez Lyonnaise des Eaux ended the contract estimating risks that were too high for further operation (UNDP, 2006: 93). The net loss (1.6 billion US$) had been caused almost completely by the devaluation of the Argentinean peso (UNDP, 2006: 94). The concession is now managed by Aguas Bonaerenses S.A., whose capital is mainly from the government of the Provincia de Buenos Ares (90%) –the rest are worker's participation.

The problems of the concessions in Buenos Aires and its important failures are related to governance issues, institutional weaknesses and lack of control mechanisms. The regulatory organism ETOSS (Ente Tripartito de Obras y Servicios Sanitarios) which was created to control water management, has been highly politicized, consumer interests have not been represented, and it suffers from a severe lack of transparency (UNDP, 2006: 100, Hardoy et al., 2005). Public discourses and scholars state that "*ETOSS has proven to be largely toothless in a process in which élite groups in government and the private company (and to some extent in the union) make decisions amongst themselves*". (Liftus / McDonald, 2001: 198). Nowadays the control organism is OCABA (Organismo de Control de Aguas de Buenos Aires).

The **water treatment** system of the Metropolitan Area of Buenos Aires is still deficient. The service provided by AYSA S.A. has only three treatment plants (Atlas Ambiental de Buenos Aires, 2009b):

1) Planta Sudoeste (Aldo Bonzi), constructed in 1972, located in La Matanza treats an average of 2.0 m^3/s with a peak of 2.5 m^3/s and is designed to treat the sewage of 550,000 inhabitants.

2) Planta Norte located in San Fernando, was constructed by Aguas Argentinas S. A. in 1998 and serves the *partidos* of Tigre, San Fernando y San Isidro forming part of the basin of the Reconquista river (total: 270,000 inhabitants). On average 0.9 m^3/s are treated, and a further expansion is planned.

3) A further plant is located in Ezeiza (Planta El Jagüel) and serves the *partidos* Esteban Echeverría and Ezeiza but has to be considered of very limited importance due to its average treatment volume of only 0.12 m^3/s.

Two major water related infrastructure projects have been initiated: The construction of a drinking water plant in Tigre and the construction of a wastewater treatment plant "Del Bicentenario", in Berazategui. Furthermore there are important renovation and amplification projects concerning the drinking water plants in General San Martín and General Belgrano and the water treatment plants Sudoeste y Norte (AySA, 2009).

6. Conclusion Buenos Aires: challenges, risks and obstacles

Based on the analysis of the documents and the ecperts input the following challenges, risks and obstacles for sustainable development have been identified.

Main challenges:

1) Confronting the issues of unemployment and new urban poverty resulting from economic crisis.

2) Overcoming the deficiencies of access to drinking water supply, sewage coverage and waste water treatment.

3) Implement an integrative solid waste management system, most of all concerning the generation of domestic waste.

4) Rethink the energy issue from a sustainability point of view, including the scarceness of traditional energy sources and promoting the use of alternative sources and efficient

technologies. This is relevant due to the high electric energy per capita consumption level (see table 11).

Main risks:

1) New urban poverty: during the nineties and most of all as a result of the economic and financial crisis in 2001/2002, poverty has grown rapidly.
2) The growth of informal and precarious housing areas.
3) Growing number of flood events.
4) Growing air, water and soil pollution.

Main obstacles:

1) The Region of Buenos Aires includes different levels of jurisdiction and territorial governments, which have overlapping functions and responsibilities. They are not coordinated by one integrating entity, which can be considered a primary obstacle for governance in the region of Buenos Aires.
2) This situation is even more complex with the inclusion of different sectorial entities. Their management and investment decisions reflect technical and political criteria. It must be added, furthermore, the emergence of a private sector which during the nineties was increasingly powerful.
3) Lack of a long-term vision of the city, partially due to the dominating private sector looking for profitable investments in the short term. Deficient participatory instruments for defining strategic city visions in dialogue with the citizenship.

C. City profile: Lima

BOX 25
SUMMARY OF FINDINGS. LIMA

- The presence of two Departmental Governments (Lima and Callao) presents a major obstacle in regional planning; this is combined with a lack of an integrated development strategy in economic, social and environmental dimensions.
- The most urgent social issues are no longer directly related to extreme poverty, which demonstrates satisfactory results in the last several years. Nevertheless, the labor market shows tendencies of growing differences due to issues of underemployment, informality and decaying wage levels in low qualified jobs in real terms.
- In terms of socio-spatial differentiation, Lima is a highly segregated metropolitan region with large low income sectors, with elevated environmental risk levels.
- High pollution levels of the main river presents a major health risk for low income sectors due to the insufficient drinking water supply system and informal wells.
- The Metropolitan Area is still lacking an efficient public transport system. The different plans which have been elaborated in the last several years have not been implemented.

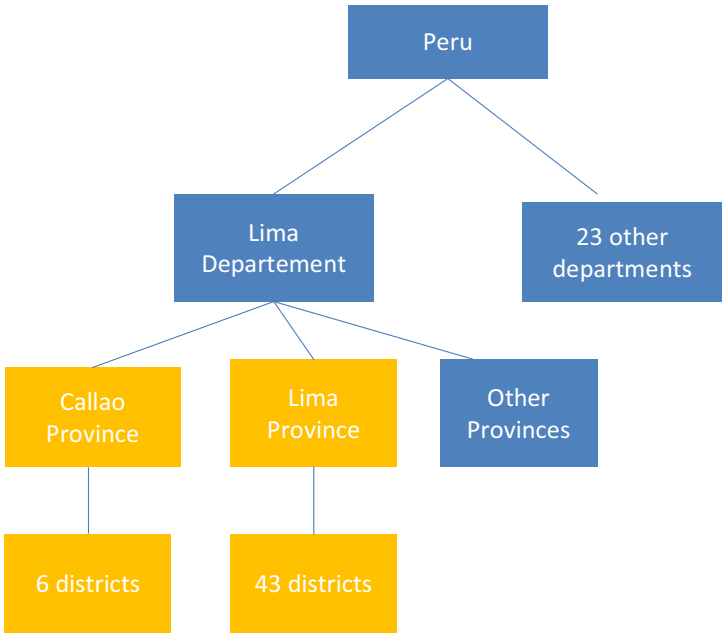
Source: Authors' compilation.

1. General data

The metropolitan area of Lima is the financial and commercial center of Peru, with the presence of modern skyscrapers, exclusive neighborhoods, avenues, parks, hotels, restaurants, entertainment and shopping centers on the one hand and a precarious periphery with serious deficiencies in terms of access to basic services on the other hand. Therefore, unequal growth and spatial concentration of economic activities in privileged districts is characteristic of Lima. However, there are a series of common challenges in all sectors such as urban transport and access to basic services.

As discussed in the cases of Buenos Aires and Mexico, the administrative division is an important governance issue in the Metropolitan Region of Lima as it is divided between two regional governments. The Lima Metropolitan Region is comprised of the *Provincia de Callao*, and a part of the *Provincia de Lima* including some 49 districts (see Figure 13). As these provincial governments have a relatively high level of autonomy, this results in a serious problem of coordination in planning issues (Riofrío, 2003). Consequently, there is also lack of urban planning in terms of orienting the development of economic activities and their spatial patterns towards a higher level of competitiveness and in terms of defining a policy of sustainable development that is understood as protection of the natural environment and the improvement of the quality of life (Gobierno Regional Lima Metropolitana, 2004: 62).

FIGURE 13
LIMA: ADMINISTRATIVE STRUCTURE



Source: Author`s compilation

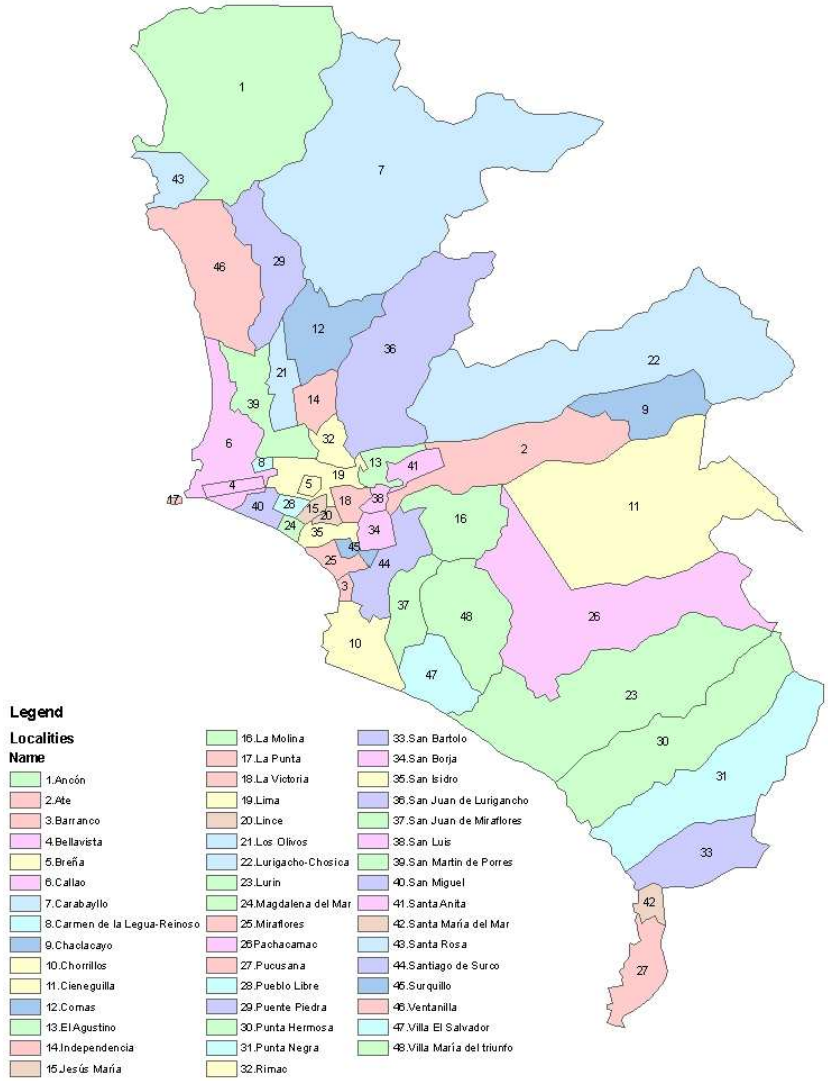
Nevertheless, in the metropolitana area, called *Lima Metropolitana* a special regime applies, comparable to the level of the governments of *departamentos* (the highest sub national level). The *Lima Metropolitana* has an elected mayor and a total of 49 mayors of the districts.

In urban planning, one can observe a certain decentralization, as the district may emit regulations on construction (within the Urban Development Plan), although there are National Building Regulations in Peru. Hence we observe a co-existence of different regulations and parameters. Moreover, there are certain neighborhoods, particularly in seaside resorts, which formulate their own regulations on constructions.

On regional planning in Lima, different plans have been defined (Gobierno Regional Lima Metropolitana, 2004: 84).

- Plan Regional de Seguridad Ciudadana.
- Plan Regional de Desarrollo de Capacidades Humanas.
- Plan Regional de Reacondicionamiento Territorial Urbano y Desarrollo de la Infraestructura de Transporte.
- Plan Regional de Gestión Ambiental.
- Plan Regional de Promoción de Inversiones.
- Plan Regional de Competitividad de Lima Metropolitana.

MAP 6
LIMA: ADMINISTRATIVE UNITS



Source: Author`s compilation
Note: The borders shown on this map do not imply endorsement by the United Nations.

TABLE 35
THE LOCALITIES OF LIMA AND CALLAO

Comuna	Population	Area km^2
Provincia de Lima		
Ancon	33 367	298.64
Ate	478 278	77.72
Barranco	33 903	3.33
Breña	81 909	3.22
Carabayllo	213 386	346.88
Cieneguilla	26 725	240.33
Comas	486 977	48.75
Chaclacayo	41 110	39.5
Chorrillos	286 977	38.94
El Agustino	180 262	12.54
Independencia	207 647	14.56
Jesus María	66 171	4.57
La Molina	132 498	65.75
La Victoria	192 724	8.74
Lince	55 242	3.03
Lima	299 493	21.98
Los Olivos	318 140	18.25
Lurín	62 940	180.26
Lurigancho-Chosica	169 359	236.47
Magdalena del Mar	50 764	3.61
Magdalena Vieja	74 164	4.38
Miraflores	85 065	9.62
Pachacamac	68 441	160.23
Pucusana	10 633	31.66
Puente Piedra	233 602	71.18
Punta Hermosa	5 762	119.5
Punta Negra	5 284	130.5
Rimac	176 169	11.87
San Bartolo	6 412	45.01
San Borja	105 076	9.96
San Isidro	58 056	11.1
San Juan de Lurigancho	898 443	131.25
San Juan de Miraflores	362 643	23.98
San Luis	54 634	3.49
San Martin de Porres	579 561	36.91
San Miguel	129 107	10.72
Santa María del Mar	184 614	10.69
Santa Anita	184 614	9.81
Santa Rosa	10 903	21.5
Santiago de Surco	289 597	34.75
Surquillo	89 283	3.46
Villa el Salvador	381 790	35.46
Villa María del Triunfo	378 470	70.57

(Continued)

Table 35 (concluded)

Comuna	Population	Area km2
Provincia del Callao		
El Callao	415 888	45.65
Bella Vista	75 163	4.56
Carmen de la Legua-Reynoso	41 863	2.12
La Perla	61 698	2.75
La Punta	4 370	0.75
Ventanilla	277 895	73.52

Source: INEI, 2007 and INEI, 2009.

Besides the mentioned administrative structure and the administrative units shown in map 6 and in table 35, the following distinction is also used to analyse different sectors of the Metropolitan Area of Lima (Ipsos Apoyo, 2009: 10):

- **Lima Norte**: Ancón, Carabayllo, Comas, Independencia, Los Olivos, Puente Piedra, San Martín de Porres and Santa Rosa.
- **Lima Este**: Ate, Chaclacayo, Cieneguilla, El Agustino, Lurigancho, San Juan de Lurigancho, and Santa Anita.
- **Lima Sur**: San Juan de Miraflores, Villa El Salvador, Villa María del Triunfo, Lurín, Pachacámac, Punta Hermosa, Punta Negra, San Bartolo, Santa María and Pucusana.
- **Lima Centro**: Lima (Cercado), Rímac, San Luis, La Victoria and Breña.
- **Lima Moderna**: Barranco, Jesús María, Lince, Magdalena, Miraflores, Pueblo Libre, San Isidro, San Miguel, Surquillo, La Molina, San Borja, Surco and Chorrillos.
- **Callao**: Bellavista, Carmen de la Legua, La Perla, La Punta, Ventanilla and Callao.

These sectors show similar population numbers (see table 36). Lima is highly segregated in socio-spatial terms. The high income groups are concentrated in a sector called "Lima Moderno", where about 80% of the housing belongs to socio-economic sectors A and B. The highest income sector "A" is concentrated in a few localities: 50% of the highest income group lives either in Surco or in La Molina, followed by San Isidro (17.9%), San Borja (15.6%) and Miraflores (9%). The average income in this sector is about three or four times higher than in other zones of the Metropolitan Region. The outskirt lying sectors in Lima Norte, Oriente and Sur host a large number of lower income groups (the poorest zone is Lima Sur). The zone with the highest population is Lima Norte, dominantly lower middle class and low-income groups.

TABLE 36
LIMA: POPULATION BY THE CITY'S MAIN SECTORS

	Population	Percentage
Lima Sur	1 193 351	15.4
Lima Norte	1 904 792	24.5
Lima Centro & Moderno	2 105 531	27.1
Lima Este	1 750 843	22.5
Callao	810 568	10.4
Total	7 765 085	100.0

Source: Authors' compilation, based on table 35.

2. Extreme poverty

As shown in chapter II.A.2, extreme poverty indicators register high levels in Lima, which has the worst indicator level among the six metropolitan cities. The regional government also defines this as one of the most important weaknesses (in a SWOT analysis aimed at defining a development strategy for the region) as high and growing poverty levels can be observed, partially related to a high index of violence and delinquency and growing consumption of drugs.

Nevertheless, the situation in Lima concerning most of these indicators is better than the national average: **under five mortality** in Lima / Callao for example presents the lowest level of all of the departments: 27 vs. the national average of 60 and urban average of 39 in the period 1990-2000; similar differences of poverty and health can be observed using perinatal mortality as an indicator (MDG 4: 1-4).

Discussing poverty and extreme poverty issues requires a more detailed look at poverty lines, such as that which is presented by the important Microfinance Institution (*Mibanco)*. In the case of Lima the 1 US$ poverty line (and even the 2 US$ line) is almost irrelevant due to high living costs – poverty incidence according to this indicator is low (see table 37). The national poverty line is based on the medium cost of a basket of basic goods and is officially defined by the government, while the Lima poverty line takes into account the higher living costs in the Metropolitan Region (Horn Welch/Devaney 2003: 3). If one were to use this specific poverty line which took into account the higher price level, Lima presents a very high incidence of poverty (40%), although it is also clearly below the national average (66%).

TABLE 37
LIMA: POVERTY ACCORDING TO DIFFERENT POVERTY LINE DEFINITIONS
(In percentages of population)

	National poverty line	Lima poverty line	1 US$ line	2 US$ line	INEI 2002 poverty[a]	INEI 2002 extreme poverty[a]	INEI 2006 NBI
Lima	22	40	1	6	35	3	13.5
Peru	52	66	10	30	54	24	33.9

Source: Horn Welch /Devaney, 2003: 5.

[a] Gobierno Regional Lima Metropolitana, 2004: 42.

Important improvement has been made in ensuring the satisfaction of basic needs. The population with at least one unsatisfied basic need has been reduced significantly during the last five year period (2001: 23.9; 2006: 13.5%); the same index experienced nation-wide a similar reduction (INEI, 2007: 425). The low levels of inequality are related to the relatively high level of poverty, reflecting a large number of people with similar income on a low level. A different image is offered by the analysis of the population with caloric deficit: starting from a high level in 2001 (18.7%) first, it grew quickly to 29.9% (in 2004) and afterwards showed a rapid decrease reaching 17.6% in 2006 (INEI, 2007: 431).

The most important way of combating large scale poverty is the labor market. Its formality and wage levels should be discussed in the case of Lima. Open unemployment reached 8.8% in 2006, which is a relatively low level in international comparison. Nevertheless, there are important structural limitations in the labor market, most of all underemployment and informal employment.

3. Economic development and the labor market

a) Underemployment and unemployment

Unemployment rates present among men is almost 6.8%, while the women's rate is 11.3% and growing. Most alarming element is the high level of juvenile (aged 18-24) unemployment (39.0 %), though lower than the 48.8% of 1996). Underemployment is very high in Metropolitan Area of Lima (45.2%); also shows gender disparity; women suffer higher levels of underemployment (Ministerio de Trabajo y Promoción del Empleo, 2006: 16).

TABLE 38
LIMA METROPOLITANA: EMPLOYMENT, 2006

	Number	Percentage
Employed	2 005 533	50.0
Underemployed	1 651 127	41.2
Unemployed	350 895	8.8
Economically Active Population (PEA)	4 007 555	100.0
Population aged 14 and more	*6 257 927*	

Source: Ministerio de Trabajo, 2006: 13.

The Ministry of Employemen defines informal employment as the sum of workers of micro-enterprises, independent workers which are not professionals, working family members without salaries and domestic workers. Summing these categories, a very large part of the employed persons (58.8%) is considered as part of the informal sector. This should be regarded as a main challenge, as informal labor is usually characterized by a lack of social protection and low wages. Meanwhile, in the formal economy around 60% of the employees receive health insurance and *pension;* whereas in the informal sector this applies only to approximately 5% and 8% respectively of the cases. In the Ministry's view, this sector has a low level of productivity, capacity for building capital, low use of technology and knowledge, etc. (Ministerio de Trabajo y Promoción del Empleo, 2006: 18).

TABLE 39
LABOR MARKET IN LIMA: INCOME AND REAL VARIATION BY MARKET SEGMENT

	Average income *(in Nuevos Soles; 2006)*		Real change 1996-2006
	1996	2006	*(In percentage)*
Public Sector	1 040	1 570	51.0
Private Sector	1 121	1 274	13.6
Micro enterprises	975	856	-12.2
Small enterprises	1 035	1 056	2.0
Medium and large enterprise.	1 447	1 940	34.1
Independent	747	615	-17.5
Professionals	1 223	979	-19.9
Non professional	701	581	-17.1
Domestic workers	561	503	-10.3
All sectors / activities	956	1 040	8.8

Source: Ministerio de Trabajo, 2006: 20.

Therefore, the issue of "working poor" is highly relevant in Lima. As table 39 shows, in real terms only the public sector and the large and medium sized private enterprises register an increasing level of salaries (+51.0% and + 34.1% respectively), meanwhile all other sectors, most of all independent workers, suffered an important decrease of their real wages.

The analysis of income and its real change shows clearly the growing difference between employees with university degree and those with low level of education. Especially persons without formal education or only primary school suffered a severe decrease of their salaries in real terms. This effect is relevant even for employees with secondary school. Furthermore these groups are frequently underemployed – another aspect which is deepening the challenges of working poor in Lima.

TABLE 40
LABOR MARKET IN LIMA: INCOME AND REAL VARIATION BY EDUCATION LEVEL

Education level	Average income *(in Nuevos Soles, 2006)*		Real change 1996-2006 *(In percentage)*	Underemployment 2006 *(In percentage)*
	1996	2006		
Without formal education	690	541	-21.7	60.9
Primary	725	579	-20.2	62.9
Secondary	865	811	-6.2	48.7
Superior non Univ.	1 058	1 174	10.9	30.1
University	1 927	2 446	26.9	16.8
Total (all levels)	956	1 040	8.8	45.2

Source: Ministerio de Trabajo, 2006: 25.

b) Informal housing and socio-spatial segregation

In Lima, three types of different informal housing areas may be distinguished (UN Habitat and Riofrío, 2003).

- **Tugurios**. This term refers to decayed central areas (*areas tugurizadas*), namely the decayed buildings in such zones (*tugurios*). Some authors distinguish between *Solares* which means areas located in the core historic part of the cities and *tugurios* located in central areas, which are not considered as historic (UN Habitat, 2003). According to other scholars, *solares* is the official term which is furthermore accepted by the residents, meanwhile the term tugurios is the commonly used (Riofrio, 2003: 4).
- **Modern buildings with severe crowding**. This type of building is rare, but increasing over time.
- ***Pueblos jóvenes*** (known as *barrios* in the 1950's and have been called *asentamientos humanos* since the 1990's) are concentrations of low-income populations, typically located at a considerable distance from the city center. They are not necessarily densely populated but are characterized by low social prestige.

TABLE 41
LIMA METROPOLITANA: SOCIOECONOMIC LEVELS AND HOUSING CONDITIONS, 2001

Socioeconomic level	Percentage population	Persons per housing unit
A. High	3.5	4.3
B. Medium	15.6	4.7
C. Low	32.3	6.0
D. Very Low	36.3	6.1
E. Extreme poverty	12.3	5.5
Total	100.0	5.7

Source: Yepes / Ringskog, 2001: 12 based on data from IPSOS, 2009.

The last type of settlement (*pueblos jóvenes* like San Juan de Lurigancho; Villa María Triunfo; Villa El Salvador; Río Rimac) has received most of the low-income immigrant population from rural areas in the last five decades. Since the 1960's, most of the city's growth has occurred in this type of settlement and therefore, its percentage of Lima's population grew from 10% (1955) to 25% (1970) and around 35% in 2000 (Riofrio, 2003: 4). In spite of bearing the image of informal housing areas, nowadays most of these settlements are consolidated (UN Habitat, 2003: 67).

There are important programs of government assistance to housing improvement and slum formalization (Riofrio, 2003: 12):

- The National Housing Fund (*Fondo Nacional de la Vivienda – FONAVI*): offered funding for the installation of water infrastructure in numerous settlements, it was ended in 1999.
- The Materials Bank (*Banco de Materiales*): granted loans for housing and equipment.
- The Ministry of Justice: is responsible for a formalization program of low-income settlements.

During the last several years, the extreme housing deficit has been considerably reduced. The percentage of population living in housing with inappropriate physical conditions fell from 10.4% (2001) to 8.1% (2006) in only five years time and the percentage of those without sanitary service has been reduced even further: from 6.2% to 2.0% in the same period (INEI, 2007: 428). The overcrowding problem has also been limited as it currently only affects 5.3% (2006), whereas in 2001 this condition still affected 13.7% (INEI, 2007: 427).

c) Delinquency and the perception of violence

High levels of poverty, segregation and most of all the lack of perspective and access to labor markets as well as fragmentation in general are regarded as important elements in explaining rising levels of delinquency and violence, complemented by a history of political violence and weak institutions.

Lima is regarded as a metropolitan region with a relatively high level of violence, presenting 25 homicides / 100,000 inhabitants per year; this is high above the national average. Other sources register lower levels but present a growing trend (6.8 in 2005; 9.4 in 2007 FLACSO Chile, 2008). Furthermore, an increasing sensation of insecurity has been registered: only 10% feel safe in the street and only 46% feel safe in their homes (Gobierno de la Region Lima Metropolitana, 2004: 42). 21.7% declare that they have been a victim of home robbery during the last five years. In terms of probability 70.8% of its citizens expect to be a victim during the next 12 months (FLACSO Chile, 2008).

One of the identified weaknesses is the deficient quality of public education (Gobierno Regional Lima Metropolitana, 2004: 63). This refers not only to secondary and higher education deficits, but also to the still existing alphabetization problems. To meet this challenge, programs have been implemented

in Lima under the National Alphabetization Program (PRONAMA, http://alfa.minedu.gob.pe), such as the sectorial Alphabetization Program in Lima Norte, in which around 9,000 persons participate.

4. Water quality management and health in Lima

Water resources must be regarded as a key element in defining development strategies for metropolitan areas as drinking water services as well as sewage water collection and treatment are crucial in terms of health and environmental protection. In many metropolitan regions in the process of development, access to drinking water and the quality of the sewage system are both matters of social status and are clearly related to socio-spatial segregation. As shown in chapter II.A.2, Lima has an important deficit in this area: it has the lowest level of access to piped drinking water within the sample of the six megacities analyzed in this report. The connection to the sewage water collection system is even worse; around 1.3 million citizens of Lima Metropolitana do not benefit from this service. In Lima access to drinking water resources is even more relevant than in other spatial contexts due to its high poverty level, existing deficiencies in health services, and spatial patterns.

The hydrological basin of the Metropolitan Area of Lima includes the rivers Rímac, Chillón y Lurín. Rio Rímac is the most important of these, presenting an average flow volume of 29.2 m^3/s and a pronounced variation by season: its minimum is around 20 m^3/s and its maximum exceeds 40 m^3/s many years (INEI, 2009). An average of 12.5m^3/s reaches Lima and an important part of this is retained and used for generating energy and by mining installation. Some 21% of the city's water supply is generated in wells. The water offer of the basin is estimated to be around 21m^3/s whereas demand exceeded 24m^3/s in 2005. As a result, in the late 1990's, the level of ground water was at 180m and still sinking between two and three meters per year; whereas in the late 1980's, this level was only 60m below the surface (Dourojeanni / Jouravlev, 1999: 12). A further fast growth of the water demand is expected: SEDAPAL estimates that it will reach 35m^3/s by 2030.

Therefore, Lima is considered to be challenged by the risk of depleting fresh water resources; and a growing necessity to bring drinking water from longer distances and provoking negative impacts in those areas. This challenge is partially due to deficient water management projects and consumption patterns (Rivadeneira, 2000: 42).

A second major challenge is the quality of the main water bodies in the catchment area and especially within the city. This is directly related to the deficient water treatment infrastructure. As table 42 shows, the network of wastewater treatment plants presents a decentralized organization with 14 different small scale treatment plants, which as a total are highly deficient in terms of installed capacity.

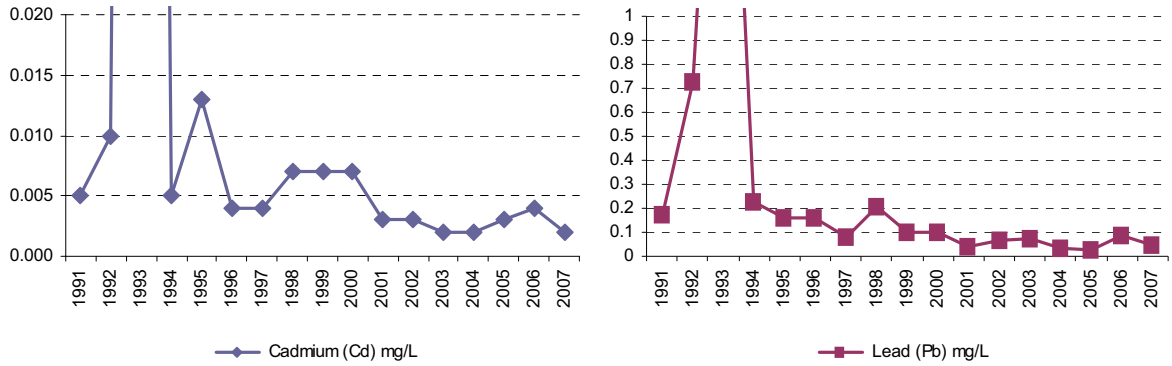
TABLE 42
LIMA: WASTEWATER TREATMENT PLANTS

Area	Number of treatment plants	Installed capacity
Sur	7	0.60 m^3/s
Centro	3	0.52 m^3/s
Norte	4	0.47 m^3/s

Source: INEI, 2007.

At the end of the last millennium, the Río Rimac was considered to be one of the most contaminated rivers in Latin America. The contamination has been primarily caused by domestic sewage and waste as well as by waste water from industry and mining activities, causing health risks especially by high concentrations of heavy metals and coliform bacteria (see Figure 14; Dourojeanni / Jouravlev, 1999: 12).

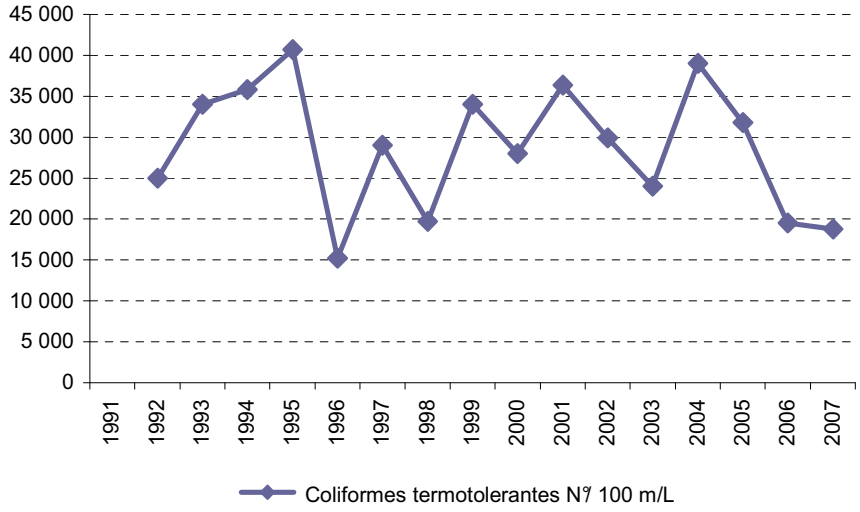
FIGURE 14
LIMA: CONCENTRATION OF CADMIUM AND LEAD IN RIO RÍMAC, 1991-2007



Source: Authors' compilation, based on INEI, 2007.

In conjunction, these different factors are a higher risk for the most socially vulnerable population, being a main cause of mortality by infectious diseases. Diarrheic diseases are an important death risk for children in sectors which lack drinking water access, which affects most of all the children of families in poverty aince they do not have access to the health system.

FIGURE 15
CONCENTRATION OF HEAT RESISTANT COLIFORMS IN RÍMAC RIVER, LIMA, 1991-2007



Source: Authors' compilation, based on INEI, 2007:58.

The water quality on the beaches of Lima and Callao are heavily affected as well: in 2003 some 11% of the beaches were qualified as "bad" corresponding to 1,000 to 4,000 coliforms (MPN).

The institutional problems **of water management** are mainly explainable by the weak organizational structure and a lack of legal instruments as well as missing participation mechanisms (Dourojeanni / Jouravlev, 1999: 108). The enterprise in charge of the drinking water supply system is SEDAPAL, which is estimated to cover almost 90% of the area. The rest of Lima's population uses informal, common and often illegal wells, which in large part do not conform to drinking water quality standards. This practice is responsible for en important number of cases of water born diseases (Loyola /

Soncco, 2007: 80). Furthermore there is an important market of water sold by vendors mostly in slums. In Lima the ratio of water vendor prices in slums to public utility prices is up to nine (UNDP, 2006: 52), which causes an extremely high cost of water in terms of percentage of monthly income. This supply system, mostly by truckers is estimated to be the main drinking water source for around 26-30% of Lima's population (UNDP, 2006).

Therefore, the drinking water supply is not only a quantitative challenge; it is also an issue of social segregation and infrastructure as well as price driven exclusion: *"Lima produces more than 300 liters of water per capita each day, but 60% of the population receives just 12% of the water"* (UNDP, 2006: 53).

5. Solid waste management

One can observe rapid growth of the per capita generation of solid waste in Peru, passing from 0.7 kg/inh./day (2001) to 1.2 kg/inh./day (2007). Lima, due to the concentration of its population and income, generated almost 2.3 millions of metric tons of solid waste in 2007.

The General Law on Solid Waste (2000) privatized the solid waste management. Private enterprises are licensed by the Dirección General de Salud Ambiental (DIGESA). Nowadays, three enterprises are in charge of the disposal, operating five landfills. Other 375 companies form part of the solid waste management system. They commercialize solid waste, offering separation, processing, recycling and transport services. The coverage of solid waste management system reaches 86% and the cost of these services has been reduced due to the privatization processes by 35% reaching 4.17 US$ per metric ton in 2007 (data provided by local expert). In spite of the high coverage rate the remaining 14% is 830 metric tons per day, challenging different sustainability issues of the metropolis. Other sources estimate that about 30% of the solid waste is improperly disposed e.g. in rivers or is burned illegally. Furthermore they state that there were in 2006, 27 illegal landfills in Lima (El Comercio cited in PNUMA, 2006).

6. Urban transport infrastructure

The chaotic transportation system in the city of Lima, disorder of the routes of transport services, the age of the fleet, and a surplus of taxi services, buses and "*combis*" is a main challenge for regional governance. It should be substantially improved by the implementation of a Metropolitan Transportation System, the recently planned bus rapid transit system in the corridor from Chorrillos to Los Olivos. The project will be concessioned by the Municipality of Metropolitan Lima to a private company for 12 years.

a) Sistema Metropolitano de Transporte

A new bus system which shows clear similarities to the Transmilenio (Bogota), Metrobus (Mexico City) and Transantiago (Santiago de Chile), the Metropolitan Transport system of Lima, known as: *Metropolitano,* is planned to started its operation in 2010. The aim of the *Metropolitano* is to improve the lives of users by saving travel time, through punctuality and service hours, increased security, improved quality of public transport and low pollution. It consists of a main line from north to south (*Linea troncal* Los Olivos – Chorrillos) which has two different trajectories in the north section, and several secondary, connecting lines (*líneas Alimentadores*). The *Metropolitan* will have a central station in downtown Lima (Avenida Grau) and two terminals in the north and south of the city, in addition to 33 local intermediate stations and bus stops that cover the entire city. The intelligent electronic card system will charge different prices, depending on the distance.

In order to achieve Green House Gas reductions and to limit air pollution, and based on the state policy of changing the energy matrix towards natural gas, the buses will use natural gas technology, applying Euro IV standards. There are two types of vehicles: i) 300 articulated buses to be used in the *Linea troncal* (18 meters long; holding between 120 and 160 passengers), and ii) 300 regular buses to be used in the city (between 12 and 8 meters long; holding 80 and 40 passengers respectively).

It is estimated that the operation of the *Metropolitano* will displace about 4,000 public transport vehicles between taxis, buses and "*combis*", improving the operation of the city: ordering urban transport, significantly reducing air pollution, improving internal travel times, reducing the average years of age of the fleet in Lima, and improving the quality of transport services for the population.

The Ministry of Transport and Communications is planning to offer up for bid the rapid urban roads section by section of the current avenues of Lima and Callao. This project is planned to be offered to private investors for 5,000 million US$. There are already three avenues provided for the case: Javier Prado, Brazil and Alfonso Ugarte.

b) Urban rail network

Despite the large number of attempts, a functional urban rail transport system has yet to be implemented in Lima. Since the 1970's, several plans have been formulated to develop an urban rail transport system for Lima and Callao but only a short part of Line Number 1 has been constructed including seven stations and 9.8 km. Since 2003, new attempts have been undertaken in an effort to begin operating this short segment as a regular service and to take the first steps towards an expansion for Line 1. Plans have been made to establish a vast expansion, with the initial construction of four lines prior to 2025, whereafter the system would be incremented to seven urban rail lines (see map 7).

MAP 7
LIMA: PLANNED URBAN RAIL NETWORK

Source: Autoridad Autonoma del Tren Electrico (http://www.aate.gob.pe/).

The expansion of Line 1 to the Av. Grau, which is one of the most important traffic axes, has been a priority. Implementing at least this section of the Metro would cover a rather marginalized segment and provide a direct connection to the central part of Lima. Finishing this step means an extension of Line 1 to mor than 22 km and 16 stations. However, this could not be achieved. A public agency for promoting private funding, Pro Inversión, informed that the project of enlarging the Line 1 (sector Villa El Salvador-Avenida Grau), was withdrawn in 2009 as none of the qualified bidders presented a project proposal (El Comercio, 29.01.2009).

7. Conclusion Lima: challenges, risks and obstacles

Based on the evaluation of local experts the following challenges, risks and obstacles of sustainable urban development of Lima have been identified.

Main challenges and risks of the metropolitan city of Lima:

1) Urban growth of about 130,000 inhabitants per year and an unsatisfied demand for basic services like drinking water, transport, and housing.
2) Motorization growth and traffic is an important pressure factor on health.
3) Growing social conflicts due to unsatisfied basic needs and unequal environmental conditions.
4) Growing socio-economic differentiation and high income sector segregation.

Main obstacles:

1) Segmentation of the city into 49 districts, resulting in fragmentation, segregation and an uneven growth of the city with outstanding contrasts between high income and low income sectors. However, all districts of the city are affected by cross-cutting issues such as transport and sanitation deficit.
2) High levels of clustering and specialization in goods and services production in different districts. Important challenges in terms of spatial flows and coordination of land use policies.
3) Low coordination between local and national norms for the building industry.

D. City profile: Mexico

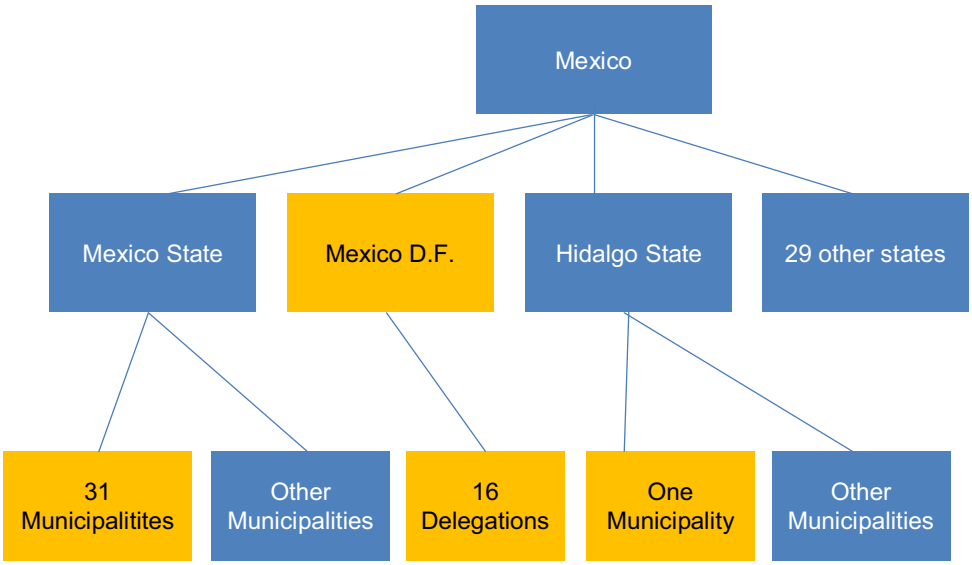
BOX 26
SUMMARY OF FINDINGS. MEXICO

- The metropolitan area of Mexico City includes the Distrito Federal, a large number of different municipios in the Estado de Mexico and Hidalgo, which is an important obstacle in terms of regional planning.
- Mexico City is considered to be one of the cities with the highest levels of air pollution. That being said, it also is a noteworthy example of positive governance outputs. One of the most successful and sustained policies for air pollution reduction has been applied for almost 20 years.
- Sustainable water management is the most complex issue, as the metropolitan area requires inputs of fresh water from other river basins for more than five decades. Low quality of infrastructure challenges the supply and distribution system of water resources. Floods are another important risk.
- Transport system limitations challenge planning of mobility, city management and economic growth. Congestion levels as well as travel times are extremely high. In spite of the largest and most efficient subway system of the analyzed cities, the public transport system is reaching its limits in terms of demand and supply capacity.

Source: Authors' compilation.

1. General data

FIGURE 16
METROPOLITAN CITY OF MEXICO: ADMINISTRATIVE STRUCTURE



Source: Author`s compilation.

The Metropolitan Area, the so called *Zona Metropolitana Ciudad de Mexico* ZMCM –includes the Distrito Federal (Mexico D.F. formed by 16 Delegations) and a number of municipalities of the State of Mexico (Estado de Mexico) varying between 27 and 58 (Iracheta, 2002: 428). In the present report we use a selection of three of the municipalities of the Estado de Mexico as shown in table 43 and include one further municipality of the Estado de Hidalgo.

In the 1970's the Mexican Metropolis was the Distrito Federal as well as the municipalities that already formed part of the urbanized area such as Naucalpan, Tlalnepantla, Ecatepec and Nezahualcoyotl. In 1990, the name *Zona Metropolitana de la Ciudad de Mexico* was officially introduced and was the Distrito Federal (its 16 delegations) and 38 municipalities of the Mexico State. In December 2005, the executive commission of metropolitan coordination in the *Cámara de Diputados* declared the official limits of the *Zona Metropolitana del Valle de Mexico;* this included, apart from the Distrito Federal, 59 municipalities of the State of Mexico and the municipality Tizayuca of the Hidalgo State. The growing number of *municipios* considered part of the metropolitan area reflects the growing urban sprawl. We used the ZMCM approach in the comparative section. Subsequently, some statements refer to the slightly wider concept of Mexico City, the ZMVM.

TABLE 43
URBAN GROWTH IN THE ZMVM (1950-2000)

	1950	1960	1970	1980	1990	2000
Population						
Distrito Federal	2 923 194	4 846 497	6 874 165	8 831 079	8 235 744	8 605 239
Municipios Conurbados	58 881	308 830	1 782 686	4 903 575	6 811 941	9 791 438
Total ZMVM	2 982 075	5 155 327	8 656 851	13 734 654	15 047 685	18 396 677
Housing Units						
D.F	600 450	897 152	1 219 419	1 744 727	1 789 171	2 103 752
Municipios Conurbados	12 275	53 376	287 475	845 010	1 334 341	2 108 011
Total ZMVM	612 725	950 528	1 506 894	2 589 737	3 123 512	4 211 763
Area (ha)						
D.F.	24 059	31 415	46 136	54 884	66 190	79 782
Municipios Conurbados	2 216	10 275	26 110	34 228	63 312	133 796
Total ZMVM	26 275	41 690	72 246	89 112	129 502	213 578
Density (pop./ha)						
D.F.	121.50	154.27	149.00	160.90	124.43	107.70
Municipios Conurbados	26.57	30.06	68.26	143.26	107.59	70.80
Total ZMVM	113.49	123.66	119.82	154.13	116.20	84.60

Source: Information provided by local expert.

There is a direct link between population growth of the ZMVM and policies at the national level, as the latter produce important migration flows towards the ZMVM of about 400.000 inhabitants annually. The result is a chaotic, nearly anarchic spatial growth process due to institutional failure, a lack of a unique planning organism, informal real estate markets in some sectors of the city, insufficient enforcement of urban planning regulations and undefined rights of land use.

Historically the valley of Mexico was intensely populated in pre-Hispanic times. It had –at the moment of the conquest– around two million inhabitants, approx. 700,000 of them being in the capital Tenochtitlan. In its natural state, the Valley of Mexico nowadays covered by the city, was mostly covered by lakes, mainly the Texcoco Lake. The area is a naturally closed depression which has suffered a profound change, especially starting at the end of the 18th century in order to prevent the frequent inundations and due to urban growth. The natural condition with abundance of water has changed completely due to the urbanization by altering the regions ecology completely.

In order to face the challenges of sustainable development, urban planning on a metropolitan scale requires a unique planning entity with clearly defined roles of authority and duties, otherwise the city's vulnerability and its current disorder would increase. This institution should foster the participation

and cooperation of different governmental institutions and the main actors of the city's civil society. The lack of a strong urban planning institution leaves authority in the hands of private real estate interests, which has led to pressure on price levels and increasing inequities. Relevant processes of this subsystem are furthermore i) to coordinate, update and harmonize the different legal, technical and fiscal instruments for the metropolitan area, and ii) to innovate financial mechanisms in in support of urban planning.

During the 20th century there have been six earthquakes of major importance with more than eight degrees Richter. The event dated September, 19th 1985 lasted more tan two minutes and provoked major destructions in the urban area, especially in the city center (*delegación* Cuauhtémoc) and thousands of fatalities. Since this event there has been built up a public awareness and policies to reduce risks and establish disaster management strategies.

The major authority of each of the states is an elected Governor. The chief of the government of the Distrito Federal boasts an authority similar to that of the State Governors. This position was formerly designated by the President of the Republic (United States of Mexico); however, for little more than a decade it has been elected directly by the citizens of D.F. Due to the existing different jurisdictions, the ZMVM has been regarded as a "divided city" (Iracheta, 2002). This challenge is accentuated by political constellations, for example at the beginning of the new millennium the ZMVM was governed simultaneously by the three major parties: PAN (National level); PRD (Distrito Federal) and PRI (Estado de Mexico). All political direction of the ZMVM includes the coordination of the Distrito Federal, the two involved states and also the participation of the Federal Government (national level). Institutions at the level of the metropolitan region act merely as coordinating entities, as they have neither their own competencies nor independent budget. Additionally, Metropolitan Commissions have been established in the National Congress and in the respective organisms at the state level, which exchange information and implement dialogues on issues that are implemented by the governments. All the different issues discussed in this city profile strengthen the need for a regional public policy on a regional scale, nevertheless a regional metropolitan government still does not exist.

TABLE 44
LOCALITIES OF THE METROPOLITAN AREA OF MEXICO CITY

Delegaciones / Municipios		Population 2000	Population 2010	Area (km^2)
Azcapotzalco	DF	441 008	410 678	34
Coyoacán	DF	640 423	659 897	54
Cuajimalpa de Morelos	DF	151 222	176 540	70
Gustavo A. Madero	DF	1 235 542	1 218 353	88
Iztacalco	DF	411 321	363 807	23
Iztapalapa	DF	1 773 343	2 062 096	114
Magdalena Contreras	DF	222 050	243 104	64
Milpa Alta	DF	96 773	112 975	287
Alvaro Obregón	DF	687 020	736 655	96
Tláhuac	DF	302 790	366 574	86
Tlalpan	DF	581 781	664 613	310
Xochimilco	DF	369 787	445 056	119
Benito Juárez	DF	360 478	329 650	26
Cuauhtémoc	DF	516 255	472 105	33
Miguel Hidalgo	DF	352 640	318 278	46
Venustiano Carranza	DF	462 806	436 214	34
Acolman	EdoMex	61 250	75 695	82
Atenco	EdoMex	34 435	44 123	136
Atizapán de Zaragoza	EdoMex	467 886	603 625	84
Coacalco de Berriozábal	EdoMex	252 555	324 872	38
Coyotepec	EdoMex	35 358	43 440	50
Cuautitlán	EdoMex	75 836	89 320	27
Chalco	EdoMex	541 433	750 566	224
Chicoloapan	EdoMex	77 579	94 940	34
Chiconcuac	EdoMex	17 972	19 852	5
Chimalhuacán	EdoMex	490 772	688 280	56
Ecatepec	EdoMex	162 697	1 937 709	158
Huixquilucan	EdoMex	193 468	193 468	143
Ixtapaluca	EdoMex	297 570	383 898	276
Jaltenco	EdoMex	31 629	36 598	16
Melchor Ocampo	EdoMex	37 716	47 115	20
Naucalpan de Juárez	EdoMex	858 711	929 012	151
Nezahualcóyotl	EdoMex	1 225 972	1 195 665	70
Nextlalpan	EdoMex	19 532	25 396	68
Nicolás Romero	EdoMex	269 546	337 707	224
La Paz	EdoMex	212 694	269 885	34
Tecámac	EdoMex	172 813	207 377	152
Teoloyucan	EdoMex	66 556	83 549	46
Tepotzotlán	EdoMex	62 280	80 819	195
Texcoco	EdoMex	204 102	250 267	404
Tezoyuca	EdoMex	18 852	24 132	13
Tlalmanalco	EdoMex	42 507	49 672	202
Tlalnepantla de Baz	EdoMex	721 415	735 235	74

(Continued)

TABLE 44 (concluded)

Delegaciones / Municipios		Population 2000	Population 2010	Area (km2)
Tultepec	EdoMex	93 277	129 682	28
Tultitlán	EdoMex	432 141	579 635	65
Zumpango	EdoMex	99 774	124 394	65
Cuautitlán Izcalli	EdoMex	75 836	89 320	27
Tizayuca	E. Hidalgo	46 344	5 8405	77
Total		16 005 747	19 520 248	4 728

Source: PNUMA, 2003; INEGI, 2005.

The population dynamics of the peripheral areas and the stagnating and in part decreasing number of inhabitants in central areas of Mexico City, change the spatial patterns of land use, producing a loss of protected areas, while also challenging the service systems as well as transport infrastructure. "Mega urbanization" has been identified as the main challenge for the development of Mexico City.

2. Water quality and management

Mexico has a history of more than 50 years of severe problems in water management. Underground water bodies of the Valle de Mexico have been used since the 19th century and are overexploited, the original (pre-Hispanic) lakes are dry and two of the few remaining rivers (Magdalena and De los Remedios) are now in a rescue process due to high pollution. Due to this overexploitation, it has been necessary to incorporate new catchment areas since the 1940's. Long distance connections have been constructed between the Rio Lerma (implemented in the 1940's) and the Cutzamala River (starting in 1976 in four phases) in order to supply the consumption in the Valle de Mexico. The river Lerma is overexploited, which means that extraction is higher than the recharge rate (UNDP, 2006: 146). This has caused important conflicts with the states and local communities.

a) Water supply

Water supply from Cutzamala basin has boosted water imports of the ZMVM in response to the growing demand; however, it has also been partially promoted due to the existing conflicts in the water basin of the Rio Lerma. It is composed of a system of connected artificial lakes, used also as an energy resource called "Sistema Hidroeléctrico Miguel Alemán." At the beginning of the new millennium around 66% of the water consumption in ZMVM (72 m^3/s; Del Valle, 2009: 3) came from the water bodies of the Valle de Mexico, while 9% was transported to the metropolitan region from the Valle de Lerma 60 km away, and 25% came from the Cutzamala (Castelán, 2002). Pumping water from the Lerma and Cutzamalá systems involves driving it 127 kilometers and lifting it up 1,100 meters, which consumes 3.4 million barrels of oil per year (GDF, 2002).

Water infiltration programs to recharge groundwater in Mexico City, as well as capturing low scale rainwater in private buildings, have recently been started. The slowness and low volume of actions reflect the weak awareness and lack of environmental culture that still exists

Water supply is a vulnerability factor for ZMVM due to both natural conditions and political confrontations related to power and control between the Federal Government, the D.F. and the Estado de Mexico.

There is still an important lack of regional planning in terms of water basin management. In 1989, a joint program was signed with the participation of the governments from the states of Guanajuato, Jalisco, Mexico, Michoacán y Querétaro, in pursuit of planned use of the Basin Rio Lerma – Chapala; this program was extended in 1997 to the hydrological region Rio Lerma-Santiago (Dourojeanni / Jouravlev, 1999: 98).

The current water supply system of the ZMVM carries important negative consequences in terms of sustainability:

- Negative impact on biological systems and agriculture in catchment areas and the resulting social conflicts.
- Important water losses due to the deterioration of pipelines are estimated at approximately 40% (UNDP, 2006: 89).
- Low efficiency and high energy consumption due to large distances and high relief differences (the pipelines have to cross the *Sierra*).

b) Water management, efficiency and price policies

The topographic differences of the area present a major obstacle, causing major energy costs, thereby converting the amount of energy necessary into an important limiting factor for this supply system. It is estimated that the water supply system of the ZMVM is consuming some 5% of the national energy production. The energy required by the Cutzamala system alone is estimated to be around 1,787 million Kwh/year producing yearly costs of approximately 62.5 million US$ (Tortajada, 2006: . Nowadays, the average cost of 1 m^3 of drinking water is US$ 1.34 (Castelán, 2002: 5). Increasing water supply from distant basins including the need of pumping it across mountains would imply higher energy costs which may boost the water supply costs.

The price charged to water consumers is not enough to cover these costs. Furthermore it is estimated than 1/3 of the water connections in the regiona are informal and therefore there consumption is not billed (Tortajada, 2006: 24). Water price is differentiated according to their demand, increasing with higher consumption. Additionally water price was substantially reduced for small users since 1996 (Tortajada, 2006: 26). Mexico has shown limited results in its implementation of socially differentiated price systems and cross-subsidies. There is an important limitation caused by the fact that the poor population does not have formal access to drinking water and is thereby forced to buy drinking water from informal water vendors. The informal market is not affected by the subsidies and furthermore tends to be even more expensive than the formal market price.

One of the main challenges is caused by the unplanned and partially chaotic urban expansion which does not follow the planning and the establishment of a consistent network of water supply lines.

Recently, programs aiming towards the infiltration of water into groundwater bodies as well as programs providing incentives for the use of rainwater in private households have been initiated. Nevertheless, due to low funding and a slow pace, there is still a weak culture of responsible water use.

The water management issue is an important factor of vulnerability for the ZMVM, not only due to the natural conditions and ecological and social consequences of the water supply from other catchment areas, but also in terms of governance as it has become an important element on the political agenda, stirring up power struggles between the federal government, the Distrito Federal and the Estado de Mexico.

c) Ground stability

Due to the fact that the city is partially built on the area of a former lake (*Lago Texcoco*) and because the ground is nowadays very unstable, there is ongoing subsidence, mainly caused by the continuously sinking ground water level resulting from the over-exploitation of aquifers (Satterthwate, 2007: 27). In the mid 20th century, there was a reported subsidence of the ground level of more than 40cm/year in some areas due to the increasing extraction of groundwater in the *Valle de Mexico* (UN Habitat, 2007: 322). The city is sinking in some areas at a rate between five and 40 centimeters per year.

The collapse in the central region of the city reached 10m at the end of the 20th century, while in the sub-basin Chalco-Xochimilco, it reached 7m.

This is undermining the stability of buildings as well as water, gas and transport infrastructure systems, making them more susceptible to earthquakes, which means an increased risk for the population. The cracking, landslides and slumping caused by local phenomena associated with the lack of underground stability are becoming more frequent. In several neighborhoods cracking has destroyed or severely damaged buildings, houses, rooms and roads, drainage and water networks. The infrastructure of drinking water and drainage systems have been the most impacted, causing the need for new pumping infrastructure support in some areas.

This is clearly a man-made hazard, generated by different activities related to urbanization. On the one hand, urban construction is putting increasing pressure on the underground and on the other hand, over-exploitation of groundwater reduces the volume by compacting the clay. This risk is well known as it has caused severe damages during the history of the city and remains highly relevant.

In terms of the internal distribution of this effect within the ZMVM, the most affected areas during the 1980's were the city center (Aragón, Iztapalapa and Gustavo A. Madero) and the municipalities of urban growth, Nezahualcoyotl and Chalco. During the second half of the 1990's, it was primarily observed in the eastern and southern limits of the D.F., in Nezahualcoyotl, in the airport area and in Xochimilco.

One of the most serious problems caused by this process is the decline in the level of the metropolitan area in relation to the level of Lake Texcoco, which under natural conditions was previously the lowest point within the present urban area. In 1900, the level of Lake Texcoco was three meters deeper than the average level of the city centre. In 1974, it was already two meters above. These changes have deepened the flooding problems and have forced a change in the design, construction and operation of the city's complex drainage system (PNUMA: GEO-Mexico City).

d) Drinking water contamination

Extreme pollution problems exist, caused by lack of wastewater treatment. A treatment plant was constructed in the 1980's; however, its capacity (7 m^3) has never been able to treat the sewage of the Megacity, which is why a large amount of untreated sewage still flows into the leftovers of Lake Texcoco. Mexico still uses a high level of sewage water for agricultural purposes, resulting in higher production levels but also leading to health and quality standard risks. The waste water of Mexico City for example is partially used in the basin of Rio Tula, giving birth to agricultural production in an originally semiarid area (Dourojeanni / Jouravlev, 1999: 18).

3. Air quality and the Proaire program

Mexico City is considered worldwide to be one of the most polluted places in terms of air pollution (Blacksmith Institute, 2007); this is partially caused by specific climatic and morphologic conditions which generate thermal inversion events and reduce ventilation of the *Valle de Mexico*. Nevertheless, the city is also known for the implementation of a large number of different programs and plans in order to reduce pollution levels.

In order to define and analyze pollution reduction, one must consider the structure of the main sources of air pollution. The transport sector is considered to be the major source of air pollution; around 75% of the total pollution is from traffic. Vehicles are responsible for 99% of CO; 81% of NOx; 46% of VOC's and 30% of SO_2 emissions (Vincent, 2008: 4).

Within the transport sectors, private cars are the most important source of pollution, emitting more than any other means of transport. They are estimated to have the poorest efficiency rate as only 15% of daily trips are done in private cars but they are responsible for approximately 50% of the pollution (Jacobi, 2003: 87).

Based on the extreme high air pollution levels registered at the end of the 1980's, since 1990 different policies have been designed to reduce emissions and improve air quality. The following comprehensive programs have been milestones of the implementation of these policies (Sheinbaum, 2006; Jacobi, 2003: 87:

- October 1990: Holistic Program Against Atmospheric Pollution in the Valle de Mexico (Programa Integral Contra la Contaminación Atmosférica en el Valle de Mexico, PICCA).
- March 1996: Air Quality Improvement Program Valle de Mexico (Programa para Mejorar la Calidad del Aire en el Valle de Mexico) 1995-2000 (PROAIRE).
- February 2002: Air Quality Improvement Program (Programa para Mejorar la Calidad del Aire en la ZMVM 2002-2010).

As the Figure 17 shows, these programs have successfully achieved important reductions in pollution, starting first with steps such as the restriction of the circulation of private cars (the program "*Hoy No Circula*") established in 1989, which anticipated the PICCA program (Jacobi, 2003 / Simioni, 2003: 135). Other early measures taken were the introduction of gasoline without lead in 1990, the introduction of 2-way catalytic converters in vehicles in 1991 (APERC, 2007: 82) and the closure of main contaminating plants like the refinery "18 de marzo" in Mexico D.F.

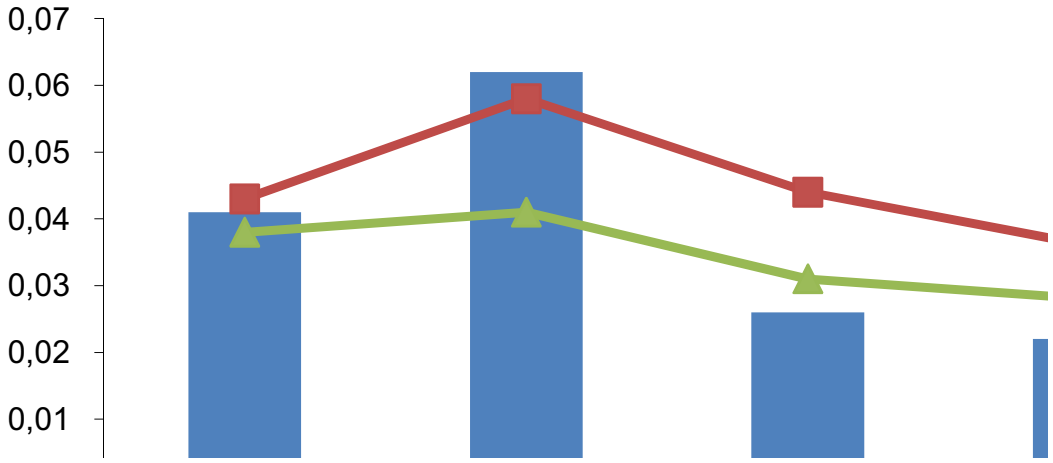
The PROAIRE Program addressed the air pollution problem primarily from a health perspective, not only because of the high risk level, but also because of knowledge concerning the effects of air pollution on respiratory diseases and their exacerbated effects on the most vulnerable groups of the population. Important goals concerning reducing the health risks of air pollution have been achieved primarily through technical measures and by introducing fuel quality standards: eliminating lead and reducing the concentration of Sulfur in gasoline. Further expectations of Proaire were to reduce the emissions of hydrocarbons by 50% and NOx emissions by 40% (Simioni, 2003: 136).

Key measures of the PROAIRE Program are (Winchester, 2007: 35; SMA, 2004):

1) Reduction of emission by strengthening technical measures and improvement of fuel quality, modernizing the vehicular monitoring; reducing the emissions generated by power plants. An important element of defining legal limits is the functionality and liability of enforcement institutions. Since 2001, Mexico D.F. has monitored 100% of all registered vehicles. All of the service centers offering the monitoring procedure are required to have the ISO 9,000 quality certificate (Scheinbaum, 2006: 22).
2) Restrictions and self-regulation, especially the traffic restriction. The control of emissions from industry sources has been improved by implementing self-regulation programs and environmental management; targeting small and medium enterprises has been especially supported.
3) Renovation and modernization of the public transportation system towards high capacity public transportation; putting into operation major public transportation corridors, (Metrobus).
4) Infrastructure improvement: second story upper-deck freeways over the Periferico, on/off ramps, overpasses, traffic distributors and other highways. Bicycle roads and pathways.
5) Alternative energy sources: to promote the use of solar energy in place of fossil fuels.

FIGURE 17
MEXICO CITY: REDUCTION OF AIR POLLUTION, 1989-2004

(Concentration in mg/m^3)

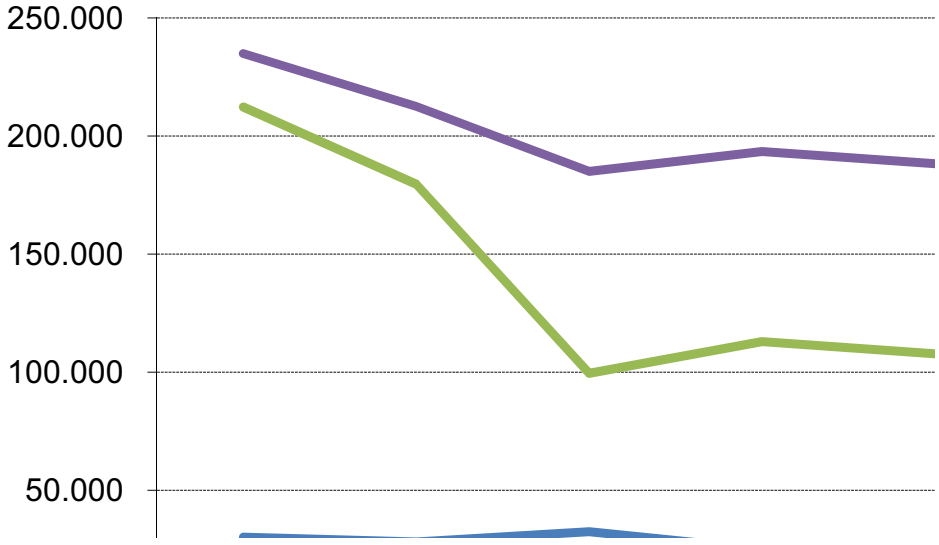


Source: Authors' compilation, based on APERC, 2007: 82 and Sheinbaum, 2005.

As a result of these measures, sulfur and CO emissions were reduced in the second half of the 1990's in spite of the continuously growing traffic volume and motorization.

FIGURE 18
MEXICO CITY: AIR POLLUTION. EMISSIONS OF SELECTED CONTAMINANTS, 1994-2004

(In metric tons per year)



Source: Gobierno del Distrito Federal, Secretaria del Medio Ambiente (2006): 131.

A visible reduction of the emission of almost all contaminants have been registered in a relative short term (2002-2004), in which CO, SO_2, NOx and PM emissions have been reduced by around 10%. The ZMVM achieved an agreement with the state Mexican fuel producer PEMEX in order to reduce the

quantity of polluting agents in commercial fuels and the long term implementation of European fuel quality standards.

TABLE 45
CONCENTRATION OF SULFUR BY TYPE OF FUELS AND FUEL CONSUMPTION IN THE TRANSPORT SECTOR OF ZMVM, 2006

	Sulfur content *(in ppm)*		Date	Energetic consumption	
	Average	Maximum	*(Of norm)*	*(In PJ)*	*(In percentages)*
Gasoline Premium	250	300	Jan 2004	32.0	10.3
	30	80	Jan 2006		
Gasoline Magna	300	500	Jan 2005	202.8	65.0
	30	80	Jan 2008		
Diesel		300	Jan 2006	69.0	22.1
		15	Jan 2008		
Gas				8.3	2.6

Source: Sheinbaum, 2006: 32; SMA, 2008b: 19.

At present contingencies occur mostly because of ozone concentration and the Federal District Government as well as the State of Mexico Government focus on this through the Metropolitan Environmental Commission, impact on population's health, in particular on children and elderly people, considered to be the most vulnerable.

Public policy to reduce air pollution has been in place for more than 20 years and has without a doubt achieved important improvements. The different air quality programs of the Valle de Mexico should be considered as remarkable examples of good practices. The programs have successfully integrated different political, social and private actors in order to face a problem that is affecting all sectors of society. The plans and programs have been designed and carried out by consulting civil society, international organizations and representatives of the local economy. To begin, they summarized the initiatives of the government of the Distrito Federal, later on they included the central government of Mexico and the regional government of the Estado de Mexico. In this manner, it was possible to extend the area of action to the whole Valle de Mexico; to include general standards (fuels, technologies) and control of vehicles, and even integrate fiscal instruments.

Furthermore, a remarkable result of this policy is the high level of institutionalization and the approval of laws and environmental norms, which have gradually been improved.

4. Urban transport

The Zona Metropolitana Valle de Mexico is the largest of the analyzed megacities regarding the number of inhabitants and constructed area. Due to suburbanization processes, periurban growth, the appearance of important periurban sub centers, and the growing functional links to some distant centers like Toluca, Puebla etc., there is a growing need for daily large distance commuting. This provokes a higher density of traffic flow in almost all directions, not only from the periphery towards the center but also between different sub centers and peripheral areas. In the metropolitan city of Mexico, on a daily base more than five million trips are generated, of which 2.2 million correspond to people travelling from municipios of the Estado de Mexico towards the Distrito Federal.

As a result, Mexico City's motorized traffic, namely in the ZMVM, is hit daily by severe congestion problems, making this means of transport economically inefficient and causing growing

social and environmental costs (externalities), primarily due to the use of low capacity transport vehicles like private cars, taxis and mini-buses.

a) Urban road infrastructure and private cars

Not only do these effects present environmental risks, they also challenge the functionality of the Metropolitan Region as a system. Since the 1950's, various large-scale vial infrastructure projects have been constructed in Mexico City (Sommerhoff / Weber 1999: 203). A system of urban highways (*Periferico* and *Circuito interior*) complemented by the habilitation of large avenues and the construction of a series of concentric rings with highway characteristics (no intersections), has been built up. The latest project of this magnitude was the construction of a second floor of the *periférico* highway. This infrastructure project could not avoid growing congestion problems due to the higher motorization rate and longer daily trips. This is visible in the extremely high daily travel time which the inhabitants of ZMVM have to assume. It is likely that in 2020 only the subway (metro) will be able to maintain a travel speed above 30 km/h. This will generate further pressure on the environment as air pollution increases with growing traffic congestion.

As private car mobility is loosing efficiency, public transportation is becoming more attractive. This is reducing the number of vehicles used and hence, reducing the per capita emissions of air contaminants. As public transportation modes are reaching their capacities during peak hours, the possibility for the future growth of passengers is limited. It is worth it to mention that although Mexico has a relatively high motorization rate, it has a relatively low use of private cars in the modal split of daily trips (see chapter III.B.4).

The need to redesign the urban transport system and invest in modern and sustainable infrastructure concepts persists (Navarro, 2008; PNUMA, 2003). One of the important measures of this type is the Bus Rapid Transport System *Metrobus*.

b) Public transport system and the Metrobus (BRT system)

As shown in the indicator sector of this report, public transportation still clearly dominates in Mexico (some 80% of the daily trips) in spite of the high motorization rate. Public transport is provided by a concession, in general with old vehicles with low emission standards, low quality of service, and high security risks.

In response, the D.F. has designed an alternative, which has been gradually implemented in the last decade: the *Metrobus*. Inspired by other successful BRT systems (Curitiba and Bogota) it was designed to implement nine lines by 2012. In the first stage, the first *corridor* was constructed including 20 km of exclusive lanes and 36 stations along the avenue *Insurgentes* (North-South); it was inaugurated in 2005. After, the first line was enlarged towards the south, a second one –the Tacubaya-Tepalcates (East-West) line was put into operation. Both lines are currently operating with very good results in terms of users and they have also contributed to the reduction of the emission of air contaminants.

The construction of exclusive lanes has contributed (in spite of contrary expectations) to less congestion on the avenue *Insurgentes* (Line 1) and a reduction in travel time of 33% on this route, which ultimately has led to a reduction of Green House Gas emissions of 35,000 tons per year and a relevant reduction of other contaminants which is estimated to be 11,000 tons/year (CMM, 2006: 32).

The use of exclusive lanes increases transport speed and the exclusive stations have improved security. Unlike the integrated system in Santiago, the Mexican *Metrobus* is still a standalone solution, using a separated payment system which doesn't permit modal interchanges neither to the Metro nor to the traditional bus system.

Another positive effect is the higher efficiency achieved by the bus fleet choice. In the first corridor (*Insurgentes, Indios Verdes-Dr. Galvez*) 84 large capacity buses with high energy efficiency were used, which replaced 265 old buses and 87 microbuses (CMM, 2006: 31).

The following benefits can be summarized from the second phase (Vincent, 2008: 16):

- 97 articulated BRT vehicles replaced 350 older buses.
- One minute at peak frequency.
- 21 km/h average speed.
- 260,000 daily trips.
- 35,000 tons of annual CO_2 reduction.

Furthermore, it must be stated that these benefits have been achieved using a relatively low level of investment, due to lower infrastructure costs as have other means of transport such as the Metro.

In terms of governance, it is remarkable that in an effort to avoid conflicts with the enterprises that ran the old system and also to maintain the number of jobs within the transport system, a mixed, private-public enterprise was formed and now operates the Metrobus lines. The government of the Distrito Federal financed the construction of the infrastructure (exclusive lines and stations), acquired the new busses, and trained employees. Vast communication campaigns have been implemented to inform and educate future passengers as well as private car drivers.

c) The metropolitan subway. Relevance and efficiency

Still, the most important transport system is the subway with approximately four million passengers per day. Long distance commuters use this mode of transport due to its outstanding speed and frequency. An evaluation of the sustainability of massive urban transport systems has to take into account efficiency in terms of the number of passengers, kilometers and most of all the consumed energy resources in relation to output indicators (see table 46).

TABLE 46
METRO MEXICO CITY: BASIC OPERATIVE DATA AND ENERGY EFFICIENCY

	2007	2008
Passengers (daily average)	3 707 120	3 987 648
Kilometers (daily average)	107 647	110 129
El. Energy consumed (kWh per year)	1 023 037	1 063 310
Electric energy/passenger	23.02	22.22
Electric Energy/km	791.97	804.60

Source: Authors' compilation, based on INEGI, 2009. Gobierno del Distrito Federal. Sistema de Transporte Colectivo Metro.

There are important differences in terms of passenger affluence on different Metro Lines. Lines 1, 2 and 3 together account for around 30% of the network distance but for more than 50% of the passengers. In contrast, lines number 4, 5, 6 and 7 register lower productivity values in terms of passengers/km (CMM, 2006: 30).

In Mexico there are two less important transport systems based on electric energy (Servicio de Transportes Eléctricos STE), including 15 lines of trolleybuses (454 km) and one suburban light train (13.5 km). These systems have suffered considerable reduction of their service in the last decades.

5. Protected natural areas, green areas and biodiversity

The protection of natural areas within or in the neighborhood of the Metropolitan Area of Mexico City is in a constant confrontation with the process of urban sprawl and illegal settlements. In spite of having declared large protected areas especially during the 1970s, they have been occupied in a large degree by informal settlements. This represents a risk for the equilibrium of climatic and ecological conditions, especially the conservation of forests with high importance for the local water cycles and protection against erosion (Mollá Ruiz-Gómez, 2006).

TABLE 47
NATURAL PROTECTED AREA IN THE METROPOLITAN ZONE (ZMVM)

Name	Locality	Area	Established (legally)
State Parks (PE)			
PE “Sierra Hermosa”	Tecamac (Edo. Mex.)	618 ha	1994
PE “Sierra de Tepotzotlan”	Huehuetoca and Tepotzotlan (Edo. Mex.)	9 768 ha	1977
PE “Cerro Gordo”	Temascalapa, Axapusco, San Martín de las Pirámides (Edo. Mex.)	2 915 ha	1977
PE “Sierra de Guadalupe”	Coacalco, Ecatepec, Tlalnepantla, Tultitlan (Edo. Mex.) and Gustavo A. Madero (D.F.)	5 307 ha	1976
PE “Sierra Patlachique”	Tepetlaoxtoc, Chiautla, Acolman, Teotihuacan, San Martin de las Pirámides (Edo. Mex.)	3 077 ha	1977
Ecological Conservation Zone			
Parque Urbano Bosque de Tlalpan			1997
Ejidos de Xochimilco y San Gregorio Atlapulco	Xochimilco	2657	1992
Sierra de Santa Catarina	Iztapalapa y Tláhuac	745 ha	2003
Parque Ecológico de la Mexico City	Tlalpan	728 ha	1989
Bosque de Las Lomas	Miguel Hidalgo	26 ha	1994
Tercera Sección Chapultepec	Miguel Hidalgo	227 ha	1992
National Parks (PN)			
PN “Desierto de los Leones”	Cuajimalpa and Alvaro Obregon (D.F.)	1 529 ha	1917
PN El Tepeyac	Gustavo A. Madero (D.F.)	1 500 ha	1937
PN “Cumbres del Ajusco”	Tlalpan (D.F.)	920 ha	1936
PN “Cerro de la Estrella”	Ïztapalapa (D.F.)	1 093 ha	1936
PN “Insurgente Miguel Hidalgo y Costilla”	Cuajimapla	336 ha	1936
PN Fuentes Brotantes de Tlalpan	Tlalpan (D.F.)	129 ha	1936
PN Lomas de Padierna	*Álvaro Obregón; Magdalena Contreras (D.F.)*	*670 ha*	*1938 (closed in 2002)*

Source: Gobierno del Estado de Mexico SMA, 2009; http://www.sma.df.gob.mx/corenader/conser/dsanp/conceptos /mapa-sen-17.html.

During the 1990s and in the new millennium this process has slowed down, partially due to legal standards and governmental action but it still presents an important challenge as pressure on land use is still high and within the city there is important resistance towards further densification (Mollá Ruiz-Gómez, 2006). In spite of improving legal frameworks the state of protected areas is still poor. As an extreme example may be mentioned the former National Park Lomas de Padierna, established 70 years ago, which presents a very low level of protection and suffered continuous degradation. The park

has been successively incorporated into the urbanized area and has currently only around 33 ha of area (aprox. 5% of the initially declared 670 ha). Furthermore, within the national park there are several informal human settlements where the total population is estimated to be around 15,000 inhabitants. There are also industrial activities.

The existing pressure from urbanization on reduced natural areas is very intense. The loss of the forests and agricultural areas in the surroundings of Mexico City is remarkable and their vulnerability is high. The governments of both the State of Mexico and the Federal District have put into effect various mechanisms in order to limit the growth of the urbanized area on natural areas, but this goal has still not been achieved. Currently the Federal District has defined Soil Conservation areas (both forest and agricultural) summing 87,310 ha. In addition to urban pressure, this area is vulnerable to fire and inadequate practices of agriculture and deforestation. There are many areas that are increasingly losing vegetation cover. Forests play a key role in mitigation of greenhouse gas emissions it is necessary to retrieve forests that serve as a carbon sink, which support also a better aquifer recharge and water supply of the metropolitan area.

TABLE 48
REFORESTATION AND FIRE DAMAGES IN THE METROPOLITAN ZONE (ZMVM)

	Reforestation		Fire damages
	2002 *(In ha)*	2004 *(In ha)*	2004 *(In ha)*
Mexico D.F.	4 443	4 933	1 687
Other Municipalities ZMVM	6 738	3 769	598
Total	11 185	8 702	2 284

Source: INEGI, 2005: table 2.4 and 2.5.

6. Conclusion Mexico: challenges, risks and obstacles

Based on the inputs of local expert the following main challenges, risks and obstacles of sustainable development of Mexico City have been identified.

Main challenges of sustainable development of Mexico City:

1) Development of an institutional framework for planning and management on a metropolitan level.
2) Development of environmental and river basin strategic planning in order to orient urban growth.
3) Incentives and subsidies for private investment in non-polluting technologies in order to create employment.
4) Strengthen the metropolitan public transport system.
5) Updating public policy for air quality within the metropolitan city.
6) Policy coordination for solid waste management.
7) Adaptation to the impacts of climate change – these will be discussed in a separate document.

Main risks:

1) Social fragmentation and high levels of precarious housing conditions (see table 5 and 20) as well as growing insecurity are considered main risk elements for sustainable urban development.
2) Environmental degradation in unurbanized areas of the basin due to the pressure of growth and the lack of planning of land use.
3) Negative impacts of water scarcity, air pollution and limited green and public spaces on public health and social inclusion.
4) Floods are already presenting a major risk; as climate change is alternating the frequency and intensity of rainfall and temperature it is likely that this risk will increasy.

Main obstacles:

1) Lack of public institution coordination between different governmental levels and low recognition of urban-regional context.
2) Low capacity of the national urban and regional planning system to cope with megacity growth and the scarcity of natural resources.
3) Lack of new fiscal instruments to promote investment and employment programs improving urban territorial planning.

E. City profile: Santiago de Chile

BOX 27
SUMMARY OF FINDINGS. SANTIAGO

- The Metropolitan Area of Santiago de Chile forms part of the Region Metropolitana nevertheless there is little regional planning, as the most powerful institutions are ministries on the national level and only some of the comunas (local level).
- Santiago is considered to be one of the cities with the highest levels of socio-spatial differentiation and the lowest level of poverty and extreme poverty. Decades of social housing policies have reduced informal housing to almost zero but at the same time have contributed to the segregated patterns.
- In terms of land use, Santiago is the metropolitan region with high level of growth and its urban structure presents one of the most important limitations of sustainable development.
- This structure challenges the transport system in terms of design and efficiency. Important investment projects during the last two decades have built up a vast automotive transport infrastructure that determines urban growth. The emblematic project of reforming the public transport system, Transantiago, has shown the lack of strategic relation between urban transport management and land use planning.
- Air pollution has been, and still is in some points, the most relevant environmental risk in the metropolitan area. It has been reduced significantly due to the application of legal and technical measures.

Source: Authors' compilation.

1. General data

Santiago de Chile maintains a very high level of primacy in the urban system of Chile, concentrating 40% of the national population. Since the 1950's, its territorial expansion has been significant and it began to accelerate in the mid 1980's due to economic growth and the deregulation of urban planning. The Metropolitan Area (AMS) consists of 34 localities (*Comunas*) which have a total area of 84,000 ha and a continuous urban area that is estimated to slightly exceed 60,000 hectares. In the last decade, the built up area has grown at a rate of 2.2% per year, thus exceeding the population growth rate of the AMS (1.26%).

TABLE 49
LOCALITIES OF SANTIAGO DE CHILE

Comuna	Population 2006	Urbanized Area km^2
Santiago	166 231	23.11
Cerrillos	68 768	13.50
Cerro Navia	141 920	9.07
Conchalí	118 527	11.03
El Bosque	172 233	14.28
Estación Central	114 339	13.88
Huechuraba	82 473	11.56
Independencia	55 176	7.45
La Cisterna	76 878	10.00
La Florida	393 856	37.85
La Granja	128 701	10.08
La Pintana	200 365	16.61
La Reina	96 116	17.69
Las Condes	270 789	38.18
Lo Barnechea	94 897	25.77
Lo Espejo	105 762	8.22
Lo Prado	107 845	6.59
Macul	103 388	12.84
Maipú	675 245	44.61
Ñuñoa	151 145	16.90
Pedro Aguirre Cerda	102 066	8.68
Peñalolén	238 294	23.77
Providencia	118 563	12.91
Pudahuel	239 392	28.82
Quilicura	176 341	22.10
Quinta Normal	93 935	11.90
Recoleta	133 538	13.55
Renca	133 983	13.93
San Joaquín	84 936	10.01
San Miguel	71 584	9.64
San Ramón	89 252	6.31

(Continued)

TABLE 49 (concluded)

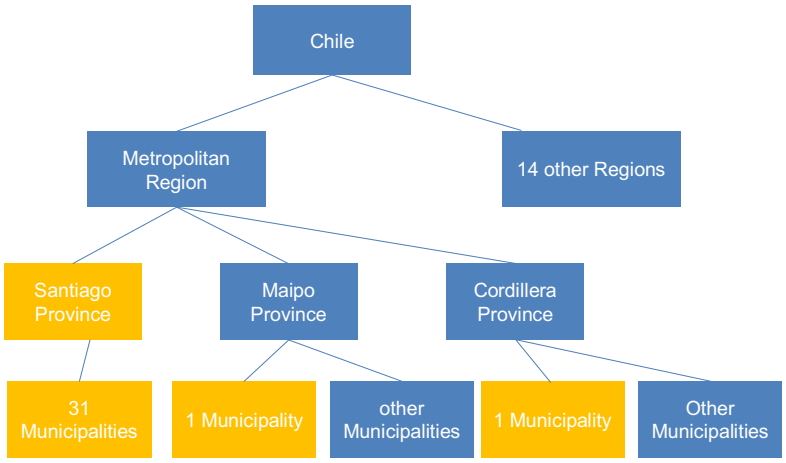
Comuna	Population 2006	Area km2
Vitacura	80 371	19.72
Puente Alto	629 861	39.56
San Bernardo	285 272	36.59
Total	5 802 042	842.34

Source: Mideplan CASEN, 2006; Galetovic / Poduje, 2006: 13.

The governance structure of the metropolitan region is dominated by two important levels: the most important and powerful national departments and the local (*comunas*) level; the institutions below national level are considered mostly weak (Sierra, 2006). There is criticism regarding the lack of appropriate regional planning institutions that are able to take into account the scale of metropolitan challenges (Arenas, 2008: 74).

In general, critical voices focus on an institutional "fragmentation", which causes sectorial policies that are not articulated and are in some cases contradictory (Arenas, 2008: 70), the reduction of public actors' influence, and an increasing importance of real estate actors in planning processes (Tokman, 2006; Poduje, 2006; Galetovic / Jordán, 2006).

FIGURE 19
REGION OF SANTIAGO DE CHILE: STRUCTURE OF TERRITORIAL GOVERNANCE

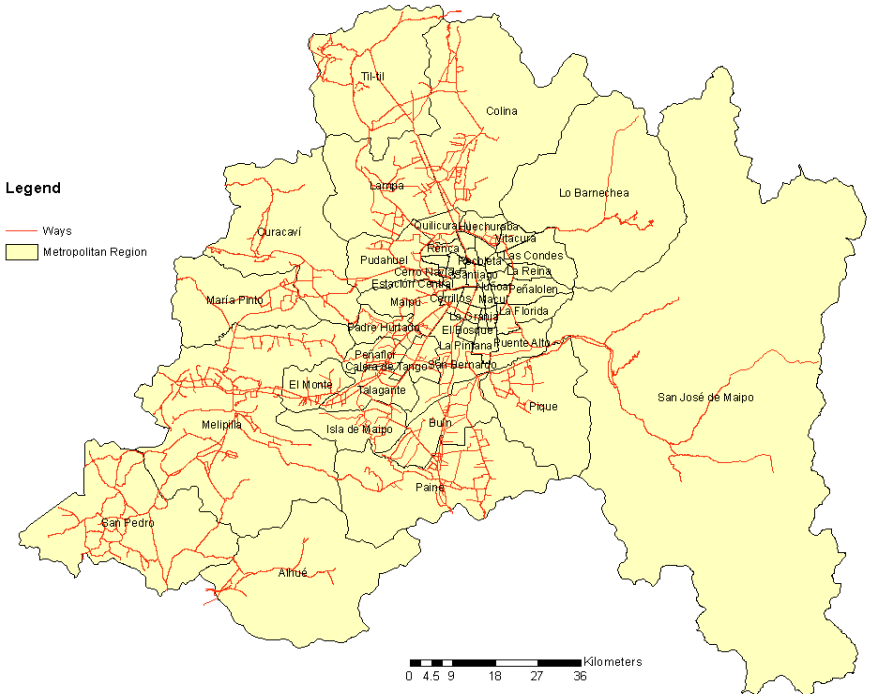


Source: Authors' compilation.

The possibility for local institutions (*comunas*) to participate in planning processes suffers from important limitations, which is an effect of the policies defined by national institutions. Most of all, the low income municipalities in the *Area Metropolitana* have a reduced territorial autonomy (Orellana / Fuentes, 2008: 125). Another important limitation is the fact that each of the municipalities has their own set of financial resources, an indicator which reflects an extremely divergent spatial structure with highly autonomous municipalities in the high income sector of the city, while among the municipalities with a middle and low income population only the *comuna* Santiago (City Center) has a high level of public income per capita (Orellana / Fuentes, 2008: 122,123).

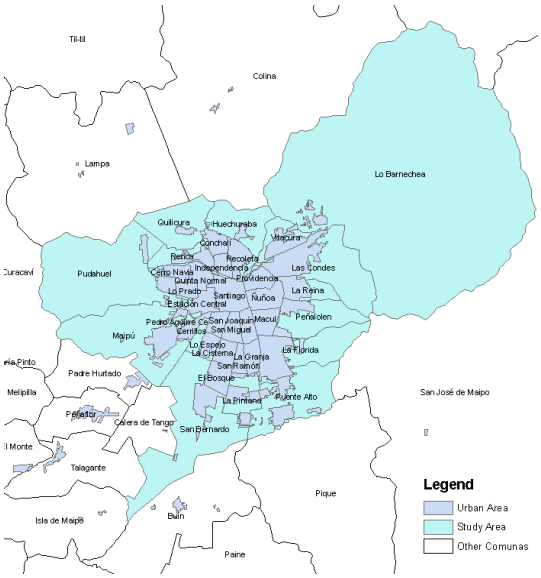
The maps show the different municipalities of the Metropolitan Region (map 8) and the Metropolitan Area Santiago (AMS) used in this document as a proxy to the urbanized area (map 9).

MAP 8
METROPOLITAN REGION SANTIAGO DE CHILE (RMS)



Source: own elaboration.
Note: The borders shown on this map do not imply endorsement by the United Nations.

MAP 9
METROPOLITAN AREA SANTIAGO DE CHILE (AMS)



Source: own elaboration.
Note: The borders shown on this map do not imply endorsement by the United Nations.

2. Socio-spatial segregation, social housing, peri-urban growth and the real estate market

Unlike many other megacities in Latin America, Santiago de Chile presents a highly formalized housing sector, with an extremely low percentage living in informal settlements (*campamentos*). Rapid growth of constructed area is highly segregated and with often large scale housing projects (Yañez / Rehner / Figueroa, 2010: 1). This excessive growth and the resulting socio-spatial segregation in Chile's capital has been discussed frequently (e.g. de Mattos, 2004; Rodriguez & Winchester, 2001; Meyer / Bähr, 2001; Salcedo / Torres, 2004).

Since the late 1970's, more than 200,000 social housing units have been constructed in the Metropolitan Region of Santiago (see table 50). In spite of quantitative successes in terms of reductions in the housing deficit and overcrowding, Chilean social housing policies have been frequently criticized because of their effect on segregation, loss of local identity, the continuous reproduction of exclusion, as well as deficient access to some services and bad connectivity (Hidalgo et al, 2008: 219). These consequences are –among other elements– product of the location of social housing projects in areas of low real estate price –as they are mostly large scale projects, they are located in suburban and periurban areas. The existing spontaneous and fast urbanization is faced with a lack of both infrastructure and urban planning. Furthermore, there are deficiencies in the road network, which is also linked to the deficit of public transportation. Citizens are exposed to serious health and environmental risks. Policies face two simultaneous challenges: to raise density in already developed and damaged areas, and (to) solve distance problems and traffic congestion.

TABLE 50
SOCIAL HOUSING UNITS CONSTRUCTED IN THE METROPOLITAN REGION OF SANTIAGO

Area	1978-1983	1984-1989	1990-1995	1996-2002	Total
Periurban Area	3 467	3 575	10 628	9 076	26 746
Metropolitan Area	37 908	68 804	55 268	37 369	199 349
Total	41 375	72 379	65 896	46 445	226 095

Source: Hidalgo et al., 2008: 226.

This peri-urban growth is a general tendency which refers not only to social housing. By two important and powerful acts of the military government (Decreto Supremo 420, 1979 and Decreto Ley 1536; 1980) the former urban limit, which has been a borderline for suburban growth, was abolished and hence it became possible to divide rural *parcelas* up to a minimum size of 0.5 ha, thereby allowing for a condition necessary for the urbanization of rural areas in the vicinity of the Metropolitan Area (Naranjo, 2008: 181). This mechanism has been extremely important in the processes induced in the northern part of the Metropolitan Region (Provincia Chacabuco); by the late 1990's more than 120.000 ha (almost 60% of the provinces area; especially in the *comuna* Colina) have made use of this new possibility (Naranjo, 2008: 190).

In 2007, the Metropolitan Region registered 122 so called campamentos where 5,599 families were living –which indicates an extremely low level of informality in international comparison. Most of these settlements are small (48) or medium sized (64) –only ten are considered large campamentos, with more than 100 families residing in them. The majority of households living in Santiago's informal settlements have access to electric energy (60%), while only 41% have access to piped water –their connection to the sewage water service system is almost zero (0.8%) (CIS Un Techo para Chile 2007: 57). In terms of localization and risk factors, these settlements are mostly located in the immediate neighborhood of urban highways or (highly contaminated) rivers and canals.

TABLE 51
SANTIAGO: GATED COMMUNITIES BY TYPE OF CONSTRUCTION

	Apartment		Gated Communities	
	Projects	Housing units	Projects	Housing units
Las Condes	509	28 912	78	1 353
Santiago	220	17 338	33	252
Providencia	317	10 472	3	12
Ñuñoa	168	6 428	11	87
San Miguel	75	3 629	4	73
Vitacura	106	3 584	2	17
Maipú	12	3 232	4	285
Lo Barnechea	87	2 492	12	1 278
La Florida	19	1 385	39	575
La Reina	11	1 116	207	1 655
Peñalolén	0	0	57	3 526
Puente Alto	1	78	11	3 135
San Bernardo	0	0	14	1 278
Huechuraba	2	704	37	974
Quilicura	1	90	2	882
Estación Central	3	266	5	705
Others	*29*	*3 506*	*244*	*1 455*
Total	1 560	83 232	763	17 542

Source: Borsdorf / Hidalgo, 2004: 32.

In Chile there is an important presence of governmental institutions and programs, as well as NGO's working in the informal settlements, to establish permanent housing solutions for all families living informal settlements by the end of 2010. The most important institutions and programs are: Chile Solidario (Central Government) and to a lesser extent Chile Barrio (Central Government); Un Techo Para Chile (NGO) and activities of the respective Municipalities (CIS Un Techo para Chile, 2007: 18). In general, these settlements have a high degree of self-organization, mostly in the form of neighborhood committees (CIS Un Techo para Chile, 2007: 22).

3. Demographic change, education and social security

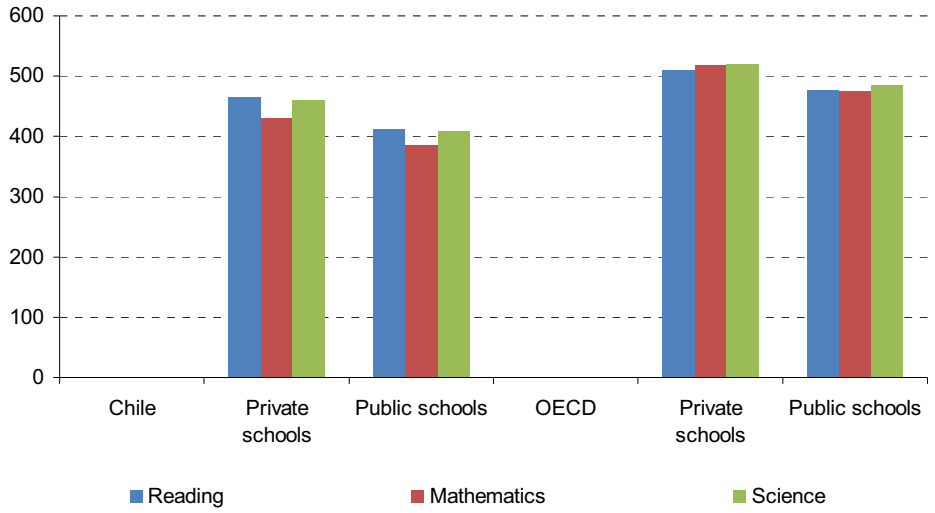
a) Education

Generally speaking, Chile is characterized by a highly segregated education system: In the PISA test conducted in 2006, students from private schools in Chile obtained results averaging approx. 12-13% higher than public schools –in OECD Member states these differences also exist, but they are lower (7-9%) (OECD PISA data base). As a result, only ¼ of the students in public universities come from public schools, in spite of their higher participation in matriculation (2/3 of the graduated students of secondary education) (Küpfer NN).

A clear dominance of private schools can be observed with regard to the number of students in the Metropolitan Region of Santiago – the highest number of students are attending private schools receiving public funds. These schools are very frequently observed in middle class and lower middle class neighbourhoods.

FIGURE 20
RESULTS OF PISA TEST OF CHILEAN AND OECD MEMBER STATE SCHOOLS

(Average scores obtained by area)



Source: Authors' compilation, based on OECD database, 2008.

TABLE 52
SANTIAGO: NUMBER OF STUDENTS BY OWNERSHIP TYPE OF SCHOOLS

School type	Number of students	Percent
Municipal	469 589	32.5
Private with subvention	736 941	51.0
Private	151 843	10.5
Others	87 707	6.1
Total	1 446 080	100.0

Source: Authors' compilation, based on Mideplan CASEN, 2006.

TABLE 53
SANTIAGO: STUDENTS EVALUATION BY TYPE OF EDUCATION

	Primary education (4th year)				Secondary education (2nd year)			
	Mathematics		Spanish		Mathematics		Spanish	
	Points	Difference	Points	Difference	Points	Difference	Points	Difference
Private	299		300		326		306	
Private, gov. support	256	-14.4	261	-13.0	249	-23.6	253	-17.3
Municipal	228	-23.7	236	-21.3	257	-21.2	260	-15.0
Corp. Municipal	230	-23.1	237	-21.0	249	-23.6	252	-17.6
Corp. Private	242	-19.1	253	-15.7	247	-24.2	248	-19.0

Source: Authors' compilation, based on www.simce.cl.

The socioeconomic polarization of Santiago is reflected and reproduced by the quality of the education system and the proficiency level of students. The results of the official measure for student's

knowledge levels, SIMCE, are shown in table 53. There is a notorious gap existing even at the level of primary education (cuarto básico; ten year old students) showing that the average level of students in private schools is 23.7% (mathematics) and 21.3% (language) higher than in public schools (Municipal). There is a considerable, though lower difference between private schools (fully paid) and private schools which receive a government subsidy –many of which have lately been established in lower middle class sectors.

Analyzing the same group of students (primary education) by their household socioeconomic situation also shows a clear gap between the highest and the lowest group, with similar differences as shown before (28.0% and 25.2% respectively).

TABLE 54
SANTIAGO: STUDENTS EVALUATION BY SOCIO-ECONOMIC SITUATION OF THEIR PARENTS

	Primary education (4th year)				Secondary education (2nd year)			
	Mathematics		Spanish		Mathematics		Spanish	
	points	difference	points	difference	points	difference	points	difference
High	300		301		327		307	
Medium High	272	-9.3	276	-8.3	308	-5.8	294	-4.2
Medium	247	-17.7	254	-15.6	265	-19.0	266	-13.4
Medium-Low	222	-26.0	231	-23.3	227	-30.6	237	-22.8
Low	216	-28.0	225	-25.2	209	-36.1	223	-27.4

Source: Authors' compilation, based on www.simce.cl.

The gap is in part growing through time. Comparing the gap in primary education with that of secondary education (*segundo medio*, 16 year old students) it is evident that some of the disparities increase dramatically, reaching more than a 36% difference in mathematics between the highest and lowest income group. Only the upper middle class is showing a slight improvement, reaching levels that are closer to the highest income group in secondary education than they are in primary education. Regarding the different types of school ownership, one must highlight the growth of the gap between private schools and private schools with subsidies.

This difference is an outstanding challenge for educational policy as it limits possibilities for social mobility and reproduces social differences as well as spatial segregation.

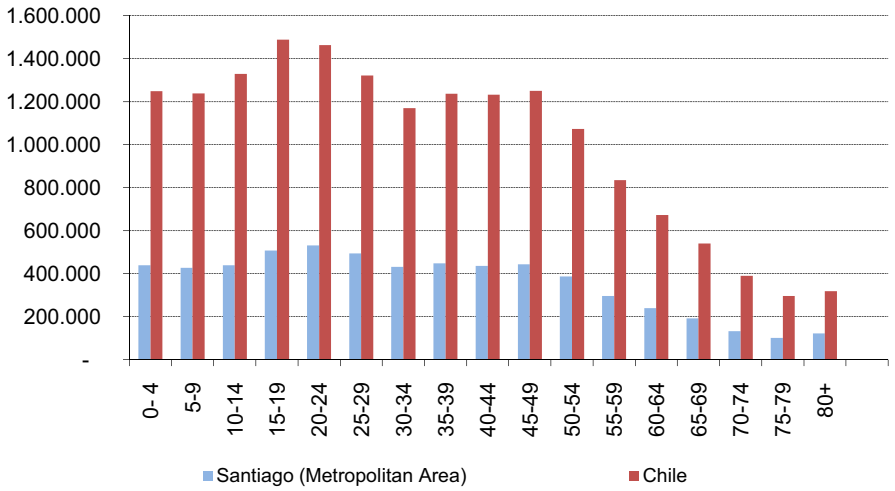
b) Demographic structure

One of the most important future challenges on a macro-level for Latin American societies is their changing age structure, growing dependency index and an ageing society. The concept of *demographic bonus* refers to demographics favorable for socio-economic development due to a high percentage of the population in economically active age groups (CELADE / UNFPA, 2005: 12). In Santiago, this is an issue of higher relevance in comparison to other cases. Chile will be one of the first Latin American countries to reach the end of the bonus (by 2015; while Brazil, Colombia and Mexico will reach this point around the year 2020 and Argentina and Peru later on; CELADE UNFPA, 2005: 14).

Nowadays, the Metropolitan Region of Santiago presents less demographic dependency than Chile on a national scale, exhibiting a very similar percentage of elderly people (see table 55). Nevertheless the low fertility rate in the Metropolitan Region (1.78; compared to Chile 1.93; INE 2008: 19) indicates the ageing of society in Santiago. The changing structure of Santiago's population by age groups is reflected in the projection for 2010 and 2020 (see table 56) –with increasing participation of

elderly people and very high percentage of economically active age groups due to the sinking number of children younger than 14 years.

FIGURE 21
POPULATION OF CHILE AND METROPOLITAN AREA SANTIAGO BY AGE GROUPS, 2010



Source: Authors' compilation, based on INE, 2010.

TABLE 55
REGION SANTIAGO AND CHILE: INDICATORS OF AGEING SOCIETY, 2005

	Elderly people (60 and more)		Demographic Dependency
	(per 100 aged < 15)	*(per 100 inhabitants)*	
RM Santiago	46.2	11.2	55.1
Chile	46.1	11.5	57.2

Source: INE, 2008: 16.

TABLE 56
METROPOLITAN AREA OF SANTIAGO: PROJECTION OF THE POPULATION BY AGE STRUCTURE, 2000-2020

	2000	In percentages	2010	In percentages	2020	In percentages
0 -14 years	1 460 790	26.6	1 302 861	21.5	1 280 720	19.7
15-29 years	1 362 533	24.8	1 531 875	25.3	1 431 966	22.0
30-64 years	2 290 005	41.6	2 679 408	44.2	3 033 383	46.6
65 years and more	391 131	7.1	545 933	9.0	767 209	11.8
Total	5 504 459		6 060 077		6 513 278	

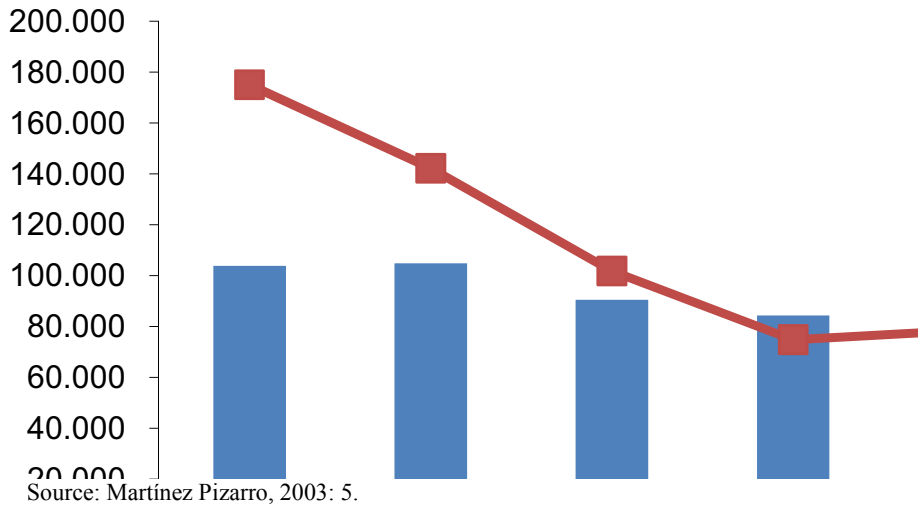
Source: Authors' compilation, based on INE, 2010.

In the central area, one can observe a clear tendency of a concentration of young people, especially professionals with university degrees in some specific barrios located in the *comunas* of Santiago and Providencia.

c) Migration on national scale

As Figure 22 shows, Chile presents a very low level of international immigration. In Buenos Aires for instance, during the 1990's around 10% of the city's population were foreigners (Saltillo, 2000: 433). Therefore, one might have doubts regarding the quantitative relevance of this immigration in the local labor market (Martínez Pizarro, 2003: 53). Nevertheless, the most important part of immigrants (2/3) resides in the Metropolitan Region Santiago.

FIGURE 22
CHILE: IMMIGRATION AND FOREIGN POPULATION
(In absolute number and in percentages)



Source: Martínez Pizarro, 2003: 5.

Furthermore it has to be mentioned that between 1990 and 1996 almost 28.000 Chileans returned to their country and between 1997 and 2002 more than 42.000 Chilean citizens came back from foreign countries (INE, 2005: 22).

TABLE 57
CHILE: IMMIGRANTS BY COUNTRY OF ORIGIN, 2002

Country of origin	Number	Percentages of total	Masculinity index	Growth 1992-2002 (In percentages)	Children (below 15 years) *(As percentages of total)*
Argentina	48 176	26.12	100	39 99	31.12
Perú	37 860	20.52	66	394 97	9.00
Bolivia	10 919	5.92	84	41 27	9.96
Ecuador	9 393	5.09	83	314 34	19.54
Spain	9 084	4.92	107	-7 77	8.42
USA	7 753	4.20	123	24 07	27.29
Brazil	6 895	3.74	85	49 57	22.87
Germany	5 473	2.97	95	-2 32	10.03
Venezuela	4 338	2.35	94	80 98	23.33
Colombia	4 095	2.22	82	145 80	13.77
Total	184 464	100.0	0.91	60 97	18.44

Source: Martínez Pizarro, 2003: 32.

Recent immigration trends show a growing tendency of immigration from Peru and Ecuador. The Peruvian immigration group in particular presents a very low Masculinity Index (0.66 in 2002). The masculinity indix represents the numeric relation between men and women among the respective population, being 100 the value of equilibrium. Low numbers indicate a predominance of women, usually caused by specific labor market segments, as domestic workers.

c) Migration on national scale

Inmigrants from Peru and Ecuador show an even higher concentration in the Metropolitan Region than most of the other groups of immigrants (Martínez Pizarro, 2003: 38); almost 80% of Peruvian women living in Chile in 2002 were registered in Santiago.

The Metropolitan Area of Santiago has a slightly negative migration balance regarding national migration, and registers a higher education of immigrants than emigrants (during 1997-2002) which is remarkable as other metropolitan areas like Mexico City, Rio de Janeiro and Sao Paulo show a slightly higher educational level of emigrants (CELADE / UNFPA, 2005: 45).

This phenomenon is directly related to Peruvian women's occupation as domestic workers in the high-income sector of the Metropolitan Region. As table 58 shows, apart from the center, the highest number of Peruvian women is registered in the three highest income *comunas* of Santiago (Lo Barnechea, Las Condes and Vitacura), showing extreme low indices of masculinity.

TABLE 58
SANTIAGO: PERUVIAN IMMIGRANTS BY COMUNA OF RESIDENCE, 2002

	Men	Women	Total	Index of masculinity
Santiago	2 933	2 917	5 850	100.5
Las Condes	535	2 561	3 096	20.9
Recoleta	736	730	1 466	100.8
Vitacura	150	1 275	1 425	11.8
Estación Central	679	675	1 354	100.6
Independencia	646	642	1 288	100.6
Providencia	387	857	1 244	45.2
Lo Barnechea	147	1 031	1 178	14.3
La Florida	498	614	1 112	81.1
Peñalolén	426	683	1 109	62.4
Others	3 650	4 967	8 617	73.5
Total	10 787	16 952	27 739	63.6

Source: Martínez Pizarro, 2003: 40.

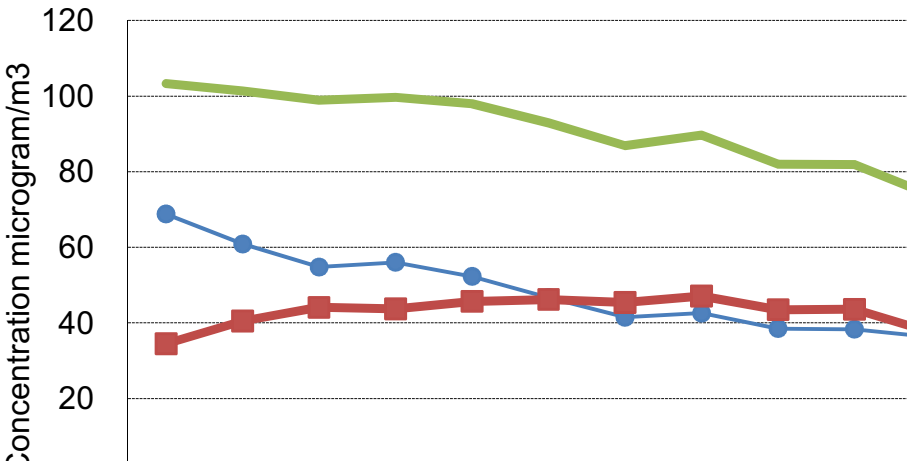
4. Air pollution

At the beginning of the 1990's, Santiago de Chile was considered to be one of the most contaminated cities in the world, a condition which seriously limits citizens' quality of life. Still in 1996, the Metropolitan Area of Santiago was regarded as saturated by concentrations of CO, PM and O3 (Jacobi, 2003: 84). The high level of these contaminants' concentration has not only been generated by high emissions due to low standards and a lack of efficiency; it has also been caused by the specific climatic and geomorphologic conditions of the Central Valley, namely the Santiago Basin where surrounding mountains obstacles to ventilation and leads to frequent events of thermal inversion. Therefore, contaminants are accumulated in the long-term, causing severe health risks primarily for the respiratory system, but also causing some dermatological diseases. A statistical relationship between the concentration of contaminants and the number of respiratory problems has been shown; a correlation has

also been shown with regard to rates of mortality caused by respiratory diseases especially of children and elderly people (PNUMA, 2003: 80).

The highest health risk is provoked by concentrations of PM 2.5 and its combination with CO. This contaminant in particular has been shown to be correlated to the number of deaths caused by respiratory diseases (PNUMA 2003: 81). As Figure 23 shows, during 1990's, the concentration of PM2.5 and PM10 was reduced substantially.

FIGURE 23
SANTIAGO DE CHILE: REDUCTION OF PM10 AND PM2.5 CONCENTRATIONS, 1989-2004



Source: Authors' compilation, based on CONAMA, 2007: 12.

Nowadays, the most important sources of pollution in Santiago come from the transport sector especially PM 10, PM 2.5, CO and NOx emissions (Jacobi, 2003: 84).

a) Governance

Since 1994, important advances have been made in strengthening institutions and mechanisms of regulation (technical revision of cars and industries) and in restricting transit. Nevertheless, these instruments have not (at least not in the beginning) changed consumption and mobility patterns (Jacobi, 2003: 84). The most important responsible institution is the National Commission of Environment (CONAMA) on a national level, which is complemented by the regional commissions of this organism.

TABLE 59
SANTIAGO: REDUCING AIR POLLUTION MAIN LONG TERM CHANGES

	Mid 1990's	2004
Buses	14 000 of vehicles: medium age 15 years	7 500 of vehicles: medium age five years
Diesel	5 000 ppm S	50 ppm S
Gasoline	with lead	Only unleaded
Private cars	0% with catalytic converter	75% with catalytic converter
Industry	Main energy sources: wood; carbon, petroleum	Natural Gas, Diesel

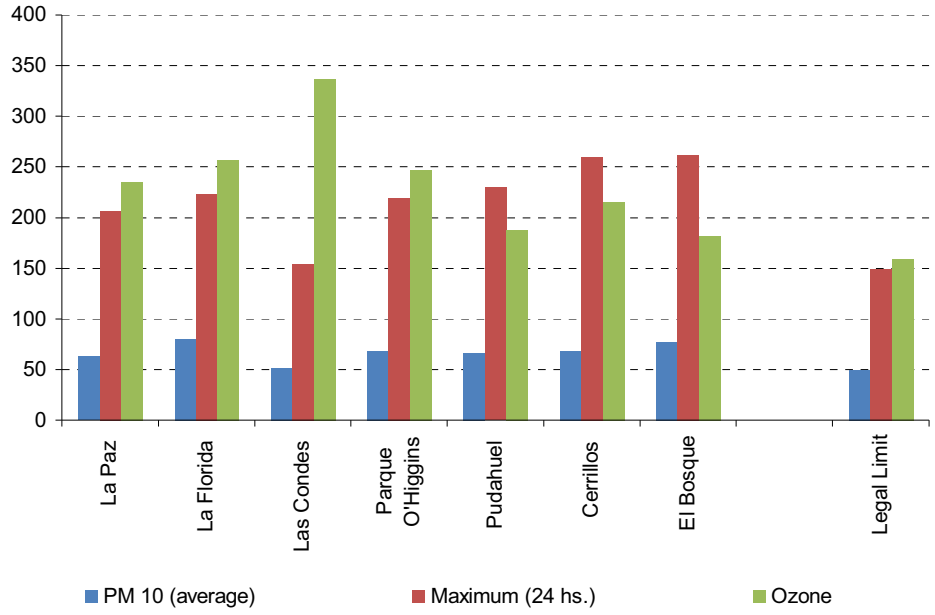
Source: CONAMA, 2007: 15.

Different plans have been elaborated.

- Plan for Athmospheric Depollution of the Metropolitan Region (PDARM).
- "*Santiago limpio*" took measures to prohibit the circulation of vehicles (rotating system on a daily base according to the registration number between March and December) and technical revision of automobiles without catalytic technology among others.

FIGURE 24
SANTIAGO: PM10 AND OZONE CONCENTRATION, 2004

(In microgram/m^3)



Source: own presentation based on CONAMA, 2007: 17/21.

In spite of the undeniable advances in the last 15-20 years in terms of reducing air pollution, this environmental issue still is a major risk for the metropolitan region, population's health and quality of life. As Figure 24 shows, the distance to achieving the goal, which is defined by a legal limit of PM10 concentration, is still high in most of the cases. Only the environmental evaluation and measuring station in Las Condes (high income sector, close to the mountains) was close to achieving these goals in 2004 but not for Ozone. The situation in Santiago is positive in general with regard to the other main air contaminants.

TABLE 60
SANTIAGO: CONCENTRATION OF MAIN CONTAMINANTS, 2004

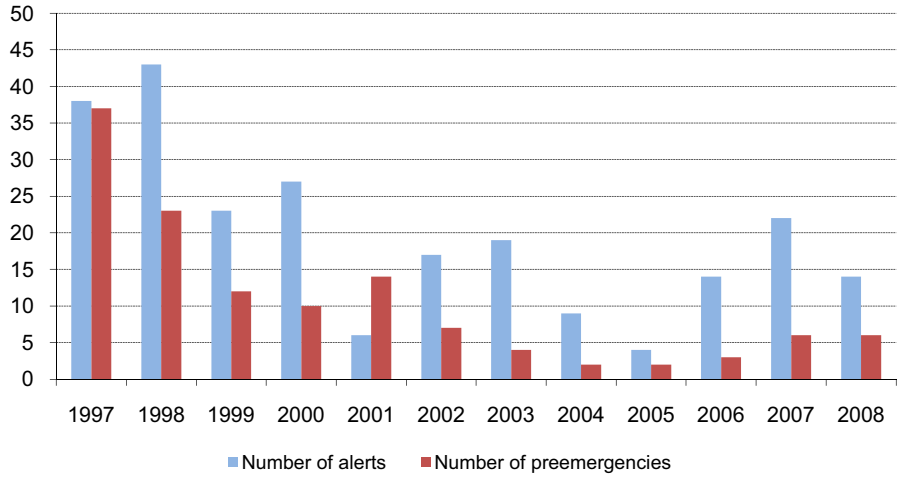
	CO		SO2		NO2
	Max. a hour average *(mg/m3)*	Max. eight hour average *(mg/m3)*	Annual average *(mg/m3)*	Daily maximum	Annual average *(microg/m3*
Santiago	22.1	18.0	9	55	39.0
Legal Limit	40.0	10.0	80	365	100.0

Source: CONAMA, 2007: 23-26.

For the last two decades, people from Santiago have been badly affected by pollution: it is a health hazard and a present threat to the sustainable development of the region. Every case of air pollution in Santiago is recorded by CONAMA through monitoring and evaluation stations of air quality. Since 1988, they have been able to follow the city's air pollutant behavior. ICAP (air quality index per particulate pollutants) is the most used index to declare critical pollution events. These monitoring stations measure air pollutant components in Santiago: CO, SO2, O3, Nox/NO2, MP2.5 and MP10.

Historical records of the PM10 based official alert mechanism show a clear downward trend with slight increase in alerts and preemergences in 2006 and 2007. Since 2000, records indicate no single air pollutant emergence (CONAMA 2008: 6).

FIGURE 25
SANTIAGO: ENVIRONMENTAL ALERT AND PRE-EMERGENCIES, 2003-2007



Source: own elaboration based on CONAMA 2008: 6.

5. Energy policies and energy efficiency

Chile doesn't have relevant fossil fuel resources, depending entirely on the energy supply imports; this is an issue which has provoked dissonances during the last several years. Energy policies seek to ensure an energy base for economic growth. Priority is given to this goal above environmental sustainability (PNUD & CNE, 2005: 3).

The above shown reductions of pollution levels are partially caused by changes in the energy mix. During the 1990's, there were significant reductions of the use of wood as an energy source, replaced by natural gas (not only in households, but also in the industrial sector) this had an important positive impact on the environment (PNUMA, 2003: 29).

In spite of existing energetic problems, the use of electric energy in the Metropolitan region has shown a rapid growth of 7.58% per year, reaching a total consumption of 15.135 GWh (INE, 2006b: 2). The regional electric energy supply system Sistema Interconectado Central (SIC) has an installed capacity of 8,288 MW of which 3593 MW are related to thermal generation and 4,695 MW to hydraulic generation of electric energy (INE, 2006b: 3).

The most important institutions in Chilean energy sector are national (CNE & GTZ, 2009):

- Comisión Nacional de Energía (CNE).
- Superintendencia de Electricidad y Combustibles (SEC).
- Comisión Nacional del Medio Ambiente (CONAMA).
- Panel de Expertos de la Ley General de Servicios Eléctricos.
- Centros de Despacho Económico de Carga (CDEC).

In the last several years, the Clean Development Mechanism supported alternative energy sources. Some energy related CDM projects in the Metropolitan Region are:

- Loma Los Colorados Landfill Gas Recovery Project, located in Montenegro (Municipio Til-Til) 65 km north of the city of Santiago, aims to reduce CH4 emissions by 160,000 tons between 2006 and 2012 which is equivalent to a CO2 reduction of 3.37 millions tons (Ospina, 2005: 8).
- Metrogas Methane Recovery from Pipeline Rehabilitation Project. Metrogas distributes gas through two different networks; by means of this project, the old network will be rehabilitated aiming to reduce losses from 5% to 0.5%. The planned accumulated reduction of Methane (CH4) is 7,143 tons (corresponds to an approximate reduction of 150,000 tons of CO2) during a time period of ten years (Ospina, 2005: 9).
- Metrogas Package Cogeneration Project. The cogeneration system permits to reduce the consumption of electric energy used for heating purposes. Green house gas reduction is estimated to reach 115,000 tons of CO2 equivalents within ten years (Ospina, 2005: 14).

6. Urban transport and urban design

The growth of the metropolitan area of Santiago is still high and is driven among other reasons by the favorable economic development of the last 20 years (with the exception of a short recession in the context of the Asian crisis). The considerable spatial expansion has caused an important demand for transport infrastructure, which has been responded to by the central government with large infrastructure investments, partially as concessions (in the case of urban highways). Another emblematic project has been the considerable enlargement of the subway system (see map 12). At the same time, the improved infrastructure itself is a driving force for further spatial growth. The specific pattern of urban growth, the large-scale real estate projects in suburban and periurban areas as well as a general suburbanization trend have pushed the use of private cars.

The existence of low housing density in Santiago has been questioned when comparing the city with other megacities (Martínez Lemoine, 2006). There is an unquestionable demand for daily long distance commuting trips within the metropolitan area caused by high functional and socio-economic segregation in (partially) large, low density areas. Consequently, a coherent development strategy of urban planning and the public transport system is a key component of sustainable development in Santiago. The subway system presents only a partial solution. There is complete lack of suburban/regional trains, and an old local bus transport system in a highly fragmented, low standard and ecologically deficient state (Diaz et al, 2006) needed a complete renovation, that led to the implementation of the integrated System **Transantiago**. It included a total revision of all bus lines, new trajectories, construction of new terminals, partially exclusive bus lanes and further improvement of road infrastructure, implementation of a different and completely integrated tariff system, permitting interchanges between different transport modes.

MAP 10
SANTIAGO: THE METRO NETWORK

Source: http://www.metrosantiago.cl/

Since its implementation in February 2007, Transantiago has suffered a series of deficiencies: design issues, management models and operative insufficiencies. During the first few months of the radical implementation of the new system, was severely criticized, most of all due to the poor travel conditions caused by extreme overcrowding and long waiting times in some sectors.

The management model applied, with participation of different private enterprises has complicated the management and coordination of Transantiago (Figueroa/Orellana, 2007). While in Bogota, the public investment in Transmilenio was about 40%, the public funds received by the Transantiago Project only summed 10% (Figueroa, 2007: 169).

a) Sustainability and the public transport system

In spite of the problems faced by the Transantiago System it is designed to be an important pillar of sustainable development in the metropolitan area of Santiago, due to its contribution to reduce air pollution. Concrete goals, evaluations and measures refer to pollution issues (Transantiago, 2009):

- Reduction of atmospheric pollution (especially PM and NOx) and Green House Gas emission, basically CO_2.
- Environmental evaluation of different design and technical solutions e.g. alternative energy sources (gas, hybrid technology and electric).
- Use of filter technologies on older busses.
- Compensation mechanisms for emission reduction.
- Noise control.
- Consideration of environmental issues in the bidding process.
- Environmental management procedures.

In a joint project of the Chilean Government and GEF (Global Environmental Facility) "*Proyecto de calidad del aire y transporte sustentable para Santiago,*" sustainability measures for the transport system are further implemented (Transantiago, 2009b):

- Strengthen the use of bicycles by constructing exclusive bicycle lanes in the comunas of Santiago, Ñuñoa and Providencia.
- Improve the service of Centro de Control y Certification Vehicular (3CV).
- Monitoring of social and environmental effects of the new bus system.
- Evaluation of further use of the withdrawn buses.
- Evaluation of possibilities to integrate policies of land use and transport.

Through the Transantiago system important improvements have been achieved (indicated by Transantiago):

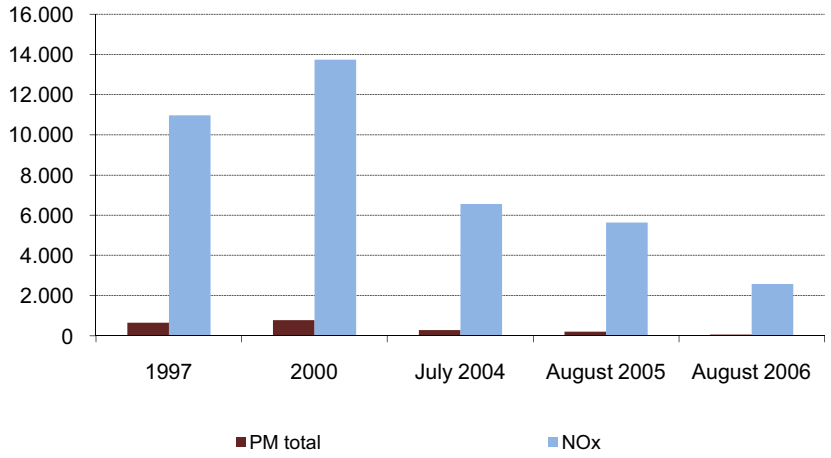
- Reducing the bus fleet (from 7,000 to 4,700 approximately).
- Using (partially) busses which are fulfilling the Euro I and Euro II emission standards.
- Using improved fuels (most of all with reduced sulfur content).
- Implementation of exclusive lanes (only on a few routes).
- Expansion of the subway network.
- Reduction of travel times and total kilometers.

There have been clear indicators of rapid growth of the subway service in Santiago throughout the last several years. The total length of the network has doubled within eight years starting from 40.3 km in 2000 and reaching 85.1 km in 2007. This has been achieved through important expansions of existing lines and the incorporation of a new one (Line 4). As this new infrastructure is oriented most of all towards the connection of middle class and lower middle class sectors of the city, it is a factor of integration. The number of metro stations went from 52 in 2000 to 92 in 2007. The average number of passengers on a working day grew from 741,966 in 2000 to 1,996,077 in 2007.

b) Energy efficiency

The operative data from the Metro (table 61), show a constant trend between 2000 and 2003, a growth phase 2004-2006 (with the implementation of a new line) and rapid growth in 2007, which corresponds to the initiation of Transantiago (February 2007). The number of passengers has almost doubled within a year period. This effect is causing a substantial improvement of energy efficiency, although the amount of electric energy consumption is rapidly growing. The efficiency indicator based on served kilometers is constant over time with very low variation.

FIGURE 26
METRO OF SANTIAGO DE CHILE: EMISSIONS, 1997-2006
(In metric tons.)



Source: own elaboration based on http://www.transantiago.cl/imagenes/ppda.jpg.

TABLE 61
METRO OF SANTIAGO: BASIC OPERATIVE DATA

	2000	2001	2002	2003	2004	2005	2006	2007
Number of passengers *(million)*	208	203	199	203	232	267	331	601
Service *(1000 kilometers)*	38 413	40 051	39 009	40 009	45 097	51 344	71 181	94 197
Energy used *(MWh)*	131 793	136 457	131 447	131 227	150 261	178 201	246 856	321 961
Energy Efficiency *(kWh/passenger)*	0.63	0.67	0.66	0.65	0.65	0.67	0.74	0.54
Energy Efficiency *(kWh/km)*	3.43	3.41	3.37	3.20	3.33	3.47	3.47	3.42

Source: Authors' compilation, based on data from Metro S.A., 2008.

7. Conclusion Santiago: challenges, risks and obstacles

Based on the inputs of local expert the following main challenges, risks and obstacles of sustainable development of Santiago de Chile have been identified.

Main challenges of sustainable development:

1) Institutional Development. The management of environmental issues is still suffering from institutional fragmentation and sectoral approaches as well as the interference of different levels of government.
2) Controlled Densification. The urbanized area of Santiago de Chile is still rapidly growing, thereby generating new needs for transport while also consuming agricultural areas and green spaces, which offer high quality environmental services.
3) Globalization. Rapid population growth, liberalization and privatization are related to the general globalization trend. There is a need for a metropolitan regional strategy on how to confront globalization's risks and the use of its benefits.
4) Protection of natural resources. Conservation of the natural resources' carrying capacity of the river basin is a condition for climate change adaptation strategies and programs in the coming years.
5) Urban planning and public spaces. Public spaces are considered as necessary elements of social inclusion and also –if they are constituted as protected green areas– of great importance for ecological cycles. That must be integrated into urban planning.

Main risks:

1) Air pollution.
2) Urban expansion.
3) Social cohesion.
4) Criminality (with very low homicide rate but important public discourse of criminality and high victimization level referring to all kind of crimes, see table 18).

Main obstacles:

1) Centralized governance structure.
2) Sectoral approach to planning and investment.
3) Lack of regional planning institutions.
4) Urban network infrastructure development limits land use and urban planning.

E. City profile: Sao Paulo

BOX 28
SUMMARY OF FINDINGS. SAO PAULO

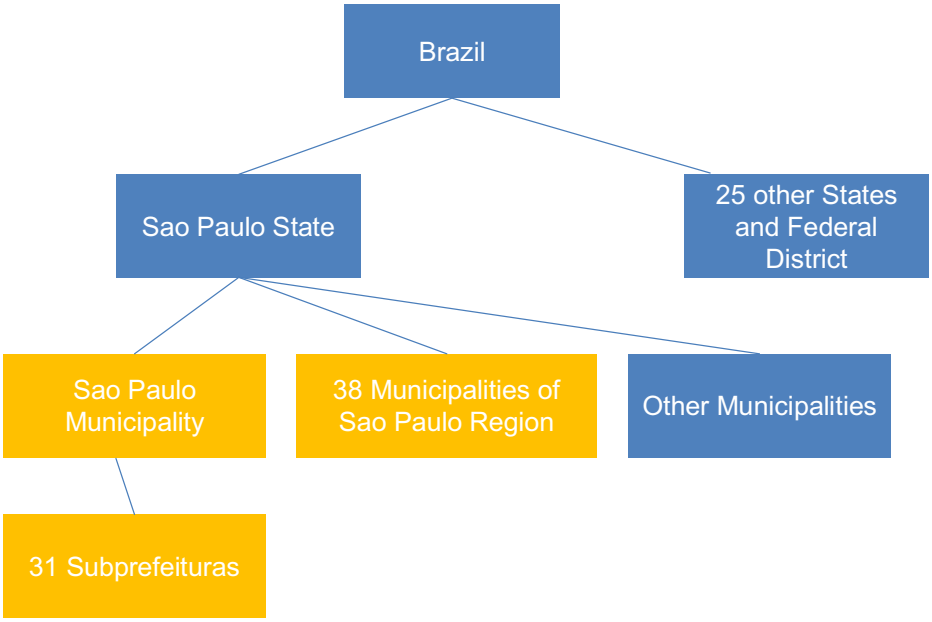
- Spatial and morphological characteristics of the city determine risks: erosion and deforestation; wetlands pollution, water and ground water provision, growing water treatment costs.
- Socio-spatial segregation and the size of the metropolitan area is related to different levels of access to education, health, public assistance and community centers.
- Sao Paulo is one of the cities with the highest levels of slum population and inner city degradation which has been addressed during the last couple of decades by public policies on a local and regional scale.
- Violence and delincuency is the highest of all six of the analyzed cities. There are strong differences between different areas of the city related to socio-spatial differentiation. Low "presence" of state institutions in some of the poorer neighbourhoods generates conditions for violence and delincuency growth.
- Sao Paulo presents the highest level of private car participation in modal split of daily commuting. It's related to the unsufficient public transport system.
- In relation to the previous point, automotive transportation is the main source of air pollution. Low priorities for environmental policies have limited the impacts of measures and actions looking for air pollution reduction.

Source: Authors' compilation.

1. General data

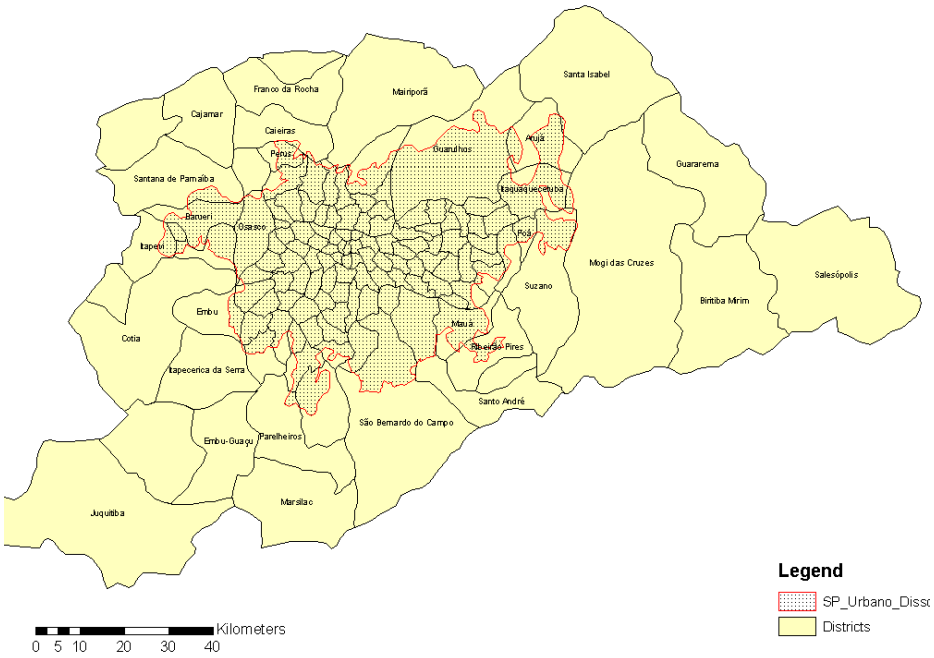
Brazil has 26 Federal States and a Federal District, each one with an elected Governor (José Serra in Sao Paulo) and a Vice Governor (Alberto Goldman). Each state is formed by *Prefeituras* governed by prefectos elected by popular vote, which are divided into *Subprefeituras*. The Metropolitan Region of Sao Paulo (RMSP) is formed by the *Municipo* of Sao Paulo and 39 further Municipios that are regarded as part of the continuously urbanized area. Regarding the specific territorial management issues, there are other regional definitions such as the *Unidades Hidrográficas de Gerenciamento de Recursos Hídricos* –UGRHI, where the UGRHI 6 Alto Tietê includes an area which is slightly larger than the RMSP (CETESB, 208: 85).

FIGURE 27
SAO PAULO: ADMINSITRATIVE STRUCTURE



Source: Authors' compilation.

MAP 11
THE METROPOLITAN REGION SAO PAULO: ADMINISTRATIVE UNITS



Source: own elaboration.
Note: The borders shown on this map do not imply endorsement by the United Nations.

TABLE 62
LOCALITIES OF SAO PAULO (MUNICIPALITY)

Subprefeitura	Population	Area (km^2)
Aricanduva/Formosa/Carrão	273 029	22
Butantã	409 951	56
Campo Limpo	554 109	37
Capela do Socorro	618 213	133
Casa Verde/Cachoeirinha	332 654	27
Cidade Ademar	404 204	31
Cidade Tiradentes	207 237	15
Ermelino Matarazzo	217 785	16
Freguesia/Brasilândia	426 378	32
Guaianases	281 098	18
Ipiranga	447 340	38
Itaim Paulista	391 224	22
Itaquera	524 847	55
Jabaquara	225 860	14
Jaçanã/Tremembé	272 572	65
Lapa	275 005	41
M'Boi Mirim	536 566	64
Mooca	312 838	36
Parelheiros	125 218	361
Penha	494 670	43
Perús	120 282	57
Pinheiros	271 403	32
Pirituba	417 855	55
Santana/Tucuruvi	332 866	36
Santo Amaro	223 373	38
Sao Mateus	413 551	45
Sao Miguel	409 471	25
Sé	383 925	27
Vila Maria/Vila Guilherme	318 671	27
Vila Mariana	315 051	27
Vila Prudente/Sapopemba	548 330	33
Total	11 085 577	1 528

Sources: Prefeitura de Sao Paulo, 2009; PNUMA, 2003.

Since 2002, the city of Sao Paulo (*municipio*) has been divided into 31 districts (*subprefeituras*) in order to decentralize some aspects of public administration. Local mayors of subprefeituras are not elected but named by the elected Mayor of the *Municipio* Sao Paulo. The Metropolitan Region Sao Paulo was defined by law in 1973 and it is comprised of, apart from Sao Paulo, 38 other municipios.

TABLE 63
SAO PAULO: THE METROPOLITAN REGION

Municipio	Área (km2)[a]	Population 2001[b]	Population 2007[a]
Arujá	97	59 185	72 713
Barueri	64	208 281	252 748
Biritiba-Mirim	317	24 653	27 483
Caieiras	96	71 221	81 163
Cajamar	128	50 761	58 403
Carapicuíba	35	344 596	379 566
Cotia	324	148 987	172 823
Diadema	31	357 064	386 779
Embu	70	207 663	237 318
Embu-Guaçu	155	59 916	59 083
Ferraz de Vasconcelos	30	142 377	168 897
Francisco Morato	49	133 738	146 634
Franco da Rocha	134	108 122	121 451
Guararema	271	21 904	24 854
Guarulhos	318	1 072 717	1 236 192
Itapevi	91	129 685	193 686
Itapecerica da Serra	151	162 433	148 728
Itaquaquecetuba	82	272 942	334 914
Jandira	18	91 807	103 531
Juquitiba	522	26 459	27 777
Mairiporã	321	60 111	71 754
Mauá	62	363 392	402 643
Mogi das Cruzes	714	330 241	362 991
Osasco	65	652 593	701 012
Pirapora do Bom Jesus	108	12 395	14 370
Poá	17	95 801	104 904
Ribeirão Pires	99	104 508	107 046
Rio Grande da Serra	37	37 091	39 270
Salesópolis	426	14 357	15 157
Santa Isabel	361	43 740	44 817
Santana de Parnaíba	184	74 828	100 236
Santo André	175	649 331	667 891
Sao Bernardo do Campo	406	703 177	781 390
Sao Caetano do Sul	15	140 159	144 857
Sao Lourenço da Serra	187	12 199	16 121
Sao Paulo	1523	10 435 546	10 886 518
Suzano	206	228 690	268 777
Taboão da Serra	20	209 215	219 200
Vargem Grande Paulista	34	32 683	40 200

Source: Authors' compilation, based on official data.

[a] IBGE, "Portal Cidades". http://www.ibge.gov.br/cidadesat/topwindow.htm?1. Download on June 12th, 2009.
[b] MEIO URBANO. http://barreiros.arq.br/. Download on June 12th, 2009.

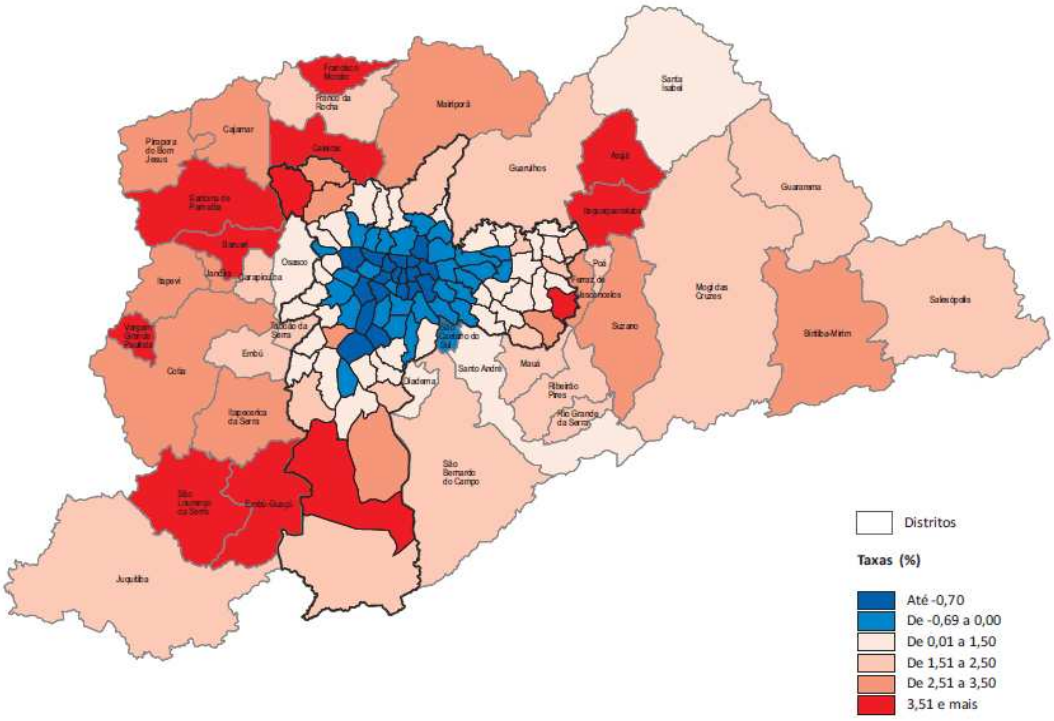
During the last 20 years, urban growth of the agglomeration has taken place at great distance to the central area. Even the growth of the Municipio de Sao Paulo is completely concentrated in the *subprefeituras* on the southern and eastern border of the *municipio*, while the historical centre shows a decreasing population number (see map 14).

2. Informal housing and revitalization programs

The most important challenge of the metropolitan area of Sao Paulo is related to disparities and their spatial manifestation. Sao Paulo is the dominant economic center of South America with a high average income, investment and added value generated in the area; however, it simultaneously presents high poverty indices and socio-spatial disparities of importance in each field of governance.

The most notable spatial expression of poverty is the existence of numerous informal low income neighborhoods (Slums) in two main forms: *Favelas* and *Cortiços* (Fix et al, 2003: 9).

MAP 12
SAO PAULO REGION: POPULATION GROWTH, 1991-2005



Source: SEMPLA, 2007: 14.

Note: The borders shown on this map do not imply endorsement by the United Nations.

Cortiços are low priced housing areas, in general one or more multistory buildings located in the inner city. They are characterized as *"precarious rented housing, rented rooms in subdivided inner-city tenement buildings"* (UN Habitat, 2003: 75). One can distinguish between two different types of *cortiços*: i) *cortiços adaptados*: which refer to buildings which were originally used as commercial units or offices and have since been subdivided due to a process of decay of the neighborhood or the building itself. The second type ii) *cortiços concebidos* were constructed to offer rented housing at the lowest price, and lowest quality standard. They surged at the end of the 19th century until 1930, being the main alternative for members of the working class living in the center of Sao Paulo. *Cortiços* grew

significantly during the early industrial end economic expansion of Sao Paulo, offering housing space for the migrants attracted by the explosive growth of the city.

According to official definitions used by the municipality, the *cortices* present totally or partially the following characteristics:

a) "made up of one or more buildings constructed on an urban lot;

b) subdivided into several rented, sub-let or ceded on any ground whatsoever;

c) several functions performed in the same room;

d) common access and use of non-constructed spaces and sanitary installations;

e) in general, precarious circulation and infrastructure;

f) overcrowding of persons" (UN Habitat, 2003: 75).

Especially in the 1970's and 1980's, suburban low cost housing (*favelas*) surged and replaced *cortiços* due to a considerable reduction of housing space in the center related to a changing retail market (Schor / Botin, 1997: 152). Their explosive growth (reaching almost 20% of the population at the end of the century) is associated with the end of the persistent economic growth which had been dominating the region of Sao Paulo. The consolidation of Sao Paulo as the major industrial center of Brazil, which took place in the decades 1930 and 1950, showed first a slight decrease of population growth rates starting in the 1960's; and in the 1980's a rapidly decreasing population growth was registered related to the economic crisis (Nobre, 2008: 248). In contrast to the situation of the *cortiços, favelas* are predominately uni-familiar housing and are usually owned by the dwellers. Nevertheless, the lots are mostly invaded and therefore the owners of the building do not have any security of tenure (Fix et al, 2003: 9).

According to the municipality's official definition "Favelas are agglomerations of dwellings with reduced dimensions, built with inadequate materials (old wood, tin, cans and even cardboard) distributed irregularly in lots almost always lacking urban and social services and equipment, forming a complex social, economic, sanitary, educational and urban order" (UN Habitat, 2003: 75). The Brazilian statistical Institute IBGE considers *favelas* to be a *"subnormal agglomeration"* with a minimum of 50 housing units in the condition of informality (UN Habitat, 2003: 75). Dense occupation, a lack of basic services and planning, and their frequent location in peripheral areas are characteristic elements.

While historically the *favelas* have been concentrated in the southern part of the city, during the 1990's a concentration in the northern part of Sao Paulo was observed (e.g. in Cantareira). The spatial and morphological characteristics of these new and peripheral occupations generate important risks (Pasternak, 2003: 330):

- Erosion and deforestation.
- Pollution of the wetlands in the southern part of the city (due to the lack of a sewage system).
- Reducing the possibility of using ground water and the water collection subsystem (billings).
- Growing water treatment costs.
- Location of *favelas* near the main water bodies and in high slopes.

In terms of the construction materials and physical conditions of *favela* housing, it is necessary to note a significant change: during the 1970's and 1980's most of the *favelas* were still constructed in wood, during the nineties this changed towards brick construction which is clearly dominating nowadays.

During the 1980ies the number of *favelas* grew rapidly while the population growth in Sao Paulo was reduced. Afterwards the favela's growth was slightly reduced during the 1990's, but number of people living in slums still shows a fast growing tendency. These numbers have been questioned, due to studies of the FIPE (Fundaçao Instituto de Pesquisa Econômica; Universidade de Sao Paulo) which

estimates a total number of 1,901,884 for 1993 (Moraes, 2008: 87). A summary of critical arguments regarding the methodology of the Brazilian Statistical Institute IGBE are discussed by Pasternak (2003).

TABLE 64
SAO PAULO: FAVELAS: NUMBER, HOUSEHOLDS AND POPULATION

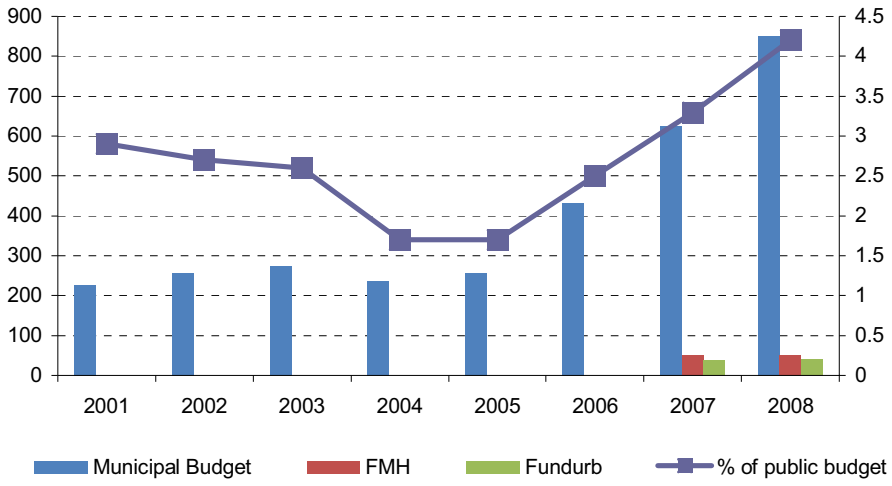
	1980	1991	2000	1991 CEM	2000 CEM
Favelas	188	629	612	1 975	2 018
Households	71 258	146 891	225 133	196 389	286 954
Population	335 334	711 050	932 628	891 673	1 160 590
Percentage of Population (Municipio)	4.07	7.46	8.92		

Source: Moraes, 2008: 87; Amaral de Sampaio / Perreira, 2003.

As shown before, one of the main characteristics of the *favelas* is their high population density –hich showed slight growth during the 1990's: from 360 to 380 inhabitants/hectare average density. According to the estimation of CEM, the area covered by favelas also showed an important growth from 2,471 a 3,062 ha.

The improvements of basic service accessibility, infrastructure, legalization and tenure security are therefore considered to be some of the most important issues regarding the implementation of sustainable development strategies for these neighborhoods. These have been considered by public programs of improvement of the *favelas* (*Programa de Urbanizaçao de Favelas*) and legalization of the illegally occupied territories (Nobre, 2005). Municipal rehabilitation programs like the formalization program *Regularizaçao HABI* are designed explicitly to cope with the tenure security issue. They integrate i) legal formalization of occupied land, which means the registration of the slots in the official real estate register, ii) administrative regulation by defining urbanization and construction norms in urban development by designing solutions for management of natural risk, creating urban infrastructure and building up further housing units. This two stage plan includes 268 different small scale areas (a total of 112 ha) where some 65,000 families live (http://portal.prefeitura.sp.gov.br).

FIGURE 28
SAO PAULO: PUBLIC FUNDING OF LOW INCOME HOUSING, 2001-2008
(In millions of Reais – left scale; in percentages – right scale)



Source: Authors' compilation, based on portal.prefeitura.sp.gov.br.

Nevertheless, an important initiative of displacement also exists, regarding the *favelas* that present major risk factors such as: high pollution of soils, very poor transport infrastructure, location at the riversides, areas of high landslip risk, and on ecological protection areas. Since 2005, nine *favelas* have been removed, corresponding to a population of 3,870 families.

There are also some programs directed at *cortices,* for example two central, historical *subprefeituras* (Mooca and Sé) are forcing the owners of the *cortiço* to adapt their buildings to official legislation defining norms of habitability of *cortiços* (*Lei Moura*). Up to now, this program has brought benefits for 4,121 families living in *cortiços.*

The most important actors in terms of social housing are: the public enterprise COHAB/SP (Companhia Metropolitana de Habitacao de Sao Paulo, created in 1965) which is in charge of implementing the municipality's housing policies and the CDHU (Companhia de Desenvolvimiento Habitacional e Urbano, created in 1949). Within five decades, together they have built up almost 290,000 housing units, mostly located in the periphery (Nobre, 2008: 252). In spite of this high number, these public policy units have never been able to cover the huge housing deficit in the low income sector. In the last several years, rapidly growing funds have been dedicated to social and other low income housing programs (see Figure 28).

a) Spatial patterns

As the location patterns –namely those of the *favelas*– show a concentration in suburban areas and the periphery of the Sao Paulo Region, one can observe a clear income disparity between central areas and the outskirts areas. There are central high income areas located in the *subprefeituras* Lapa, Pinheiros, Vila Mariana, while the historical central areas Sé and Mooca for instance have lower average income levels and a certain importance of the presence of *cortiços*.

TABLE 65
SAO PAULO (MUNICIPIO): LOCATION OF FAVELAS

	1991	1996	2000
Central	211	0	0
Interior	6 156	2 920	4 557
Intermediar	74 053	63 219	94 610
Exterior	230 416	217 361	220 365
Periferico	398 223	463 822	611 096
Total	711 050	749 318	932 628

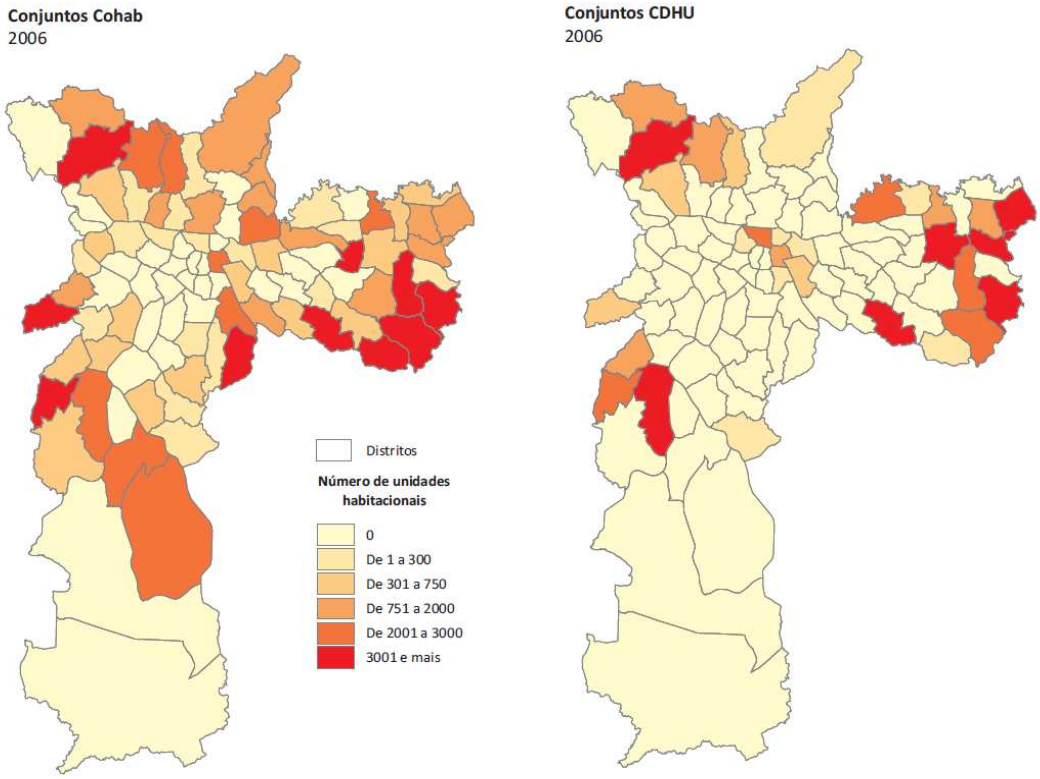
Source: Moraes, 2008.

The so called "lost decades" did not only produce a certain *favelization* of Sao Paulo (Deak, 2005: 422) but also a partial deterioration of the historic city center during the 1980's and 1990's which has continued in the context of accelerating globalization. The new functions related to the growing economic importance of Sao Paulo as a global city and financial center of South America are concentrated mainly in new spaces (e.g. on the river banks of Rio Pinheros) and transformed some specific areas of the traditional city, such as the Avenida Paulista. The historic city center has partially degraded.

During the government of Mayor Marta Suplicy (PT), a public policy program was initiated towards a renovation of the historical city center. This program includes privately financed initiatives (Bank of Boston) to remobilize the value of central buildings for leisure and cultural activities, as well as initiatives of public policy and local citizens initiatives (Deak, 2005: 423). One of the main issues of this program was the rehabilitation of the central zone, looking for improvements in the living conditions of low income dwellers of these areas. In terms of actions, the main pillars were the renovation of decayed

zones and the improvement of infrastructure and services. Therefore, the program is related mainly to social housing policies (Montaner / Muxi, 2008; Prefeitura de Sao Paulo / URB AL, 2009).

MAP 13
SAO PAULO: LOCALIZATION OF SOCIAL HOUSING, 2006



Source: Sempla, 2007

Note: The borders shown on this map do not imply endorsement by the United Nations.

The program of renovation and transformation of the central area (PROCENTRO) is implemented by the current Gilberto Kasab administration and financed substantially manner (some 100 million of the total of 164 million US$) by the Inter-American Development Bank. The program is executed by EMURB (Municipal Urban Development Corporation) and aims to improve certain central areas mostly by the action of public-private partnerships. There is contradictory empirical evidence on the results of these programs. In the case of Faria Lima, it has been stated that its urban planning process has been guided more by real estate interests than by social needs (Maricato / Fereira, 2002) and it is argued that there is a private appropriation of benefits, while disregarding social and environmental effects (Bogus, 2008). Others (Sandroni / Bidermann, 2005) analyze the economic effects in terms of real estate price levels, tax collection and the gentrification process.

In terms of social housing and urban renovation, the current Strategic Development Plan (PDE Plano Director Estratégico) defines four types of zones of special social interest (ZEIS Zonas Especiais de Interesse Social; Nobre, 2008: 254):

- ZEIS 1: favelas and other precarious housing areas.
- ZEIS 2: not adequately used or abandoned areas; land fit to be urbanized.
- ZEIS 3: central area lots which are not used adequately.
- ZEIS 4: areas located in protection zones.

Type ZEIS three areas, in particular, present high potential for the construction of low cost and social housing as they present positive conditions due to their location –most of them are abandoned industrial and storage areas.

There are studies on the relationship between segregation and spatial zoning. Nery Junior (2005) demonstrates that zoning was used as an instrument of high income classes in the southwestern sector of the city.

3. Delinquency and violence

As shown in the chapter on social coherence (table 18) Sao Paulo presents the highest level of delinquency. The presence of gang violence, partial anarchy and a breakdown of law and order has been identified as the most important social challenges concerning governance in Sao Paulo (UN Habitat, 2007: 94). Nevertheless, one can observe important differences within the city: homicide rates vary between one per 100,000 inhabitants (in the exclusive *subprefeitura* Jardim Paulista) and up to 116 in Guaianazes and 141 in Diadema respectively. Reasons for these differences are the specific spatial structures of activities which frequently produce violence (like local drug markets) as well as policy strategies and even differences in cultural and social values (UN Habitat, 2007: 55). Crime increased along with the rapid pace of urbanization, which has been overwhelming civil institutions and their governance capacity. This is considered a main cause of the existence of "*hundreds of illegal subdivisions that sprang up, where standards of due process of law are low or non-existent and levels of retributive justice and vigilantism are high*" (UN Habitat, 2007: 69). Nevertheless, the same UN Program states that positive examples such as the case study of Diadema shows successes which may be achieved by coordinated and sustained political action and effective partnerships (UN Habitat, 2007: 95). There have been positive experiences based on participative planning processes and an integrative approach, including social issues with a special participation of the youth (Petrella / Vanderschueren, 2003: 228 discuss the example of San André). At the end of the 1990's, the model of *communitarian police* was implemented due to an institutional crisis and the need for military police reform, which despite numerous problems of implementation, has been regarded at least as a positive element of communication between police and civil society (de Mesquita Neto; Frühling, 2003). On the other hand, central areas also suffer from a high criminality level, although of a different kind, with crimes such as robbery predominate. The high income and middle class areas show an important frequency of crimes against property, leading to more protection measures and exclusion.

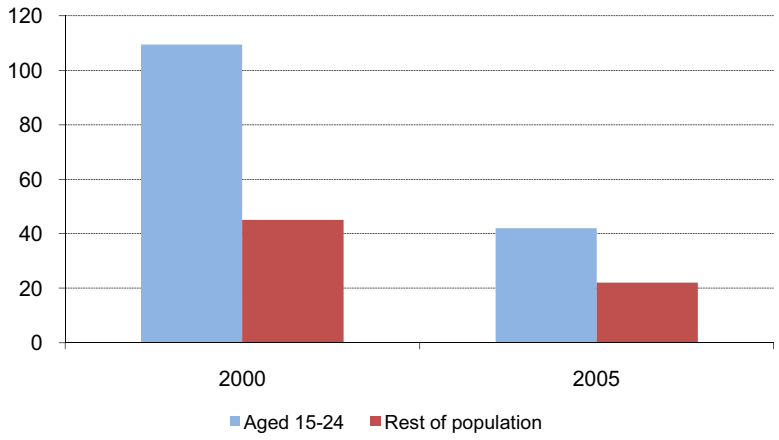
Due to the socio-spatial segregation and the lack of services in vast areas, a large number of citizens of Sao Paulo are living with scarce access to education, public assistance, and community centers among others. This is part of a complex system producing social exclusion. In terms of the labor market in 2000 16.5% of the young people between 15 and 19 years were neither working nor studying. In the in the northern, southern and eastern periphery there can be observed values up to 25% and even 35% (Sempla, 2007: 36).

Although the concentration of low income areas in inner cities are considered as a typical tendency for Latin American metropolis the spatial concentration of the *favelas* in Sao Paulo is even more evident (Salama, 2008). One of the main consequences of this situation is the reduced possibility of social mobility, which is considered to be one of the main factors of violence and delinquency –hence leading to a vicious cycle. The result of this may be considered as a vicious circle, where due to an insufficient functionality of civil institutions, especially in the mentioned zones, one can observe a predominance of parallel organizations linked to drug dealing. Nevertheless, there is an important element of police violence –it has been estimated that during 2007, the police of Sao Paulo killed about 500 citizens (in the same year, police in the USA are estimated to have killed approximately 200 citizens in the whole country). Most of all, the extremely high homicide rate, which is produced mainly by confrontations of different gangs, affects especially young men and is even reflected in the overall life expectancy statistics, as one of the causes which has produced a reduction of the average life expectancy by 2.48 years (Salama, 2008). The aforementioned vicious circle has resulted in a loss of trust in public institutions, in police, and in justice; a loss of cohesion within society has occurred and is considered to

be a main cause of the correlation between growing differences and violence. Of importance are the activities of different groups of organized crime –regarded by government officials in the context of prison mutiny during 2001, as *mafia* structures directing real armies (Manrique, 2006:5). Many of these confrontations also follow the precarious conditions of many Sao Paulo's prisons.

FIGURE 29
SAO PAULO: HOMICIDE RATES BY AGE GROUP, 2000 AND 2005

(number per 100.000 inhabitants)



Source: Authors' compilation, based on Sempla, 2007: 58.

4. Urban transport infrastructure

As shown in chapter III.C.2, Sao Paulo is one of the cities most affected by traffic congestion, causing high economic loss. The number of registered cars is still rapidly increasing (+37% since 2003) and the daily commuting trips are extremely long (1:40 hours) (Vincent, 2008: 5). Sao Paulo is the metropolitan city in the presented sample with the highest level of private cars' participation in the modal split of daily commuting. This predominance of individual automobile transport is partially a result of the insufficient public transport system.

Facing this challenge the urban rapid train system (Metro) is of growing importance. Its construction started in 1968 and in 1992 was founded the Company CPTM (Companhia Paulista Metropolitan Trains) receiving the network of 261 km of lines from the former public organization. CPTM operates today six lines and a total of 89 stations. The total numbers seem relatively low when compared to the subway system of Mexico City or even Santiago de Chile which presents almost the same number of passengers in spite of having only some 50% of Sao Paulo's population.

In recent years the Metro system carried on significant investments programs in building and reconstructing ten stations and modernizing seven, in improving accessibility, constructing 7.5 km of additional lines and purchasing new trains among other projects. Also new signaling systems and traffic control are being implemented – this makes it possible to decrease the interval between trains and improve service. Furthermore new projects are supporting combined transport means; for example new bike racks have been constructed. Another initiative is a program allowing the transport of bicycles on trains, on weekends and holidays.

MAP 14
SAO PAULO: URBAN RAIL TRANSPORT NETWORK

Legenda

1 Linha 1 · Azul	METRÔ	
2 Linha 2 · Verde	METRÔ	
3 Linha 3 · Vermelha	METRÔ	
4 Linha 4 · Amarela (de segunda a sexta-feira, das 8h às 15h)	VIAQUATRO	
5 Linha 5 · Lilás	METRÔ	
7 Linha 7 · Rubi	CPTM	
8 Linha 8 · Diamante	CPTM	
9 Linha 9 · Esmeralda	CPTM	
10 Linha 10 · Turquesa	CPTM	
11 Linha 11 · Coral	CPTM	
11 Linha 11 · Coral - Expresso Leste	CPTM	
12 Linha 12 · Safira	CPTM	
Linha de Ônibus Especial	CPTM	
Expresso Turístico (consulte os dias e horários de funcionamento)	CPTM	
Ponte ORCA - gratuita	EMTU	
Ponte ORCA - tarifada	EMTU	

Corredor Metropolitano de Ônibus ABD	EMTU
Terminal Metropolitano de Ônibus	
Estação	
Estação de Integração - gratuita	
Estação de Integração - tarifada	
Estações com elevador	
Paraciclos	
Bicicletário	
Bicicletário com empréstimo de bicicleta	
E FÁCIL Estacionamento Integrado Metrô, CPTM e Ônibus	

Informações

CPTM	0800 055 0121
EMTU	0800 724 0555
METRÔ	0800 770 7722
VIAQUATRO	0800 770 7100

Source: http://www.metro.sp.gov.br/redes/mapa.pdf.

The implementation of a Bus Rapid Transport System (*Corredores de ônibus*) in Sao Paulo has not yet shown the expected results, as the buses do not generally have an exclusive lane and therefore the average speed is very low (only some 50% of the expected BRT value). An emblematic project is the implementation of the Tiradentes Expressway, connecting the city center with the largest social housing area (Biderman, 2008). Since 2004, Sao Paulo citizens have a transport card (*bilhete único*) which permits mobilization within three hours (4 different trips) without an additional charge; however, there is an extra cover in the case of transferring to the metro or to the urban train (operated by CPTM). Despite having reduced transportation costs, low income households still face problems related to the transportation issue (Bógus / Pasternak, 2009).

The Secretaria de Estado dos Transportes Metropolitanos has implemented the Integrated Urban Transport Plan PITU 2020, which puts emphasis on the construction of infrastructure for the BRT system, implementing bus lines on exclusive and segregated corridors (Governo do Estado do Sao Paulo, Secretaria dos Transportes Metropolitanas, 2009).

5. Air pollution

Air pollution is in Sao Paulo mainly produced by mobile sources, especially transport vehicles and is considered one of the main challenges for the citizen`s health and sustainable urban development. Due to the high level of pollution in the metropolitan region, research on health impacts and related costs has been carried out (Miraglia et al 2005; Lin et al. 2004).

As discussed above in the cases of Santiago de Chile and Mexico City, Sao Paulo is also challenged by thermal inversion events which contribute significantly to the concentration of air contaminants. These situations occur especially between May and September (highest level June-August). As the Figure 30 shows, a seasonal peak matches with the highest levels of some of the main air contaminants during the year, which reach their highest level during winter months (e.g. PM10 and CO; Jacobi, 2003: 80).

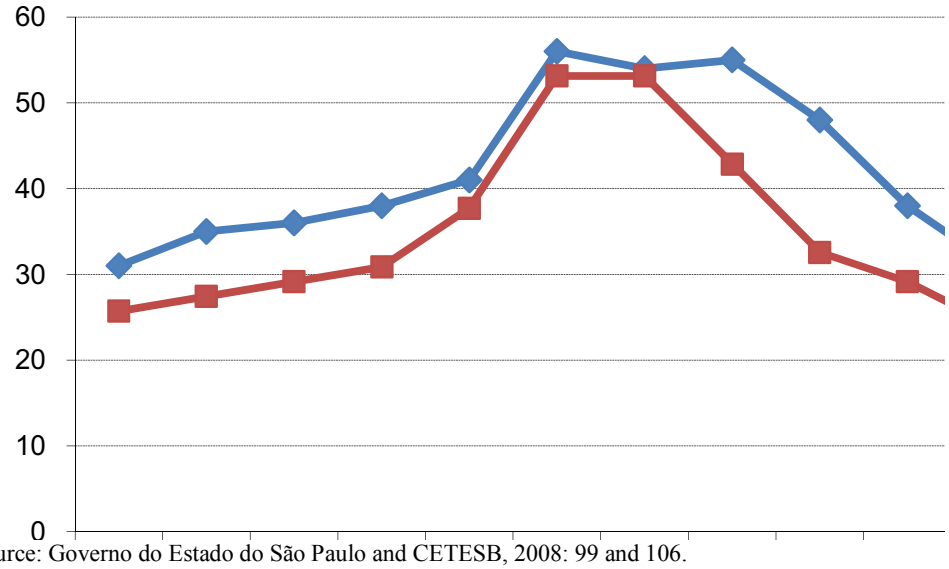
The particulate matter and carbon monoxide emissions are caused most of all by automobiles (around 90%; Jacobi, 2003: 80). During the current decade (since 2000) the level of CO pollution has generally maintained the same level which is almost 100% above the level recommended by the WHO.

In terms of **Governance** there are several institutions that are involved in air pollution issues. The most important institutions are:

- Gobierno de Estado de Sao Paulo.
- Compañía de Tecnología de Saneamiento Ambiental (CETESB). Since 2002, CETESB has been in charge of the implementation of the vehicular inspection program, which is responsible for the revision of around 4,6 million automobiles, registered in Sao Paulo (CETESB, 2009c).
- Consejo del Medio Ambiente del Estado de Sao Paulo (CONSEMA).
- Consejo de Desarrollo Sostenible (CADES) del Municipio de Sao Paulo.

FIGURE 30
SAO PAULO: PM10 AND CO CONCENTRATION BY MONTH

(average 2003-2007; in microgram/m^3)



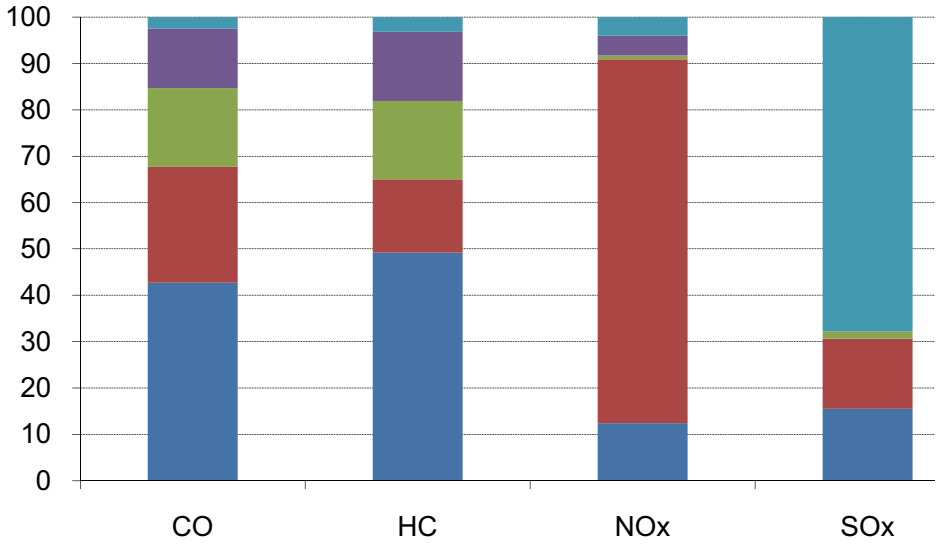
Source: Governo do Estado do São Paulo and CETESB, 2008: 99 and 106.

Political measures aimed at improving air quality have been implemented since 1979, when the first measures were taken to reduce emission levels of industrial production plants. In the same year, the Programa Nacional de Alcohol (Proálcool) was started which nevertheless was not able to cope with the high pollution levels (Lacasaña-Navarro, 1999: 205). As automotive transportation is considered to be the main source of pollution (see Figure 31), the program PROCONVE (Programa de Control de la Contaminación del Aire por Vehículos Automotores) was established in the 1980's and was subsequently complemented by federal resolutions (Lacasaña-Navarro, 1999: 206). The program was developed by the Consejo Nacional del Medio Ambiente (CONAMA) and defined the legal emission limits of motor vehicles as well as the certification of engines (starting in 1988). PROCONVE has been promoting the use of improved engine technologies such as injection and catalytic converters; this can be summarized as focusing on technological aspects, thereby putting a strong emphasis on the aspects of fuel quality and engine characteristics. Nevertheless, other programs that look for an improved conscience have been established, such as the orientation and education program *humo negro*, (black smoke) a campaign oriented towards the owners and drivers of diesel fuel vehicles, especially buses and trucks.

During the last decade, a series of measures have been defined, some of them on a national level: the Código Brasileño de Tránsito (1998) for instance, defined different mitigation measures like the inspection of all vehicles starting in 2001. Nevertheless the implementation into practice of this regulatory framework presented important delays (Jacobi, 2003: 80, 84).

FIGURE 31
SAO PAULO: CONTAMINANTS BY SOURCE OF EMISSION

(In percentages)



Source: Governo do Estado do Sao Paulo and CETESB, 2008: 91.

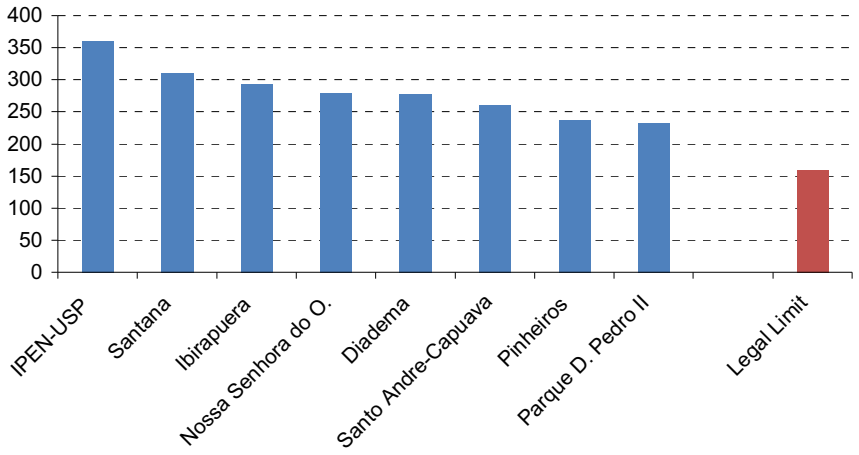
Important public discussions and political confrontations have been caused by *Operación Rodizio* (1995-1998) consisting of transit restrictions for private cars, which was introduced with the goal of preventing critical events of air quality. Nevertheless, it has been stated that the operation has shown important effects on building awareness and setting the issue on the political agenda. In 1999, it was replaced by a program of the *Prefeitura* de Sao Paulo (*Operación en horas punta*), looking for measures to prevent vehicular congestions in the most critical areas and periods (Jacobi, 2003: 81). Combating air pollution in Sao Paulo has shown little effect, high levels of ozone concentration persist and the achieved reductions of PM10 and CO concentrations have been scarce. Some authors are attributing this limited effect to the low priority of environmental policies, most likely due to their limited impact on voters' decisions; however, they have recognized an increase in private enterprises' concern with environmental issues (Jacobi, 2003: 82). Since 2008, trucks are also held accountable to circulation restrictions in the city of Sao Paulo –a measure aiming to reduce congestion which nevertheless has relevance in terms of emission reduction.

As Figure 32 illustrates, ozone concentration has basically been constant for the last ten years in spite of the different discussed initiatives. In contrast, CO concentration levels have been reduced considerably between 1998 and 2004 – in some stations by almost 50%. Since then the level is almost constant. In difference the PM10 concentration barely changed from 1998 to 2003 but has been slightly reduced since then (Governo do Estado do Sao Paulo and CETESB, 2008: 121/123).

In summary the main municipalities Sao Paulo, Guarulhos, Taboão da Serra, and Sao Caetano do Sul are affected by a severe level of Ozone concentration and different levels of PM; CO and NOx pollution (Governo do Estado do Sao Paulo, 2008: 183).

FIGURE 32
SAO PAULO: OZONE CONCENTRATION, 1998-2007

(In microgram/m^3, average of daily maximum; range of different stations within RMSP)



Source: Governo do Estado do Sao Paulo and CETESB, 2008: 112.

The legally permitted concentration of sulfur in diesel fuels is still high: up until 2005 it was 2000 ppm, between 2005 and 2008 the legal limit was fixed at 500 ppm, which must be reduced to 50 ppm on January 1st, 2009; a legal change which nevertheless has still not been implemented. A legal confrontation between CONAMA and the main gasoline producer, Petrobras, was recently won by the environmental institution. Further reduction to ten ppm is planned for 2012.

TABLE 35
SAO PAULO: LEGAL EMISSION LIMITS FOR NEW CARS BY FUEL TYPE

Year	Fuel type	CO *(g/km)*	HC *(g/km)*	NOx *(g/km)*
1980 – 1983	Gasoline C	33	3	1.4
	Alcohol	18	1.6	1
1992	Gasoline C	6.2 (-78%)	0.6 (-75%)	0.6 (-63%)
	Alcohol	3.6 (-79%)	0.6 (-63%)	0.5 (-58%)
1997	Gasolina C	1.2 (-96%)	0.2 (-92%)	0.3 (-81%)
	Alcohol	0.9 (-95%)	0.3 (-84%)	0.3 (-75%)
2006	Gasolina C	0.33 (-99%)	0.08 (-96%)	0.08 (-95%)
	Flex-Gasolina C	0.48 (-98%)	0.10 (-95%)	0.05 (-97%)
	Flex-Alcohol	0.47 (-98%)	0.11 (-95%)	0.07 (-96%)

Source: CETESB, 2009b.

As table 35 shows, there is an important gap between the legal limits, which are relevant for new cars and the emission levels of the vehicles in use. Therefore, one could expect a future effect of the recently defined legal limits.

In spite of all of the mentioned efforts and programs, the levels of CO and NOx concentrations are still very high. The technological and legal measures taken have shown a clear but also very limited

effect in terms of pollution reduction. A very high number of the automotives use catalytic technology and the improved Gasoline C; the peak of alcohol driven cars was reached in 1995. Nowadays there is a clear tendency toward the hybrid alcohol-gasoline fuel type which has been introduced in 2003 and already account for almost 1 million vehicles in RMSP (Governo do Estado do Sao Paulo and CETESB, 2008: 94).

The still growing motorization and intensive use of private cars, resulting in fast growing traffic, is responsible for the continuous pollution in spite of the mentioned actions; the existing lack of control is another main cause. In terms of fuel and engine standards, the recent legal changes' effects on air pollution are still unknown. It is expected that public transport plans will cause changes in the modal split of daily commuting trips; thereby increasing the number of passengers using public transportation in the future.

6. Conclusion Sao Paulo: challenges, risks and obstacles

Based on the inputs of local expert the following main challenges, risks and obstacles of sustainable development of Sao Paulo have been identified.

Main challenges of sustainable development:

1) Ensure access to public transport.
2) Assure treated water supply and sanitation services.
3) Guarantee adequate living conditions, mainly for the poor.
4) Reduce criminality and violence levels.
5) Reduce levels of air and river pollution.

Main risks:

1) Risk of water supply. This general issue of all megacities is even more concerning in the case of the Metropolitan Region of Sao Paulo, as the water resources of Alto Tietê are not sufficient to ensure supply. Only half of the region's water demand is covered by its own water basin; the rest is imported from the Piracicaba Basin, generating risks of lack of water resources and water pollution.
2) Risk of non-mobility: traffic congestion is no longer merely concentrated in rush hours but an almost permanent concern. Long daily trips and inefficient public transport are consequences.
3) Risk of environmental degradation.

Bibliography

Achkar, Marcel (2005), Indicadores de Sustentabilidad. In: Achkar, M., Canton, V., Cayssials, R., Domínguez, A., Fernández, G. y F. Pesce (ed.): Ordenamiento Ambiental del Territorio. Comisión Sectorial de Educación Permanente. DIRAC, Facultad de Ciencias. Montevideo, 2005.

Acueducto (2004a), PTAR Salitre Fase I. Planta de tratamiento de aguas residuales. http://www.acueducto.com.co/wpsv5/wps/html/resources/PTAR/Plegable_tecnico.pdf.

Acueducto (2004b), Aspectos técnicos en el análisis del saneamiento del Río Bogotá. http://www.secretariadeambiente.gov.co/sda/libreria/pdf/rioBogotá/eaab.ppt .

Acueducto (2006), Plan Maestro de acueducto y alcantarillado de Bogotá D.C. Decreto 314 de 2006.

Acueducto (2006b), Documento Técnico de Soporte Plan Maestro de Acueducto y Alcantarillado de Bogotá D.C. Documento principal Agosto 2006.

ACUMAR (2010): Calidad de Aguas superficiales de la cuenca Matanza-Riachuelo. Parametros fisico-quimicos y bacteriologicos calculados en campo y laboratorio. Campaña invierno 2010, Junio. http://www.acumar.gov.ar.

Acurio, Guido; Rossini, Antonio; Teixeira, Paulo Fernando and Francisco Zepeda (1997): Diagnóstico de la situación del manejo de residuos sólidos municipales en América Latina y el Caribe. Washington D.C.

Agencia suiza para el desarrollo y la Cooperación (COSUDE) (2005), Objetivo de desarrollo del milenio 4. Reducir la mortalidad de la infancia. http://www.cosude.org.pe/es/Pagina_ principal/ressources/resource_es_24679.pdf.

Aguas Andinas (2008), Reporte de Sustentabilidad 2007. https://www.aguasandinas.cl/ Repositorio RealInfo/Archivos/aandinas/empresa/reporte_de_sustentabilidad_2007.pdf.

Aguas Andinas (2009), Aguas Andinas S.A. Ficha. http://www.siss.cl/articles-4625_Andinas G1_0509.pdf .

Aguilar, Adrián Guillermo (2002), Las mega-ciudades y las periferias expandidas. In: eure 28 (85): 121-149.

Aguirre, Carlos (2006), Mercado inmobiliario. Renovación Urbana en la AMS, una mirada a los demandantes de vivienda.

Alcaldía Mayor de Bogotá (2004), La Estratificación en Bogotá D.C. y Estudios Relacionados. 1983-2004.

Alcaldía Mayor de Bogotá (2004b), Recorriendo Ciudad Bolívar 2004. Diagnóstico físico y socioeconómico de las localidades de Bogotá, D.C.

Alcaldía Mayor de Bogotá (2008), Acuerdo 302 de 2007 por el cual se expide el Presupuesto Anual de Rentas e Ingresos y de Gastos e Inversiones de Bogotá, Distrito Capital, para la vigencia

fiscal comprendida entre el 1 de enero y el 31 de diciembre de 2008. http://www.AlcaldíaBogotá.gov.co/sisjur/normas/Norma1.jsp?i=28055.

Alcaldía Mayor de Bogotá SDA Secretaría Distrital Ambiente (2007), Calidad del Aire en Bogotá e Iniciativas para mitigar cambio climático. Encuentro de ciudades de la Subred Andina de CIDEU; Medellín, Noviembre 1 y 2 de 2007.

Alcaldía Mayor de Bogotá, Secretaría Distrital Ambiente (SDA) (2008), Calidad del sistema hídrico de Bogotá.

Alcaldía Mayor de Bogotá SDIS Secretaría Distrital de Integración Social (2009), V Censo de Habitantes de Calle. http://www.integracionsocial.gov.co/modulos/contenido/default.asp?idmodulo=672 .

Alcaldía Mayor de Bogotá SDP Secretaría de Planeación (2007), Encuesta Calidad de Vida en Bogotá 2007. Mapa Personas pobres por línea de pobreza.

Alcaldía Mayor de Bogotá SDP Secretaría de Planeación (2008), Encuesta Calidad de Vida en Bogotá 2007. Resultados Preliminares. En: Colección Información y Estudios Estratégicos.

Alcaldía Mayor de Bogotá SDP Secretaría de Planeación (2008a), Encuesta Calidad de Vida 2007. Para Bogotá ECVB 2007. http://www.sdp.gov.co/www/resources/ calidad_de_vida_07.pdf

Alcaldía Mayor de Bogotá Secretaría de Planeación (SDP) (2008b), El reloj de la población.

Alcaldía Mayor de Bogotá Secretaría de Planeación (SDP) (2009), Encuesta Capacidad de pago 2004.

Alessandri Carlos, Ana Fani (2006), Dinámicas urbanas en la metrópolis de São Paulo. In: C. Carreras and A. F. A. Carlos (Ed.): Barcelona y São Paulo cara a cara. Procesos metropolitanos a la hora de globalización. Barcelona: colección polis. 104-115.

Alfonso, Oscar A. (2005), La residencia en condominios en un ámbito metropolitano andino. La conquista del campo por los citadinos y el orden segmentado en la región Bogotá-Cundimarca. V. Gouëset et al. (Ed.): Hacer metrópolis. La región urbana de Bogotá de cara la siglo XXI. 235-290.

Almansi, Florencia and Andrea Tammarazio (2008), Mobilizing projects in community organizations with a long-term perspective: neighbourhood credit funds in Buenos Aires, Argentina. In: Environment and Urbanization 20: 121-147.

Altomonte, Hugo; Coviello, Manlio and Wolfgang F. Lutz (2003), Renewable energy and energy efficiency in Latin America and the Caribbean: constraints and prospects. CEPAL series recursos naturales e infraestructura 65. Santiago de Chile.

Álvarez, Anamaria (2008), La segmentación socio-económica del espacio: La comunidad ecológica y la toma de Peñalolén. En Eure 34 (101). 121-136.

Alvazzi del Frate, Anna (2003), Victimación criminal en Latino America. In: Revista Española de Investigación Criminológica. REIC NI-01-03. http://www.criminologia.net. Download May 30, 2009.

Amaral de Sampaio, Maria Ruth and Paulo Cesar Xaria Perreira (2003), Habitaçao em São Paulo. In Estudos Avançados. 17 (48): 167-183.

AméricaEconomia (2008), Especial Ciudades 2008. Ranking. http://www.americaeconomia.com/Multimedios/Otros/2219.pdf.

Amt für Statistik Berlin-Brandenburg (2009), Die Kleine Berlin–Statistik. Amt fur Statistik Berlin-Brandenburg (State Statistical Institute Berlin-Brandenburg). Berlin.

APERC Asia Pacific Energy Research Centre (2007), Urban Transport Energy Use in the APEC Region. Trends and Options. Tokyo: APERC.

Arenas, Federico (2008), Obstáculos para la Gobernanza de los espacios metropolitanos chilenos: fragmentación institucional, desarticulación instrumental, atomización social. En: Gloria Yañez Warner et al. (Ed.): Ciudad, Poder, Gobernanza. Santiago de Chile: Colección Rideal / Geo Libros No. 9: 67-75.

Arkouli, Marcelina et al. (2010), Distribution and temporal behavior of particulate matter over the urban area of Buenos Aires. In: Atmospheric Pollution Research 1 (2010) 1-8.

Arndt; Christiane and Charles Oman (2006), Uses and Abuses of Governance Indicators. Development Centre Studies. OECD. Paris.

Asamblea Legislativa del Distrito Federal: Comisión de Desarrollo Metropolitano http://www.asambleadf.gob.mx/index2.php?pagina=1504.

Atkinson, Adrian (2003), Are third World Megacities sustainable? Development Planning Unit, University College, London.

Atlas Ambiental de Buenos Aires (2009), http://www.atlasdebuenosaires.gov.ar.

Atlas Ambiental de Buenos Aires (2009b), Infraestructura de los servicios de cloacas. http://www.atlasdebuenosaires.gov.ar/.

Avila Curiel, Abelardo and Teresa Shamah Levy (2005), Nutrición de los grupos indígenas en zonas rurales www.enlacesolidario.org.

AySA Agua y Saneamientos Argentinos S.A. (2009), Obras en ejecucion. http://www.aysa.com.ar/index.php?id_seccion=304.

____ (2009b), Expansión y desarrollo comprometida con la Inclusión Social. Informe al Usuario. Datos a diciembre de 2008.

Balbo, M.; Jordán, Ricardo and Simioni, Daniela (Ed. 2003), La ciudad inclusiva. Cuadernos de la CEPAL 88.

Banco Central de Chile (2009), Ficha: Producto Interno Bruto Regional 2003-2006. http://www.bcentral.cl/publicaciones/estadisticas/actividad-economica-gasto/aeg07b.htm.

Banco de la Provincia de Buenos Aires (CITAB) (2007), Poblacion total con necesidades Basicas Insatisfechas (NBI). Gran Buenos Aires.

____ (2001), Población total con NBI Gran Buenos Aires 2001. http://www.bapro.com.ar/citab/.

Banco Interamericano de Desarrollo: Bogotá sin indiferencia/ Bogotá sin Hambre. http://idbdocs.iadb.org/wsdocs/getdocument.aspx?docnum=926620#372,1,Diapositiva 1.

Banco Mundial / Ministerio de Ambiente, Vivienda y Desarrollo Territorial (2007), Evaluación Ambiental Estratégica de Combustibles y Calidad del Aire, Bogotá.

Banco Mundial (2008), Desarrollo con menos carbono: respuestas latinoamericanas al desafío del cambio climático. Washington.

Banrep (2004): Consumo total de energia electrica - 4 ciudades principales. http://www.banrep.gov.co/estad/dsbb/energiatotal.pdf.

Bárcena, Alicia (2009): Reflexiones sobre eficiencia energética y cambio climatico en america Latina y el Caribe. http://www.eclac.org/noticias/.

Barton, Jonathan; Jordán, Ricardo; León, S.M.; Solis M., O. (2007), ¿Cuán sustentable es la Región Metropolitana de Santiago? Metodología de evaluación de la sustentabilidad. ECLAC DDSAH.

Barton, Jonathan (2006), Sustentabilidad urbana como planificación estratégica. In: eure 32 (96): 27-45.

Beaverstock J.V.; Smith, R.G. and Taylor, P.J. (1999), A Roster of World Cities. In: Cities 16 (6), 445-458.

Beckett, Katherine and Angelina Godoy (2010), A Tale of Two Cities: A Comparative Analysis of Quality of Life Initiatives in New York and Bogota. Urban Studies 47(2) 277-301.

Berglund, Birgitta; Lindvall, Thomas and Dietrich H. Schwela (1999), Guidelines for Community Noise. World Health Organisation (WHO). Ed. 1999. http://www.who.int/docstore/peh/noise/guidelines 2.html.

Bernardes da Silva, Adriana and Ricardo Castillo (2007), Dinámicas metropolitanas en la era de la globalización: la promoción inmobiliaria para empresas en la ciudad de São Paulo, Brasil. In: eure33 (98): 45-56.

Biderman, C. E. and Sandroni, P. (2005), Avaliaçao do impacto das Grandes Intervençoes Urbanas nos preços dos imóveis do Entorno, O caso das Operaçoes Urbanas Consorciadas Faria Lima. São Paulo: Sèrie para DiscusSão CEPESP GvPesquisa (NPP) N^{o} 9.

Biderman, Ciro (2008), São Paulos Urban Transport Infrastructure. In: Urban Age. http://www.urban-age.net/0_downloads/archive/_SA/13_NewsPaper_Essay_Biderman.pdf.

Blacksmith Institute (2007), The world's worst polluted places. New York: Blacksmith Institute. www.blacksmithinstitute.org. Download: 09.04.2008.

BMBF German Federal Ministry of Education and Research (2004), The Urban Transition: Research for the sustainable development of the Metropolitan Cities of tomorrow. Bonn: BMBF, Division 622 "Global Change".

Bogotátrabaja (2009), Empleo y desempleo en Bogotá. http://www.Bogotátrabaja.gov.co/ms-articles /que-esta-pasando-con-elempleo/vinculos_interes/Empleo_y_Desempleo_en_Bogotá.pdf.

Bogotá D. C. (2008), Consolidado sector público distrital. Estado de actividad financiera, económica, social y ambiental.

Bógus, L.M.M. and Pasternak, S. (2009), Como Anda São Paulo. Rio de Janeiro: Letra Capital: Observatorio das Cidades. São Paulo.

Boltvinik, Julio (2002), Pobreza en la ciudad de México. http://www.jornada.unam.mx/2002/01/ 25/028a1eco.php?origen=index.html.

Borja, Jordi (2007), Revolucion y contrarrevolucion en la ciudad global: las expectativas frustradas por la globalizacion de nuestras ciudades. In: Eure 33 (100): 35-50.

Borsdorf, Axel and Rodrigo Hidalgo (2004), Formas tempranas de la exclusión residencial y el modelo de la ciudad cerrada en América Latina. El caso de Santiago de Chile. Revista de Geografía Norte Grande 32: 21-37.

Brautigam, Klaus-Rainer (2008), Tratamiento y Gestión de los Desechos Sólidos. Paper presented at: Foro Internacional. Bogotá – Berlin – Beijing. Desafíos y Soluciones para las Megaciudades. Bogotá, October, 2008.

Briceño-León, Roberto (2002), La nueva violencia urbana en América Latina. In: R. Briceño-León (Ed.) Violencia, Sociedad y Justicia en América Latina. Buenos Aires: CLACSO: 13-26.

Buendía Rojas, José M. (2008), Informe de la situación actual de la gestión de residuos sólidos municipales. Lima, MINAM.

Cabrera, Enrique; Diaz Carlos A.; Sanhueza, Ricardo (2006), La congestión en Santiago. En, Galetovic, A. (Ed.). Santiago ¿Dónde estamos y hacia dónde vamos? Santiago: CEP. 393-424.

Cabrero Mendoza, Enrique (2007), Competitivididad de las ciudades Mexicanas, 2007 CIDE.

Cade-Idepe Consultores en Ingenieria (2004), Diagnóstico y clasificación de los cursos y cuerpos de agua según objetivo de calidad. Cuenca del Rio Maipo. Gobierno de Chile. Direccion General de Aguas.

Cámara de Comercio de Bogotá (2001), Indicadores básicos de calidad de vida y desarrollo humano. (= Observatorio social de Bogotá 7). http://camara.ccb.org.co/.

Cámara de comercio de Bogotá (2004), Pobreza y calidad de vida en Bogotá. (= Observatorio Social de Bogotá 14). http://camara.ccb.org.co/.

Cámara de comercio de Bogotá (2007), Balance de la situación económica de Bogotá y Cundinamarca, 2006.

Cámara de comercio de Bogotá (2007b), Balance de las finanzas de Bogotá en el 2006. (=Observatorio de las finanzas publicas de Bogotá N^{o} 8).

Cámara de comercio de Bogotá (2008), La educación básica y media en Bogotá 2007. (Observatorio Social de Bogotá 21).

Cámara de comercio de Bogotá (2008b), Mejores ciudades para hacer negocios en América Latina, 2008.

Cámara de Diputados del Congreso Federal (2009), Comisión de desarrollo metropolitano. Plantilla de integrantes- http://sitl.diputados.gob.mx/integrantes_de_comision.php?comt=19.

Camilloni, Inés; Barros, Vicente (2009), Aire. In: Atlas Ambiental de Buenos Aires, updated April 2009. (www.atlasdebuenosaires.gov.ar, reviewed August 8th, 2009).

Campanha de olho nos mananciais (2007), http://www.mananciais.org.br/site/index_html.

Campolina Diniz, Clélio and Bernardo Campolina (2007), A região metropolitana de São Paulo: reestruturação, re-espacialização e novas funções. In: Eure 33 (98): 27-43.

Campos, Claudia (2007), Indicadores de contaminación fecal como parámetro para evaluar riesgo sanitario en aguas y biosólido utilizados para agricultura. http://www.latinosan2007.net/2008 /PYPs/3_MIARD/Ponencias-ARD-Pw-Point/MIER_ MANANA/Campos_Indicadores.pdf.

Carrero, Alfonso (2003): Estudio del impacto del nuevo sistema de transporte masivo Transmilenio sobre el tejido urbano de Bogotá. Disponible en: http://www-cpsv.upc.es/tesines/resummaus _alfonsocarrero.pdf.

Casas Dupuy, Pablo & Paola González Cepero (N.N.), Políticas de seguridad y reducción del homicidio en Bogotá. Mito y realidad. In: Fundación Seguridad & Democracia (Ed.): Seguridad Urbana y Policía en Colombia. 242 -289.

Castelán, Enrique (2002), El Manejo del Agua en la Zona Metropolitana de la Ciudad de México: La Forma Difícil de Aprender. Informes de Investigación 7.

Cravino, Maria Cristina; Juan Pablo del Rio and Juan Ignacio Duarte (2009), Magnitud y crecimiento de las villas y asentamientos en el Área Metropolitana de Buenos Aires en los últimos 25 años. http://www.fadu.uba.ar/extension/mat_index.html.

Cedem (2009), Informe Económico de la Ciudad de Buenos Aires. 91. Marzo - abril 2009.

Centro Mario Molina para Estudios Estratégicos de Energía y Medio Ambiente et al. (2006), Movilidad y calidad de vida: six estrategias de acción para la Zona Metropolitana del Valle de México.

Centro de Implementación de Políticas Públicas para la Equidad y el Crecimiento (CIPPEC) (2007), El financiamiento educativo. www.fundses.org.ar

Centro de Investigacion, Documentacion y Asesoría Poblacional (CIDAP) (2008), Cifras de tugurización en viviendas en Lima Metropolitana.

Centro de Investigacion Social (CIS), Un techo para Chile (2007), Catastro nacional de campamentos, 2007.

CEPAL (2007), Estadísticas para la equidad de género: magnitudes y tendencias en América Latina. Cuadernos de la CEPAL, Naciones Unidas, Santiago de Chile.

____ (2009), Panorama social de América Latina 2009. Naciones Unidas, Santiago de Chile.

____ (2010), El desarrollo sostenible en América Latina y el Caribe: tendencias, avances y desafíos en materia de consumo y producción sostenibles, minería, transporte, productos químicos y gestión de residuos. Informe para la decimoctava sesión de la Comisión sobre el Desarrollo Sostenible de las Naciones Unidas. Naciones Unidas, Santiago de Chile.

Chilectra (2009), Tarifas de Suministros Clientes Regulados – Tarifa Historica. www.chilectra.cl.

Chinchay, Romulo (NN): Accesibilidad del transporte público al centro histórico de Lima. El caso Metropolitano de Lima.

Chion, Miriam (2002), Dimensión metropolitana de la globalización: Lima a fines del siglo XX. In: eure 28 (85): 71-87.

Ciccolella, Pablo (2002), La metrópolis postsocial: Buenos Aires, ciudad rehén de la economía global. In: Rideal (Ed.): El desafío de las áreas metropolitanas en un mundo globalizado. Una mirada a Europa y Amárica Latina. 203-233.

City Mayors (2007), The 150 richest cities in the world by GDP in 2005. http://www.citymayors.com/statistics/richest-cities-2005.html

CMN Consejo de Monumentos Nacionales (2009), Nómina de Monumentos Nacionales 1925-2008. http://www.monumentos.cl/ Consulted May 7th 2009.

CNE & GTZ (2009) Las Energías renovables no convencionales en el mercado chileno.

Coing, Henri (2005), Servicios públicos en Bogotá. Impacto de las reformas sobre la solidaridad territorial y social. In: Vincent Gouëset et al. (Ed.): Hacer metrópoli. La región urbana de Bogotá de cara al siglo XXI. Universidad Externado de Colombia. 135-167.

Colegio de México (N.N.), Centro de estudios demográficos, urbanos y ambientales. http://www.colmex.mx/centros/detalle_instancias_colmex.jsp?id_centro=2.

Comisión de Derechos Humanos del Distrito Federal (2003), Legislación, políticas públicas y situación de los derechos humanos de la infancia en el distrito federal. http://directorio.cdhdf.org.mx/libros/politicaspublicas/politicaspubli.pdf.

Comisión Especial de Estudio sobre Discapacidad (2005): Contaminación: un problema latente que genera discapacidad. http://www.congreso.gob.pe/comisiones/2002/discapacidad/boletines/boletin72.pdf

Comisión Federal de Electricidad (CFE) (2010), Estadísticas de venta. http://app.cfe.gob.mx/Aplicaciones/QCFE/EstVtas/Historico.aspx.

Comité de Inversiones Extranjeras (2008), Authorized and Materialized FDI by Chilean Region (D.L. 600) http://www.cinver.cl/archivos/estadisticas/NT3.xls.

Companhia de Tecnología de saneamiento ambiental (CETESB) (2008), Material Particulado Inalável fino (MP2.5) e grosso (MP2.5-10) na atmósfera da Regiao Metropolitana de São Paulo.

____ (2008), Relatório de Qualidade do Ar no Estado de São Paulo 2007. www.cetesb.sp.gov.br /Ar/publicacoes.asp.

____ (2009), Relatório de Qualidade das Aguas Interiores no Estado de São Paulo, 2008.
____ (2009b), Emissão Veicular. PROCONVE. http://www.cetesb.sp.gov.br/Ar/emissoes/ proconve4.asp.
____ (2009c), http://www.cetesb. sp.gov.br/Institucional/ar.asp.
Corporación Nacional Forestal (CONAF) (2009), Áreas Silvestres Protegidas. www.conaf.cl/parques /index.html.
CONAGUA (2007), Capitulo 1. Contexto Geográfico y Socioeconómico http://www.conagua.gob.mx/CONAGUA07/Noticias/Cap1%5B1%5D.pdf.
CONAM (2007), Evaluación del estado situacional de gestión de residuos sólidos municipales, 2007.
CONAM (2007), Política Nacional del Ambiente. Preliminary document.
CONAM (2009a), Residuos Sólidos Generados en Lima Metropolitana (1999-2006). http://www.redrrss.pe/material/20090223164914.pdf.
CONAM (2009b), Desechos depuestos adecuadamente % por distrito 1994-2005, http://www.redrrss.pe/material/20090223171314.pdf.
Comisión Nacional del Medio Ambiente (CONAMA) (2006), Elaborarán Plan Integral para el manejo de los residuos sólidos en la Región Metropolitana. http://www.conama.cl/ rm/568/article-36515.html#h2_1.
____ (2007), Evolución de la Calidad del Aire en Santiago 1997-2004.
____ (2009), Glosario contaminación atmosférica. http://www.conama.cl/rm/568/article-1615. html.bak.
____ (2009) Departamento de descontaminación: planes y normas.
CONAMA (2008), Resultados Plan Operacional para la Gestión de Episodios Críticos de Contaminación Atmosférica por Material Particulado. Período 2008.
CONAM-PNUMA (2004), Informe Nacional sobre el Estado del Ambiente, Geo-Perú 2002. Lima.
CONAPO Consejo Nacional de Población (2005), Delimitación de las zonas metropolitanas de México 2005.
Consejo Nacional de Población (CONAPO) (2009), Zona Metropolitana del Valle de México: Grado de marginación por AGEB urbana, 2005. http://www.conapo.gob.mx/publicaciones/ IMU2005/mapas/23-ZM_VMex.pdf.
Consejo Nacional de Población (CONAPO) (2002), Anexo estadístico cuadros Índices de Desarrollo Humano http://www.conapo.gob.mx/publicaciones/indicesoc/IDH2000/dh_AnexoCuadros.pdf .
Concejo de Bogotá D.C. (2008), Acuerdo N° 308 de 2008 por el cual se adopta el plan de Desarrollo Económico, Social, Ambiental y de Obras Públicas para Bogotá D.C. 2008-2012 "Bogotá positiva – vivir mejor".
CONEVAL (2009), Dirección de Información y Comunicación Social: Comunicado de prensa No. 006/09. Reporta CONEVAL cifras de pobreza por ingresos 2008.
Congreso de la República (2009), Estadísticas de visitantes de los museos y sitios arqueológicos del Perú (1992-2009). http://www.congreso.gob.pe/museo/estadisticas.pdf Download: May 8th, 2009.
Connolly, Priscilla (1999), México City: our common future? Environment and Urbanization 11: 53-78.
Consejo de Transporte de Lima y Callao (Ed. 2004). Plan Maestro de transporte urbano para el Área Metropolitana de Lima y Callao en la República del Perú. Prioridad del transporte público.
Consejo Nacional para la Cultura y las Artes (2009), Sistema de Información Cultural. http://sic.conaculta.gob.mx/.
Consoni Rossi, Elina and Peter J. Taylor (2007), Gateway cities: circulos bancarios, concentration y dispersión en el ambiente urbano brasileño. In: Eure 33 (100): 115-133.
Coviello, Manlio F. (2007), Renewable Energy sources in Latin America and the Caribbean. Two years after the Bonn conference. Project Document. Santiago de Chile: UN ECLAC.
Cox, Wendell (2000), How urban density intensifies traffic congestion and air pollution. (= Arizona Issue Analysis 162).
Coy, Martin (2006), Gated communities and urban fragmentation in Latin America: the Brazilian experience. In: GeoJournal 66: 121-132.
Daniels, P. W. (2004), Urban challenges: the formal and informal economies in mega-cities. In: Cities 21 (6), 501-511.

De Angoitia, Regina and Fernando Ramírez (2008), Estrategias utilizadas para minimizar costos por los usuariosde telefonía celular de sectores de bajos ingresos de México. Lima, IDRC. (= Serie Investigaciones Breves 2).

De Mattos, Carlos (2004), Santiago de Chile. Metamorfosis bajo un nuevo impulso de modernización capitalista. En: De Mattos, C. et al. (Ed.): Santiago en la Globalización ¿Una nueva ciudad? Santiago: Eure Libros.

De Mesquita Neto, Paulo (N.N.), La policía comunitaria de São Paulo. Problemas de implementación y consolidación.

Deak, Csaba (2005), Presentación de la Ciudad de San Pablo. In: Marisa Carmona (Ed.): Globalización y grandes proyectos urbanos. La respuesta de 25 ciudades. Buenos Aires: Ediciones Infinito. 419-425.

Defensor del Pueblo de la Nación (2003), Informe Especial sobre la cuenca Matanza-Riachuelo. http://www.defensor.gov.ar/informes/riachuelo.pdf.

____ (2005), Informe especial de seguimento Cuenca Matanza-Riachuelo (2003-2005). http://www.defensor.gov.ar/informes/riachuelo2006.pdf.

Defensoría General de la República (2009), Datos estadísticos sobre la probreza. Canasta básica de alimentos. http://defenpo3.mpd.gov.ar/web/pobres/indec/004canastabasica.htm.

Del Valle Cardenas, Beatriz (2009), Wastewater practices in México City Metropolitan Area. www.c40tokyo.jp/en/pdf/session2/group2/México_city.pdf.

Delgadillo Macias, Javier (2008), Desigualdades territoriales en México derivadas del tratado de libre comercio de América del Norte. In: Eure 34 (101) 71-98.

Departamento Administrativo Nacional de Estadistica (DANE) (2006), Censo General 2005 – Resultados Área Metropolitana de Bogotá.

____ (2007a), Censo General, 2005. Informacion básica. Processed with Redatam+SP, CEPAL/CELADE.

____ (2007b), Censo General 2005. Resultados Area Metropolitana de Bogotá. http://www.dane.gov.co/resultados_am_municipios_colombia.pdf.

____ (2009), Encuesta de hogares continua. http://www.dane.gov.co. Consulted May 7th, 2009.

____ (2009b), Índice de precios de vivienda nueva – IPVN. http://www.dane.gov.co. Download May 8th, 2009.

____ (2009c), Déficit de vivienda, 2005. http://www.dane.gov.co/ Download May 8th, 2009.

____ (2009d), Tasas especificas de participación, desempleo y subempleo. Según grupos de edad y sexo. http://systema39.dane.gov.co:7778/pls/enh/enh_web_continua.consulta3_c. Download September 29th, 2009.

____ (2009e), Cuentas Departamentales. Producto Interno Bruto Departamental por habitante a precios corrientes. http://www.dane.gov.co/index.php?option=com_content&task=category &sectionid=33&id=59&Itemid=241.

Departamento del Distrito Federal; Gobierno del Estado de México; Secretaría de Medio Ambiente, Recursos Naturales y Pesca y Secretaría de Salud (1996), Programa para Mejorar la Calidad del Aire en el Valle de México 1995-2000. Ciudad de México.

Departamento Intersindical de Estatistica e Estudios Socioeconomicos (DIEESE) (2009), Quanto se trabalha para comer. http://www.dieese.org.br/rel/rac/trajul09.xml#SAMPA.

Departamento Nacional de Planeación (DNP) (2008), Indicadores sociales departamentales. Sistema de Indicadores Sociodemográficos para Colombia Nº 37. http://www.dnp.gov.co/PortalWeb/ Portals/0/archivos/documentos/ DDS/SISD/boletin37.pdf.

Díaz, Guillermo, Gómez-Lobo, Andrés and Andrés Velasco (2006), Micros en Santiago: de enemigo público al servicio público. En: Galetovic, A. (ed.): Santiago ¿Dónde estamos y hacia dónde vamos? Santiago: CEP. 425-460.

Díaz-Pulido, Angélica Paola (2009), Desarrollo sostenible y el agua como derecho en Colombia. In: Estudios Socio-Jurídicos 11(1): 84-116.

Dirección de Bibliotecas, Archivo y Museos (DIBAM) (2009), Estadística de visitantes. www.dibam.cl/subdirec_museos/contenido.asp?id_contenido=687. Download: May 8th 2009.

Dirección General de Estadística y Censos (2008), Encuesta Anual de Hogares. http://www.buenosaires.gov.ar/areas/hacienda/sis_estadistico/areas_tematicas/condiciones_vida/index.php.

Dirección General Museos de Buenos Aires (DGM) (2009), Estadísticas. http://www.museosaavedra.buenosaires.gov.ar/dgm_estadisticas.html. Download: May 8th 2009.

Dourojeanni, Axel and Jouravlev, Andrei (1999), Gestión de cuencas y ríos vinculados con centros urbanos. Download 14.05.2009.

Ducci, Maria Elena and Marina Gonzalez (2006), Anatomía de la expansión de Santiago, 1991-2000. En: A. Galetovic (Ed.): Santiago Dónde estamos y hacia dónde vamos. Santiago de Chile: CEP. 123-146.

Echeñique; Marcial (2006a), El crecimiento y desarrollo de las ciudades. In: A. Galetovic (Ed.): Santiago Dónde estamos y hacia dónde vamos. Santiago de Chile: CEP. 75-96.

Echeñique; Marcial (2006b), Las vías expresas urbanas: ¿Qué tan rentables son? In: A. Galetovic (Ed.): Santiago Dónde estamos y hacia dónde vamos. Santiago de Chile: CEP. 461-488.

Ecoamerica (2008), Perú. Vehículos generan el 80% de contaminación en Lima www.ecoamerica.cl.

Economic Commission for Latin America (ECLAC) (2005), Dinámica demográfica y desarrollo en América Latina y el Caribe. Serie Población y desarrollo Nº 58). Santiago de Chile.

____ (2009), Data Request on gender statistixs. (Estadisticas de genero. Trabajo remunerado y no remunerado). In: http://websie.eclac.cl/sisgen/ConsultaIntegradaFlashProc.asp.

____ (2010), online database. Latin America and the Caribbean statistics. http://websie.eclac.cl/sisgen/ConsultaIntegrada.asp?IdAplicacion=1.

Eco2site (2003), El CEIBO recupera Palermo. http://www.eco2site.com/trash/elceibo.asp. Download June 29th, 2009.

El Espectador (2008), Subirían las tarifas de energía en Bogotá. Bogotá 12 de marzo 2008.

El Tiempo (2007), En Bogotá se paga el servicio de agua potable más costoso del país. http://www.pnud.org.co/.

El Universal (2009), Delinean nuevas tarifas de agua en DF. Ciudad de México, Martes 22 de diciembre de 2009.

Empresa Paulista de Planejamento Metropolitano S.A. (EMPLASA) (2007), Indicadores metropolitanos. http://www.emplasa.sp.gov.br/portalemplasa/EncontrosMetropolitanos/Encontros_indicadores.asp.

____ (2009), RMSP - Indicadores Selecionados. http://www.emplasa.sp.gov.br/.

Escobar, Luis (2006), Indicadores sintéticos de calidad ambiental: un modelo general para grandes zonas urbanas. In: Eure 32 (96): 73-96.

Espinosa Rastrepo, León Daria (2007), El Estado en la construcción de las areas residenciales de Bogotá. In: J. C. del Castillo Daza et al. (Ed.): Áreas residenciales en Bogotá. Bogotá: Universidad Nacional de Colombia. 66-83.

Fandiño, Magdalena and Eduardo Behrentz (2009), Actualización del inventario de emisiones atmosféricas provenientes de fuentes fijas en Bogotá. Grupo de Estudios en Sostenibilidad Urbana y Regional de la Universidad de Los Andes. http://sur.uniandes.edu.co/documentos/Encuentro%20SUR%20Fuentes%20Fijas%20Abrli%2009.pdf.

Fay, Marianne and Mary Morrison (2005), Infrastructure in Latin America & the Caribbean. Recent Developments and Key Challenges. In Two Volumes. Volume I: Main Report.

Feres, Juan Carlos and Mancero, Xavier (2001), El método de las necesidades básicas insatisfechas (NBI) y sus aplicaciones en América Latina. (= estudios estadísticos y prospectivos 7).

Figueroa, Oscar (2005). Transporte urbano y globalización: Políticas y efectos en América Latina. In: Eure 31 (94): 41-53.

Figueroa, Oscar and Arturo Orellana (2007), Transantiago: gobernabilidad e institucionalidad. In: Eure 33 (100): 165-171.

Filgueira, Carlos and Andrés Peri (2004), América Latina: los rostros de la pobreza y sus causas determinantes CEPAL Serie Población y desarrollo Nº 54.

Fischer, Karin; Parnereiter, Christof and Imhof, Karin (2007), El enlace faltante entre las cadenas globales de producción y ciudades globales: el servicio financiero en ciudad de México y Santiago de Chile. En: Eure 33 (100): 135-148.

Fix, Mariana (2007), São Paulo cidade global. Fundamentos financieros de uma miragem. São Paulo: Boitempo.

Fix, Mariana; Arantes, Pedro and Giselle Tanaka (2003), Urban slum reports. The case of São Paulo, Brazil. (= Understanding slums: Case studies for the Global Report on human settlements 2003).

FLACSO Chile (2008), Proyecto Democracia y seguridad ciudadana. Cuadro de indicadores. Lima.

Food and Agriculture (FAO) (2008), FAO Statistical Yearbook, 2007-2008.

Franck, U.; Tuch, Th.; Manjarrez, M.; Wiedensohler, A.; Herbarth, O. (2006), Indoor and Outdoor Sub-Micrometer Particles: Exposure and Epidemiologic Relevance ("The three Indoor Ls"). In: Environmental Toxicology 21(6): 606-613.

Fritzsche, Federico J. and Marcela Vio (2000), Especialización y diversificación industrial en la Región Metropolitana de Buenos Aires. In: Eure 26 (79): 25-45.

Frühling Hugo (2003), Policía Comunitaria y Reforma Policial en América Latina ¿Cúal es el impacto? Serie Documentos CESC. Universidad de Chile. http://www.cesc.uchile.cl/ publicaciones/op_01_policiacomunitaria.pdf.

Fuentes Alburquenque, Mauricio E. (2008), Análisis estadístico de la variación de niveles de ruido ambiental en Santiago de Chile entre los años 1989 y 2001. VI Congreso Iberoamericano de Acústica - FIA 2008 http://www.sea-acustica.es/Buenos_Aires_2008/a-073.pdf.

Fundación Seguridad y Democracia (2008), Criminalidad y victimización en las seis principales ciudades de Colombia – Bogotá.

GAIA (2008), Basura Cero: ¿Buenos Aires será vanguardia o vergüenza mundial? www.greenpeace.org/raw/content/argentina/prensa-rss/buenos-aires-puede-serla-vang/basura-cero-buenos-aires-ser.pdf Download June 29, 2009.

Galetovic, Alexander and Pablo Jordán (2006), Santiago: ¿Dónde estamos? ¿Hacia dónde vamos? In: A. Galetovic (Ed.): Santiago. Dónde estamos y hacia dónde vamos. Santiago: CEP. 25-69.

Galetovic, Alexander and Iván Poduje (2006),¿Qué es Santiago? In: A. Galetovic (Ed.): Santiago. Dónde estamos y hacia dónde vamos. Santiago: CEP. 3-23.

Gallart, María Antonia (2005), Empleo, informalidad y formación. Segmentación de oportunidades laborales y formación. In: Revista de Trabajo: 133-139.

GaWC (2010), The World according to GaWC 2008. http://www.lboro.ac.uk/gawc/world2008t.html

García Cano, Patricia (NN), Indicadores sociales departamentales. In: Departamento Nacional de Planeación. República de Colombia. Sistema de Indicadores Sociodemográficos para Colombia SISD 37.

García Durán, Germán (2006), Die Tragödie des Bogotá-Flusses. In: Kolumbien-aktuell N° 437.

Geospower Energy Consulting (2006), Generación de energía con gases de vertedero. www.geospower.com/pubs/GPE-WGAS.pdf.

Geraiges de Lemos and Amalia Inés (2006), El centro histórico de la ciudad de São Paulo: Interpretando el problema de la vivienda. In: C. Carreras and A. F. A. Carlos (Ed.): Barcelona y São Paulo cara a cara. Procesos metropolitanos a la hora de globalización. Barcelona: colección polis. 104-115.

Giraldo, Fabio et al. (2006), Hábitat y pobreza. Los objetivos de desarrollo del milenio desde la ciudad.

Gobierno de la Ciudad de Buenos Aires (GCBA) (2006), Documento Plan Urbano Ambiental, 2006.

____ (2009), Basura Cero. http://www.buenosaires.gov.ar/areas/med_ambiente/basura_cero/ ?menu_ id=21731. Download June 29, 2009.

____ (2009), Plan de acción contra el cambio climático. http://www.buenosaires.gov.ar/areas/med_ ambiente/proteccion_ambiental/planeamiento/cambio_climatico.php?menu_id=30186. Download August 6th, 2009.

____ DGEC (2007), Ingresos de la población residente en la Ciudad de Buenos Aires. III Trimestre de 2006. Informe de Resultados N° 291. Buenos Aires.

____ DGEC (2007b), Ingresos de la población residente en la Ciudad de Buenos Aires. I Trimestre de 2007. Informe de Resultados N° 317. Buenos Aires.
____ DGEC (2008), Anuario Estadístico 2007. Ciudad de Buenos Aires. http://www.buenosaires.gov.ar /areas/ hacienda/sis_estadistico/anuario_2007.
____ DGEC (2010), Encuesta anual de hogares EAH 2008 de la Ciudad de Buenos Aires. N° 17.
____ DGEC (2010b), Encuesta anual de hogares EAH 2008. Informe Educación. Informe de Resultados N° 418. Buenos Aires.
Gobierno de la República (2006), Sexto Informe de Gobierno del Presidente de los Estados Unidos Mexicanos Vicente Fox Quesada. Anexo estadístico México.
Gobierno del Distrito Federal, Gobierno del Estado de México, Secretaría de Medio Ambiente Recursos Naturales y Pesca (1999), Inventario de Emisiones, Zona Metropolitana del Valle de México. 1998.
Gobierno del Distrito Federal (2000), Programa general de desarrollo del Distrito Federal, 2001-2006.
Gobierno del Distrito Federal- Secretaria del Medio Ambiente (2006): Inventario de Emisiones 2004. Zona Metropolitana Valle de México.
Gobierno del Distrito Federal- Departamento de Finanzas (2008), Cuenta Pública del D.F., 2007. http://www.finanzas.df. gob.mx/fiscal/4.1.html.
Gobierno del Estado de México SMA (2009), Áreas naturales protegidas. http://www.edomex.gob.mx /portal/page/portal/medioambiente/dependencias/cgce.
Gobierno Regional Lima Metropolitana (2004), Plan de competitividad de la Región de Lima Metropolitana. http://www.munlima.gob.pe/ Download: December, 16th 2008.
Gobierno Regional Metropolitano Santiago (2008), Programa Público de Inversión Región Metropolitana de Santiago. Diciembre de 2008. http://www.gobiernosantiago.cl/CMS/Files/ Documentos/PDF/2009_04_07_PROPIR_DICIEMBRE2008.PDF.
Gomez-Lobo Echeñique, Andrés (2007), A new look at the incidence of public transport subsidies: case study of Santiago de Chile. In: Serie Documentos de trabajo 253, Departamento de Economía Universidad de Chile.
González Sánchez, Jorge (2006), Dinámica reciente de la vivienda en renta en la ciudad de México. En: Scripta Nova. Revista Electrónica de Geografía y Ciencias Sociales. 10 (218). http://www.ub.es/geocrit/sn/sn-218-49.htm.
Gouëset, Vincent (2005), Reforma del servicio de agua potable y equidad territorial en la región metropolitana de Bogotá. In: Vincent Gouëset et al. (Ed.): Hacer metrópoli. La región urbana de Bogotá de cara al siglo XXI. Universidad Externado de Colombia. 169-206.
Governo de São Paulo: Secretaria de Economia e Planejamento e fundaçao, SEADE (2005), Velatorio Estadual de Acompanhamento: Objetivos do milenio.
Governo do Estado do São Paulo - CETESB (2008), Relatório de Qualidade do Ar no Estado de São Paulo 2007. São Paulo. www.cetesb.sp.gov.br/Ar/publicacoes.asp.
Governo do Estado do Sao Paulo, Secretaria dos Transportes Metropolitanas (2009), Integrated Urban Transport Plan for 2020 - Pitu 2020. http://www.stm.sp.gov.br/index.php?option=com_ content&view=article&id=2227&Itemid=237.
Graizbord, Boris; Acuña, Beatriz (2005), Movilidad residencial intraurbana en la zona metropolitana Ciudad de México. En A. G. Aguillar (Ed.): Las grandes aglomeraciones y su periferia regional. Experiencias en Latinoamérica y España. Ciudad de México. 235-272.
Greenpeace Argentina (2009), ¡Vamos a poner en marcha la Ley Basura Cero! http://www.greenpeace.org/argentina/contaminaci-n/basta-de-basura. Download June 29th, 2009.
Greenpeace (2009b), Napas contaminadas. Cuenca Matanza Riachuelo. Estudio de potabilidad de agua de pozos.
Greenpeace Argentina (2010), Resumen balance 2009 de gestión de residuos solidos urbanos de la Ciudad de Buenos Aires.
Grünwald, Armin (2006), Sustainable Development and the dynamics of Mega-cities. Institute for Technology Assessment and Systems Analysis (ITAS) of Forschungszentrum Karlsruhe.
Gutiérrez, Andrea (2000), La producción del transporte público en la metrópolis de Buenos Aires: Cambios recientes y tendencias futuras. In: Eure 26 (77): 109-136.

Hardoy, Ana; Hardoy, Jorgelina; Pandiella, Gustavo and Gastón Urquiza (2005), Governance for water and sanitation services in low-income settlements: experiences with partnership-based management in Moreno, Buenos Aires. In: Environment and Urbanization 17: 183-200.

Hardoy, Jorgelina and Gustavo Pandiella (2007), Adaptación de las ciudades argentinas a los efectos del cambio y la variabilidad climática. In: Medio Ambiente y Urbanización, vol. 67, N° 1, Nov. 2007, pp. 45-58 (14), IIED-América Latina.

Helmholtz Association et al. (2007), Risk Habitat Megacity Research Plan 2007-2013. www.risk-habitat-megacity.ufz.de.

Hidalgo, Dario (2005), Integrated Policies for Sustainable Transportation: The Bogotá Experience. Paper presented at: Workshop on Sustainable Transport and Air Quality. World Bank. Washington D.C., April 8th, 2005.

Hidalgo, Rodrigo et al. (2008), La precariópolis estatal. Repercusiones socio-espaciales de la edificación de vivienda social en la periferia del área Metropolitana de Santiago, 1992-2005. En: Gloria Yañez Warner et al. (Ed.): Ciudad, Poder, Gobernanza. Santiago de Chile: Colección Rideal / Geo Libros N° 9: 217-240.

Hoornweg, Daniel et al. (2007), City indicators: Now to Nanjing. World Bank Policy Research Working Paper 4114.

Horn Welch, Karen and Patricia Lee Devaney (2003), Poverty Outreach Findings: Mibanco, Perú. In: Insight Acción, N° 5.

Ibarrarán, María Eugenia and Robles, Carlos (2003), Inequidad de Género en Desarrollo Humano: El caso de México. Estudios sobre desarrollo humano, PNUD México N° 2003-7.

ICESI (2006), Cuarta encuesta nacional sobre inseguridad urbana. ENSI 4 Urbana. www.icesi.org.mx /documentos/encuestas/encuestasNacionales/ensi4_urbana_2005.pdf.

Idrovo Álvaro J. and Irene Casique (2006), El empoderamiento de las mujeres y la esperanza de vida al nacer en México. In: Revista Panamericana de Salud Publica 20: 1. 28-39.

INDEC (2006), Encuesta Nacional de Gastos de los Hogares 2004/2005.

INDEC (2007), Incidencia de la pobreza y de la indigencia en 31 aglomerados urbanos. Resultados 1° Semestre 2007. Buenos Aires.

INDEC (2009), Encuesta Permanente de Hogares. Mercado de trabajo, principales indicadores.

INDEC (2010), Database. http://www.indec.gov.ar/.

INEGI (2005), Sistema para la consulta del Cuaderno Estadístico de la Zona Metropolitana de la Ciudad de México. Edición 2005. http://www.inegi.gob.mx/est/contenidos/espanol/sistemas/cem05/estatal/df/m001/index.htm.

____ (2005b), Estadísticas del Medio Ambiente del Distrito Federal y Zona Metropolitana 2002. http://www.inegi.gob.mx/prod_serv/contenidos/espanol/bvinegi/productos/integracion/sociodemografico/medioambdf/2002/archivo1.pdf.

____ (2007), Sistema de consulta Cuaderno Estadístico de la Zona Metropolitana de la Ciudad de México. http://www.inegi.gob.mx/.

____ (2009), Información estadística: Principales características del sistema de transporte Colectivo Metro. http://www.inegi.org.mx/inegi/default.aspx?s=est&c=6359&e=&i=.

____ (2009b), Estadísticas de cultura. Serie de tabulados básicos de cultura. http://www.inegi.org.mx /est/contenidos/espanol/sistemas/cultura/cultura04_05/default.asp. Consulted May 7th, 2009.

INEI/UNICEF (2008), Estado de la Niñez en el Perú. Resumen ejecutivo. Lima.

Instituto Brasileiro de Geografia e Estatística (IBGE) (2010), Síntese de Indicadores Sociais Uma Análise das Condições de Vida da População Brasileira. Estudos e Pesquisas Informação Demográfi ca e Socioeconômica, N° 27 Ministério do Planejamento, Orçamento e Gestão Instituto Brasileiro de Geografi a e Estatística – IBGE. Rio de Janeiro 2010.

____ (2009), Ciudades@ São Paulo. http://www.ibge.gov.br/cidadesat/topwindow.htm?1.

Instituto de Desarrollo Urbano (IDU) (2009), Mejoramiento integral de barrios. http://www.idu.gov.co /web/guest/malla_prog_barrios.

____ (2010), Desmarginalzaciòn. http://www.idu.gov.co/web/guest/malla_prog_desmarginalizacion.

Instituto Nacional de Cultura (INC) (2008), Ministerio de Cultura. http://inc.perucultural.org.pe/.

____ (2009), Patrimonio cultural inmueble colonial y republicano. http://www.inc.gob.pe/textos/LISTADO_PATRIMONIO.xls.

Instituto Nacional de Estadistica Chile (INE) (2005), Chile: Proyecciones y Estimaciones de Población. Total país 1950-2050.

____ (2006a), Demografía, ganancia en años de vida y riesgo de muerte 1992-2002. http://www.ine.cl /canales/chile_estadistico/demografia_y_vitales/demografia/pdf/ganancia_de_vida.pdf.

____ (2006b), Enfoque Estadistico: Energía Eléctrica. Boletín Informativo del Instituto Nacional de Estadística. 16 de Junio 2006.

____ (2007), Ingresos de hogares y personas. 2006. Santiago de Chile.

____ (2008), Estadísticas Vitales. Informe Anual 2005. http://www.ine.cl/canales/chile_estadistico/demografia_y_vitales/estadisticas_vitales/ estadisticas_vitales.php.

____ (2008b), Medio Ambiente. Informe Anual 2006. Santiago de Chile.

____ (2008c), Distribucion y consumo energetico en Chile. Enfoque Estadístico Septiembre 2008.

____ (2008d), Encuesta Nacional urbana de Seguridad Ciudadana (ENUSC), 2007. Presentación abril, 2008.

____ (2008e), Resultados encuesta presupuestos familiares (nov. 2006-oct. 2008). http://www.ine.cl /canales/chile_estadistico/encuestas_presupuestos_familiares/2008/Resultados%20EPF19_05.pdf.

____ (2009), Base de datos. http://www.ine.cl/canales/base_datos/base_datos.php. Consulted between March and May, 2009.

____ (2010), Estadísticas demográficas y vitales. Proyecciones de población. http://www.ine.cl/canales/menu/indice_tematico.php. Online data base consulted between February and May 2010.

Instituto Nacional de Estadística e Informática (INEI) (2001), Principales resultados de la encuesta Nacional de Hogares sobre condiciones de vida y pobreza. http://www.mesadeconcertacion.org.pe/documentos/general/2002_0139.pdf.

____ (2007), Perú. Compendio Estadístico, 2007.

____ (2007b), Censo Nacional 2007_XI de Población y VI de Vivienda.

____ (2008), Perú. Crecimiento y distribución de la población 2007. Primeros resultados. Download 02.12.2008.

____ (2009), Estadísticas Ambientales 2009. http://iinei.inei.gob.pe/iinei/sisd/index.asp.

International Council on Clean Transportation (2003), Clean gasoline and diesel –the foundation for modern vehicles and clean air. Sulfur Policymaker Briefing.

IPSOS Apoyo Opinión y Mercado (2009), Perfil DIME, 2009. www.dime.com.pe.

Jacobi, Pedro (2003), Participación de la ciudadanía y fortalecimiento de su intervención activa en la lucha contra la contaminación atmosférica en América Latina. In: Daniela Simioni (Ed.): Contaminación atmosférica y conciencia ciudadana. Libros de la CEPAL 73. 67-94.

Jannuzzi, Martinno (1998), Income and poverty levels of vulnerable groups in the nineties in São Paulo Metropolitan Area. http://www.iussp.org/Brazil2001/s40/S48_P02_Jannuzzi.pdf.

Janoschka, Michael (2002), El nuevo modelo de la ciudad latinoamericana: fragmentación y privatización. In: eure 28 (85): 11-20.

Jaramillo, Fidel (2004), La competitividad de ciudades y regiones: experiencia y lecciones del PAC. Seminario Internacional Ciudades Región en el Nuevo Sistema Económico Internacional Ciudades- Bogotá.

JICA; Consejo de Transporte de Lima y Callao; Ministerio de Transportes y Comunicaciones de la República del Perú (2004): Plan Maestro de transporte urbano para el Área Metropolitana de Lima y Callao en la República del Perú. Prioridad del transporte público. http://www.protransporte.gob.pe/pdf/info/publi2/Resumen%20Plan%20Maestro.pdf .

Jordán, Ricardo and Rodrigo Martínez (2009), Pobreza y precariedad urbana en América Latina y el Caribe. Situación actual y financiamiento de políticas y programas. CEPAL Colección Documentos de proyectos.

Katz, Ricardo (2006), Contaminación del aire en Santiago: estamos mejor que lo que creemos, pero a mitad de camino. In: A. Galetovic (Ed.): Santiago. Dónde estamos y hacia dónde vamos. Santiago: CEP. 333-369.

Kopfmüller, Jürgen; Brandl, Volker; Jörissen, Juliane; Paetau, Michael; Banse G.; Coenen, R. and Grunwald Armin (2001), Nachhaltige Entwicklung integrativ betrachtet. Konstitutive Elemente, Regeln, Indikatoren. Berlin.

Kopfmüller, Jürgen; Jörissen, Juliane; Brandl, Volker; Grünwald, Armin and Michael Paetau (2005), El concepto integrativo de desarrollo sostenido. Internal document of Working Group Risk-Habitat-Megacity, Helmholtz Gemeinschaft: 3-6.

Korc, Marcelo E. and Aída Figari Bello (2000), Diagnóstico de las emisiones del parque automotor del área metropolitana de Lima y Callao. XXVII Congresso Interamericano de Engenharia Sanitária e Ambiental.

Lacasaña-Navarro, Marina; Aguilar-Garduño, Clemente and Isabelle Romieu (1999), Evolución de la contaminación del aire e impacto de los programas de control en tres megaciudades de América Latina. In: salud pública de México 41 (3): 203-215.

Lin, et al. (2004), Air pollution and neonatal deaths in São Paulo, Brazil. In: Brazilian Journal of Medical and Biological Research 37: 765-770.

Línea capital (2009), Argentina no tiene planes contra el cambio climático. www.lineacapital.com.ar/?noticia=25668.

Loftus, Alexander J. and David A McDonald (2001), Of liquid dreams: a political ecology of water privatization in Buenos Aires. In: Environment and Urbanization 13 (179).

López, Flor (2006), Niveles de dotacion de agua y drenaje en la Zona Metropolitana de la Ciudad de México. En A. G. Aguillar (Ed.): Las grandes aglomeraciones y su periferia regional. Experiencias en Latinoamérica y España. Ciudad de México. 143-169.

Loyola, Roger and Soncco Carlos (2007), Salud y calidad de agua en zonas urbano-marginales de Lima Metropolitana. In: Revista Economía y Sociedad 64: 80-85.

Ludeña, Wiley (2002), Lima: poder, centro y centralidad: del centro nativo al centro neoliberal. In: Eure 28 (83): 45-65.

Ludeña, Wiley (2006), Ciudad y patrones de asentamiento: estructura urbana y tipologización para el caso de Lima. In: Eure 32 (95): 37-59.

Lupano, Jorge A. and Ricardo J. Sánchez (2009), Políticas de movilidad urbana e infraestructura urbana de transporte. CEPAL, Colleccion Documentos de proyectos.

Malpartida, Alejandro R. (2003), La Cuenca del Río Matanza – Riachuelo. Revisión de antecedentes de recursos naturales, compuestos xenobióticos y otros polutantes en la cuenca.

Manrique Luis Esteban G. (2006), Un poder paralelo: el crimen organizado en América Latina. Real Institute Elcano. Área: América Latina - ARI Nº 84 /2006.

Marteau, Juan Félix (2002), Azul casi negro. La gestión policial en Buenos Aires. Notas para una política policial democrática. In R. Briceño-León (Ed.) Violencia, Sociedad y Justicia en América Latina. Buenos Aires: CLACSO: 77-113.

Martínez Lemoine, René (2006), Densificar Santiago. Una receta equivocada. In: Diseño Urbano y Paisaje 3 (8).

Martínez Pizarro, Jorge (2003), El encanto de los datos. Sociodemografía de la inmigración en Chile según el censo de 2002. CEPAL, Serie Población y desarrollo 49. Santiago de Chile.

McGranahan, G.; Jacobi. P.; Songsore, J.; Surjadi, C.; Kjellén, M. (2001), The Citizens at Risk: From Urban Sanitation to Sustainable Cities. London: Earthscan.

Mendivelso Lopez, Domingo et al. (2007), Bogota. In: M. Hermelin (Ed.). El entorno natural en 17 ciudades de Colombia. Universidad de Eafit. Medellín.

Metro D.F. (2009), Cifras de operación, 2008. http://www.metro.df.gob.mx/operación/cifrasoperacion.html.

Metro S.A. (2008), Memoria anual Metro S.A., 2007. Anexo estadístico. http://www.metrosantiago.cl/corporativo/memoria.

Metrovivienda (2010), Institucional. ¿Quiénes somos? http://www.metrovivienda.gov.co.

Metrovivienda (2010b), Balance de la gestión del Subsidio Distrital de Vivienda 2005 – 2010. http://www.metrovivienda.gov.co/portel/libreria/php/frame_detalle.php?h_id=296.
Mideplan and INE (2006), Regiones 1990-2005. Panorama Económico y Social. Región Metropolitana de Santiago.
Ministerio del Ambiente (MINAM) (2005), Demanda bioquímica de oxígeno (DBO5) en el Río Rimac 2003. http://www.minam.gob.pe:8080/sinia/index.php?idEstadistica=93.
Ministerio de Educación (MINEDU) (2004), Indicadores de la educación Perú, 2004. http://escale.minedu.gob.pe/downloads/indicadores/gasto_publico_en_educacion_por_alumno-escale.pdf.
Ministerio de Energía y Minas (MINEM) (2004), Indicadores departamentales en el subsector eléctrico. http://www.minem.gob.pe/archivos/dge/mapas/ED/02tripticomapa2004.pdf.
____ (2008), Guía de orientación del uso eficiente de la energía y de diagnósticos energéticos. Sector Residencial.
Ministério da Ciência e Tecnologia (2007), Análise da Vulnerabilidade da População Brasileira aos Impactos Sanitários das Mudanças Climáticas. Brasília, Janeiro de 2007.
Ministerio de Economía y Finanzas (2001), Estudio de oferta y demanda de agua potable y alcantarillado. Lima y Callao. http://www.mef.gob.pe/AGUAPOTABLE/ lima_informefinal1 .pdf.
Ministerio de Economía y Finanzas (2002), Estudio de oferta y demanda de los servicios de agua potable y alcantarillado de Lima y Callao.
Ministerio de Educación (2009), http://www.me.gov.ar/cgecse/caba/5_5_1_educacion.pdf.
Ministerio de Justicia, Derechos Humanos y Seguridad (2010), Estadísticas en Materia de Criminalidad.
Ministerio de la Mujer y Desarrollo Social (2001), Indicadores sociales Lima, http://www.mimdes.gob.pe/locales/indicadores/lima3.htm.
Ministerio de la Mujer y Desarrollo Social (2010), Compendio Estadístico del MIMDES 2010. http://www.mimdes.gob.pe/files/DIRECCIONES/DGPDS/compendio/capituloI_1_28.pdf.
Ministerio de Planificación División Social (MIDEPLAN) (2005), Habitando la calle. Catastro nacional de personas en situación de calle.
____ (2006), Encuesta de caracterización socioeconómica nacional. www.mideplan.cl/casen.
Ministerio de Salud de la Argentina (2007), Perfil SANA 2007. Perfil de la Salud Ambiental de la Niñez en la Argentina. http://www.msal.gov.ar/htm/site/promin/UCMISALUD/.
Ministerio de Trabajo y Promoción del Empleo (2006), Encuesta de hogares especializada en niveles de empleo 2006. El empleo en Lima Metropolitana.
Ministerio del Interior (2010), Delitos de mayor connotación social. Estadísticas anuales 2001–2009. http://www.seguridadpublica.gov.cl/delitos_de_mayor_connotacion_social.html.
Miraglia, Simone Georges El Khouri et al. (2005), An evaluation of Air Pollution Health impacts and costs in São Paulo, Brazil. Enviromental Management 35 (5): 667-676.
Mollá Ruíz-Gómez, Manuel (2006), El crecimiento de los asentamientos irregulares en áreas protegidas. La delegación Tlalpan. Investigaciones Geográficas, Boletín del Instituto de Geografía, UNAM, 60: 83-109.
Mönckeberg, Fernando (2003), Prevención de la desnutrición en Chile experiencia vivida por un actor y espectador. In: Revista chilena de nutrición. 30: 160-176. http://www.scielo.cl /scielo.php?pid=s0717-75182003030100002&script=sci_arttext.
Mondragón, Sandra (2007), Promotores privados de áreas residenciales en Bogotá. In: J. C. del Castillo Daza et al. (Ed.): Áreas residenciales en Bogotá. Bogotá: Universidad Nacional de Colombia. 84-103.
Montaner, Josep María and Zaida Muxi (2008), Acupuntura Urbana. Culturas La Vanguardia, 13 de Febrero 2008, http://www.josepmariamontaner.cat/arti/lavanguardia/São_paulo.pdf.
Mora, C.H. and S. de Oliveira (2006), Environmental exergy analysis of wastewater treatment plants. In: Engenharia Termica 5 (2): 24-29.
Mora Reyes, José Ángel (2006), El problema de la basura en la Ciudad de México. http://www.fundacion-christlieb.org.mx/estudios/estudio30.pdf.
Moraes Valença, Marcio (2008), Cidade (i)legal. Mauad Editora.

Moreno, Orlando E. (2008), Tendencias recientes en el proceso de metropolizacion del oriente de la ZMCM. In: P.C. Xavier Perreira and R. Hidalgo (Ed.): Producción inmobiliaria y reestructuración metropolitana en América Latina. São Paulo: FAU USP. 107-115.

Moura-de-Sousa, Carolina and Maria Regina Alves Cardoso (2002), Urban noise in the City of São Paulo, Brazil: An important problem of public health. In: Noise & Health 16 (4): 57-63.

Munich Re Münchener Rückversicherungs-Gesellschaft (2005), Statistics and natural hazard risk for 50 selected megacities. www.munichre.de.

Municipalidad de General San Martín (2007), Diagnóstico de San Martín. http://base.centrourbal.com /urbal/documentos/15_20071161040_R10P6-04A-dt14-spa.pdf Download June 29th, 2009.

Municipalidad Metropolitana de Lima (2007), Plan de Acción y Presupuesto 2007. http://www.munlima.gob.pe/Descarga/Presupuesto/ppto%202007-web.pdf.

Muricato E Ferreira, J.S.W (2002). Operaçao Urbana Consorciada: Diversificaçao Urbanística Participativa au Profundamento da Desigualdade. In Osorio, L.M. "Estatuto da Cidade e Reforma Urbana, novas perspectivas para as cidades brasileiras". Porto Alegre/ São Paulo: Sergio Antonio Fabris Editor.

Naranjo, Gloria (2008), Instrumentos de ordenamiento territorial en el espacio rural; ¿ordenan? En: Gloria Yañez Warner et al. (Ed.): Ciudad, Poder, Gobernanza. Santiago de Chile: Colección Rideal / Geo Libros Nº 9: 175-200.

Navarro, Bernardo (2007), Los escenarios críticos del transporte en la Zona Metropolitana de la Ciudad de México. In: Simposio Urb-3 Como las crisis transformarán las metrópolis latinoamericanas.

Newman Peter & Isabell Jennings (2008), Cities as sustainable ecosystems. Principles and practices.

N.N. (2006), Análisis de la Situación Ambiental en la cuenca Matanza-Riachuelo. http://www.metropolitana.org.ar/archivo/cuenca_matanza_riachuelo/pdf/ANEXO%20II.pdf.

Nobre, Eduardo A.C. (2008), A precaridade do habitat e política de habitacao de interesse social: o caso da Grande São Paulo. In: P.C. Xavier Perreira and R. Hidalgo (Ed.): Producción inmobiliaria y reestructuración metropolitana en América Latina. 245-256.

Observatorios Ambientales Urbanos (OAU) (2009), Glosario. http://oau.colnodo.apc.org/glosario-c.php.

Observatorio Ambiental de Bogotá DAMA (2009), Reduccion de la emisión de gases producidos en el relleno sanitario Doña Juana. http://observatorio.dama.gov.co/anexos/pdf/memorias/2.pdf.

Oceba (2009), Cuadro tarifario de las distribuidoras provinciales. http://www.oceba.gba.gov.ar/ Paginas/tarifas/CTrimOct08.pdf.

OJP Office of Justice Programs (2009), Terms & definitions. http://bjs.ojp.usdoj.gov/index.cfm?ty= tdtp&tid=9.

Orellana, Arturo and Luis Fuentes (2008), El arco, el cono y los clusters: geometrías espaciales para la gobernabilidad metropolitana y local de Santiago. En: Gloria Yañez Warner et al. (Ed.): Ciudad, Poder, Gobernanza. Santiago de Chile: Colección Rideal/Geo Libros Nº 9. 111-132.

Organisation for Economic Cooperation and Development (OECD) (2008), Programme for International Student Assessment (PISA). Database PISA, 2006. http://pisa2006.acer.edu.au/ interactive_results.php; Consulted 18.12.2008.

____ (2002), Estrategias de Desarrollo Sostenible. Libro de Consulta. París.

Organización Mundial de Salud (OMS) (2005), Guías de calidad de aire de la OMS relatival al material pariculado, el ozono, el dióxido de nitrógeno y el dióxido de azufre. Resumen de evaluación de los riesgos.

OPS/PAHO Organización Panamericana de la Salud (2003), Gestión de residuos sólidos en situación de desastre. Serie Salud ambiental y desastre Nº 1.

____ (N.N.), Instrucciones y lineamientos para la preparación del informe analítico del país. http://www.bvsde.ops-oms.org/bvsars/fulltext/informe/anexos.pdf.

OSINERG (2010), Pliego Tarifario Máximo del Servicio Público de Electricidad http://www2.osinerg. gob.pe/Tarifas/Electricidad.

Ospina, Carlos H. (2005), Oportunidades para el desarrollo de Proyectos de Reducción de Emisiones de Metano en el marco del Mecanismo para un Desarrollo Limpio. Paper presented at: 1er Seminario - Taller Internacional Sector Petroleo y Gas. Colombia, Bogotá, 6-7 October 2005.

Ovalles, Eduardo (2005), ¿Crisis de la Seguridad? Buenos Aires: Nueva Mayoría.

Pacheco, Margarita (2009), Plataforma de Concertación Interinstitucional de Región Capital Bogotá Cundinamarca. Informe Final. Bogotá.

Pacheco, Margarita (2009), La Gestión del Agua Lluvia y el Riesgo Urbano. Plataforma Latinoamericana de Riesgo Urbano. EIRD. Panamá.

Pardo, Carlos Felipe (2009), Los cambios en los sistemas integrados de transporte masivo en las principales ciudades de América Latina. CEPAL Colección Documentos de proyectos.

Paredes P., Pervis et al. (2006), Contaminación Vehicular en Lima y Callao y propuestas de solución. Informe final.

Parnreiter, Christof (2005), Tendencias de desarrollo en las metrópolis latinoamericanas en la era de la globalización: los casos de Ciudad de México y Santiago de Chile. In: Eure 31 (92) 5-28.

Parnreiter, Christof, Fischer, Karin and Imhof, Karen (2007), El enlace faltante entre cadenas globales de producción y ciudades globales: el servicio financiero en Ciudad de México y Santiago de Chile. In: Eure 33 (100):135-148.

Pasternak Taschner, Suzana (2003), Brasil y sus favelas. In: Ciudad y Territorio. Estudios Territoriales XXV (136-137): 315-333.

Pasternak, Suzana (1999), Um Olhar sobre a Habitaçao em São Paulo. São Paulo. Cadernos Metropole (PUCSP). 81-117.

PEEL Programa de Estadistica y Estudios Laborales (2007), Indicadores Laborales. Noviembre, 2007. http://www.mintra.gob.pe/peel/publicaciones/indicadores/2007/triptico_nov_2007.pdf. Download July 9th, 2009.

Peralta, José Antonio (1998), El ruído en la Ciudad de México. In: Ciencias 50. 60-66.

Pereira, José Cesar Javier and Rodrigo Hidalgo (2008), Producción inmobiliaria y reestructuración metropolitana en América Latina. In: Pereira J.C.J. and Hidalgo, R. (Ed.): Producción inmobiliaria y reestructuración metropolitana en América Latina. Santiago: Serie GEO Libros 11.

Perry, Guillermo E. et al. (2007), Informalidad: Escape y exclusión. Estudios del Banco Mundial sobre América Latina. The World Bank: Washington D.C.

Pessoa, L. and Bógus, L.M.M. (2008), Operaçoes Urbanas Nova forma de Incorporaçao Inmobiliaria: O caso das Operaçoes Urbanas Consorciadas Farina Lima e Agua Espraiada: São Paulo: Cuadernos Metrópoli (PUCSP) 20. 125-139.

Petrella Laura and Vanderschueren Franz (2003), Ciudad y violencia - Seguridad y ciudad.

Pflieger, Geraldine (2008), Historia de la universilación del acceso al agua y alcantarillado en Santiago de Chile (1970-1995). In: Eure 34 (103), 131-152.

Pírez, Pedro (2002), Buenos Aires: fragmentation and privatization of the metropolitan city. In: Environment and Urbanization 14 (1), 145-158.

____ (2008), Gobernanza metropolitana, centralización jurisdiccional y relaciones políticas. In: Gloria Yañez Warner et al. (Ed.): Ciudad, Poder, Gobernanza. Santiago de Chile: Colección Rideal / Geo Libros Nº 9: 91-110.

____ (2009), Gestión. In: Atlas Ambiental de Buenos Aires. http://www.atlasdebuenosaires.gov.ar Download June 29th, 2009.

Platzer, Lisbeth et al. (2007), Medición de los niveles de ruído ambiental en la Ciudad de Santiago. In: Otorrinolaringología 67: 122-128.

Programa de las Naciones Unidas para el Desarrollo (PNUD) (2008), Bogotá una apuesta por Colombia. Informe de Desarrollo Humano 2008.

Programa de las Naciones Unidas para el Desarrollo (PNUD) and Comision Nacional de Energía (CNE) (2005), Talleres de Discusión: Política Energética Sustentable.

Programa de Naciones Unidas para el Medio Ambiente (PNUMA) (2003a), Perspectivas del medio ambiente urbano. Geo Bogotá. http://www.pnuma.org/geociudades/PDFs/completobogot%E1.pdf.

____ (2003b), Perspectivas del medio ambiente urbano. Geo Buenos Aires. http://www.pnuma.org/geociudades/PDFs/GEO%20Buenos%20Aires%20completo.pdf.

____ (2003c), Perspectivas del medio ambiente Urbano. Geo México. http://www.pnuma.org/geociudades/PDFs/geoMéxico.pdf.

____ (2003d), Perspectivas del medio ambiente Urbano. Geo Santiago. http://www.pnuma.org/ geociudades/PDFs/LibroFinal.pdf.
____ (2003e), Panorama do Meio Ambiente Urbano. Geo cidade de São Paulo. http://www.pnuma.org /geociudades/PDFs/GEO%20São%20Paulo-r.pdf.
____ (2003f), Metodología para la elaboración de los informes GEO Ciudades. Manual de aplicación Versión 1.
____ (2006), Resumen de prensa Daily News, Martes 29 de agosto de 2006 http://www.pnuma.org/ informacion/noticias/2006-08/29ago06_e.doc.
Programa de Naciones Unidas para el Medio Ambiente (PNUMA) (2005), Perspectivas del medio ambiente urbano. Geo Lima y Callao. http://www.pnuma.org/geociudades/PDFs/completobogot %E1.pdf.
Poduje, Iván (2006), El globo y el acordeón: planificación urbana en Santiago. In: A. Geletovic (Ed.): Santiago. Dónde estamos y hacia dónde vamos. Santiago: CEP. 231-276.
Pope, C.A.; Ezzati, M.; Dockery, D.W. (2009), Fine-particulate air pollution and life expectancy in the United States. The New England Journal of Medicine 360 (4): 376-386.
Portal ODM Acompanhamento Municipal dos Objetivos de Desenvolvimento do Milênio (2009), Sistemas de Indicadores Municipais On-line. www.portalodm.com.br.
Porter, Michael (1995), The competitive advantage of the inner city. In: Harvard Business Review 73 (3): 55-71.
Porter, Michael (1996), Competitive Advantage, Agglomeratión Economics, and Regional Policy. In: International Regional Science Review 19 (1&2): 85-93.
Portes, Alejandro and Bryan Roberts (2005), Empleo y desigualdad urbanos bajo el libre Mercado. Consecuencias del experimento neoliberal. In: Nueva Sociedad 193: 76-96.
Prefeitura da Cidade de São Paulo (2009), Programa de coleta seletiva: participe. www.portal.prefeitura.sp.gov.br/secretarias/servicoseobras/limpurb/0005.
____ (2008), Municipio em datos. http://www9.prefeitura.sp.gov.br/sempla/ md/index.php?texto= tabela&ordem_tema=3&ordem_subtema=4.
____ (2009), Red URB AL 10. Lucha contra la pobreza urbana. Eje 5. Elementos circunstanciales de la problemática habitacional y urbana en Brasil. http://portal.prefeitura.sp.gov.br/urbal /espanhol/conferenciadelancamento/0016.
Presidencia del Consejo de Ministros (2009), Boletín Estadístico Social. Departamento de Lima. http://www.crecer.gob.pe/boletines/Lima.pdf.
Prévôt Schapira, Marie-France (2002), Buenos Aires en los años 1990: metropolización y desigualdades. In: Eure 28 (85): 31-50.
Prévot-Schapira, Marie-France and Cattaneo Pineda, Rodrigo (2008), Buenos Aires: la fragmentación en los intersticios de una sociedad polarizada. In: Eure 34(103).73-92.
Programa Universitario de Estudios de la Ciudad, PUEC- UNAM. http://www.puec.unam.mx/.
Pulache Vilchez, Wilmer and Lourdes Menis Alvarez (2009), Climatología urbana y cambio climático en Lima Metropolitana. Encuentro científico cambio climático en el Perú: impactos económicos y sociales, SENAMHI, March, 2009.
Pütz, Marco and Johannes Rehner (2007), Macht in konfliktreichen Grossprojekten der Stadtentwicklung Revitalisierung des Hafens Puerto Madero in Buenos Aires. En: DisP – Swiss Planning Review. 171 (4). 36-49.
Renn, Ortwin; Schweizer, Pia-Johanna; Dreyer, Marion und Andreas Klinke (2007): Risiko. Über den gesellschaftlichen Umgang mit Unsicherheit. München: Oekom Verlag.
Reporte Inmobiliario (2004), Economía & real estate. 4 de julio, 2004. www.reporteinmobiliario.com /nuke/modules.php?name=New s&file=print&sid=262.
República Argentina (2007), Segunda Comunicación Nacional de la República de Argentina a la Convención de las Naciones Unidas sobre Cambio Climático, 2007.
Riofrio, Gustavo (2003), Urban Slums Report: the case of Lima Perú. In: Understanding Slums: Case Studies for the Global Report on Human Settlements 2003. http://www.ucl.ac.uk/dpuprojects/ Global_Report/pdfs/Lima_bw.pdf.

Ríos, Diego and Pedro Pirez (2008), Urbanizaciones cerradas en áreas inundables del municipio de Tigre: ¿producción de espacio urbano de alta calidad ambiental? In: Eure 34 (101): 99-119.

Rivadeneira S., Luis (2000), América Latina y el Caribe: crecimiento económico sostenido, población y desarrollo. CEPAL, Serie Población y desarrollo N° 2.

Riwilis; Viviana (2008), Los barrios cerrados en las metrópolis latinoamericanas. ¿Nuevo producto inmobiliaria o una nueva forma de habitar la ciudad? El caso de Nordelta en Buenos Aires. In: P.C. Xavier Pereira and R. Hidalgo (Ed.): Producción inmobiliaria y reestructuración metropolitana en América Latina. São Paulo: FAU USP. 119-135.

Rocco, Roberto (2005), La Operación Urbana Faria Lima. In: Marisa Carmona (Ed.): Globalización y Grandes Proyectos Urbanos. La respuesta de 25 ciudades. Buenos Aires: Ediciones Infinito. 426-432.

Rodríguez Vignoli, Jorge (2008), Dinámica sociodemográfica metropolitana y segregación residencial: ¿qué aporta la CASEN 2006? In: Revista de Geografía Norte Grande 41: 81-102.

____ (2008), Movilidad cotidiana, desigualdad social y segregación residencial en cuatro metropolis de América Latina. In: Eure 34 (103). 49-71.

Rojas, Eduardo (2004), Volver al centro. La recuperación de áreas urbanas centrales. Washington: Banco Interamericano de Desallo.

Romero, Hugo et al. (2008), Sustentabilidad ambiental y crecimiento espacial de las metrópolis chilenas. En: Gloria Yañez Warner et al. (Ed.): Ciudad, Poder, Gobernanza. Santiago de Chile: Colección Rideal / Geo Libros N° 9: 383-412.

Romero, Hugo; Troncoso, Maritza y Ordenes, Fernando (2005), Argumentos cualitativos y cuantitativos para la evaluación estratégica del crecimiento de Santiago de Chile. En: R. Hidalgo, R. Trumper y A. Borsdorf (Ed.): Transformaciones urbanas y procesos territoriales. Lecturas del nuevo dibujo de la ciudad latinoamericana. Serie GEO Libros. Santiago de Chile. 223-245.

Rueda-García, Nicolás (2003), Urban Slums Reports: The case of Bogotá, Colombia. (=Understanding Slums: Case Studies for the Global Report on Human Settlements 2003).

Sabatini, Francisco and Brain, Isabel (2008), La segregación, los guetos y la integración social urbana: mitos y claves. In: eure 34 (103). 5-26.

Sabatini, Francisco and Gonzalo Cáceres (2004), Los barrios cerrados y la ruptura del patrón tradicional de segregación en las ciudades latinoamericanas: el caso de Santiago de Chile. In: Gonzalo Caceres and Francisco Sabatini (Ed.) Barrios cerrados en Santiago de Chile. Entre la exclusión y la integración residencial. Santiago de Chile, Lincoln Institute/Pontificia Universidad Católica de Chile.

Sabesp (2009a), Informe de sustentabilidad 2008. www.sustentabilidadesabesp.com.br.

____ (2009b), Tratamento de esgostos. www.sabesp.com.br.

____ (2009c), Números metropolitanas. www.sabesp.com.br.

____ (2010), Números. Região Metropolitana São Paulo. http://site.sabesp.com.br/site/interna/Default.aspx?secaoId=4.

Salama, Pierre (2008), Informe sobre la violencia en América Latina. In: Revista de Economía Institucional 10 (18): 81-102.

Sánchez-Rodríguez, Roberto et al. (2008) Urban Responses to Climate Change – a focus on the Americas. Workshop Report. Urbanization and Global Environmental Change. An IHDP core project. http://ccsl.iccip.net/ur2cc.pdf.

Santoas, Clemencia; Guarneros Lizbeth (2005), La expansión metropolitana en las áreas naturales protegidas y el suelo de conservación. Un análisis a partir de imágenes de satélite. En A. G. Aguillar (Ed.): Las grandes aglomeraciones y su periferia regional. Experiencias en Latinoamérica y España. Ciudad de México. 181-2000.

Sassen, Saskia (2007), El reposicionamiento de las ciudades y regiones urbanas en una economía global: empujando las opciones de políticas y gobernanza. In: Eure 33 (100): 9-34.

Satterthwaite, David et al. (2007), Adapting to Climate Change in Urban Areas. The possibilities and constraints in low- and middle-income nations. Human Settlements Discussion Paper Series. Theme Climate Change and Cities 1.

Satterthwaite, David. (Ed.) (1999), The Earthscan Reader in Sustainable Cities. London: Earthscan.
Scheinsohn, Mariano and Cecilia Cabrera (2009), Social movements and the production of housing in Buenos Aires; when policies are effective. In: Environment and Urbanization 21.
Schneider, Richard H. and Ted Kitchen (2002), Planning for Crime Prevention. A TransAtlantic Perspective. London: Routledge.
Schor, Silvia Maria and Mariso do Espirito Santo Borin (1997), Cortiços adaptados e concebidos na cidade de São Paulo. En São Paulo em Perspectivo 11 (1): 152-159.
Schteingart, Martha and Clara Salazar (2003), Expansión urbana, protección ambiental y actores socials en la Ciudad de México. In: Estudios Demográficos y Urbanos 18 (3): 433-460.
Schultz, J.; Brand, F.; Kopfmüller J. and Ott, K. (2008), Building a Theory of Sustainable development. Ywo Salient Conceptions within the German diccourse. In: International Journal for Environment and Sustainable Develoment 7 (4): 465-482.
SEADE Fundação Sistema Estadual de Análise de Dados (2009), Perfil Regional. Região Metropolitana de São Paulo. www.seade.gov.br.
Secretaría del Ambiente y Desarrollo Sustentable de la Nación (2009), Estadísticas Ambientales. www.ambiente.gov.ar.
Secretaría de Desarrollo Social (SDS) (2007), La Política Social del Gobierno del Distrito Federal 2000-2006. Una valoración general. http://www.sds.df.gob.mx/archivo/2007/documentos/ politica_social_df_2000_2006.pdf.
Secretaria de Desarrollo Urbano y Vivienda (SEDUVI) (2009), Situación en el D.F. Datos Estadísticos. http://www.seduvi.df.gob.mx/seduvi/vivienda/situacioneneldf.php.
Secretaría de Economia e planejamento do Estado de São Paulo (2007), Perfil Regional: Regiao Metropolitana de São Paulo.
Secretaría de Educación del Distrito Capital (2010), La educación en Bogotá. http://www.sedBogota. edu.co//index.php?option=com_content&task=view&id=245&Itemid=480.
Secretaría de Hacienda Distrital (2004), Cuadernos de la Ciudad. Serie Productividad y Competitividad Nº4.
Secretaría de Desarrollo Social, Gobierno del Distrito Federal (2008), Estructura del Gasto Social en el Distrito Federal 2008. http://www.sideso.df.gob.mx/documentos/ GASTO_ SOCIAL_2008.pdf.
Secretaría de Salud (2007), Salud: México 2006. Información para la rendición de cuentas. México D.F.
Secretaría de Saneamiento e Energía, Governo do Estado de São Paulo (2009), Consumo de energéticos por municipio. http://www.energia.sp.gov.br/energia/MunicipiosInfo.asp.
____ (2009), www.saneamento.sp.gov.br.
Secretaría Distrital de Ambiente (2009), Información general sobre la problemática de ruido. http://www.secretariadeambiente.gov.co/sda/libreria/php/decide.php?patron=03.1408.
Secretaría Distrital de Planeación (SDP) (2008), ECVB 2007: Sector vivienda en Bogotá. http://www.sdp.gov.co/www/resources/No_42_ecvb.pdf.
____ (2007), Comportamiento Sector Salud e Indicadores Demográficos. http://www.sdp.gov.co/www/resources/No_17_salud_demografia.pdf.
____ (2007b), Las tarifas de servicios públicos frente a la capacidad de pago de los hogares bogatanos. http://www.sdp.gov.co/resources/No_15_informalidad_laboral.pdf
____ (2007c), Sintesis de coyuntura No. 1: Comportamiento del Producto Interno Bruto, Inflación y Tipo de Cambio. http://www.sdp.gov.co/resources/coyuntura_%20No%201.pdf
Secretaria Municipal de Finanças (2009), Balance anual, 2008. www.prefeiura.sp.gov.br/cidade/ secretarias/financas/contaspublicas/.
Secretaría Municipal de Planejamento (SEMPLA) (2007), Municipios em mapas: Cultura e Territorio: Uma analise da Economia e dos Espaços Culturais na Cidade. São Paulo.
____ (2007), Olhar São Paulo, Contrastes Urbanos. São Paulo.
____ (2008), Olhar São Paulo – Violencia e Criminalidade. São Paulo.
Secretaria Municipal do Verde e do Meio ambiente and Centro de Estudos da Metrópole (2008), Indicadores Ambientais e Gestão Urbana. Desafios para a Construção da Sustentabilidade na Cidade de São Paulo. São Paulo.

Secretaria Municipal do Verde e do Meio Ambiente de São Paulo (2005), Inventário de Emissões de Gases de Efeito Estufa do Município de São Paulo. Elaboração: Centro de Estudos Integrados sobre Meio Ambiente e Mudanças Climáticas (Centro Clima) da Coordenação dos Programas de Pós-graduação de Engenharia (COPPE) da Universidade Federal do Rio de Janeiro (UFRJ), julho de 2005.

____ (2005), Inventario de Emisoes de gases de efeito estufa do Municipio do São Paulo.

SECTRA (2004), Encuesta Origen Destino de Viajes, 2001.

SECTRA (2010), Indicadores de movilidad, www.sectra.cl

SEDECO (2008), Comparecencia de la Secretaria de Desarrollo Económico. http://www.sedeco.df.gob.mx/actividades/informes/2008/ComparecenciaSeptiembre_08.pdf.

SEDECO (2008), Programa de la Secretaría de Desarrollo Económico, 2007-2012 http://www.sedeco.df.gob.mx/actividades/informes/programa_sedeco/PDE_2007_201_FINAL.pdf.

Secretaría Regional Ministerial de Planificación y Coordinación (Serplac) (2008), Análisis series Producto Interno Bruto, 2003-2006: Región Metropolitana de Santiago.

Servicio de Agua Potable y Alcantarillado de Lima (SEDAPAL) (2008), Memoria 2007. Todos podemos ahorrar agua. Lima.

Secretaría de Hacienda Distrital (SHD) (2007), Encuesta de calidad de vida, 2007, http://www.shd.gov.co/portal/page/portal/portal_internet/siec/SIEC.

____ (2009), Global City Indicators Bogotá. http://www.shd.gov.co/portal/page/portal/portal_internet/siec/SIEC/Indicadores%20globales%20de%20ciudad.

Secretaria dos Transportes Metropolitanas (STM) (2009), Integrated Urban Transport Plan for 2020 - Pitu 2020 http://www.stm.sp.gov.br/index.php?option=com_content&view=article&id=2227&Itemid=237.

Sheinbaum Pardo, Claudia (2005), Avances en la Calidad del Aire y Cumplimiento del PROAIRE. Paper presented at: Foro de calidad del aire en el distrito fedeal y cambio climatico. México D.F. 2-3 May 2005.

Sierra, Lucas (2006), Urbanismo por decreto: centralismo y confusión institucional en la ciudad chilena. In: A. Galetovic (Ed.): Santiago. Dónde estamos y hacia donde vamos. Santiago: CEP. 299- 328.

Sierra, Tania Maya (2007), Áreas residenciales y desarrollo urbano en Bogotá. La intervención estatal. In: J. C. del Castillo Daza et al. (Ed.): Áreas residenciales en Bogotá. Bogotá: Universidad Nacional de Colombia. 28-65.

Simioni, Daniela (2006), Tendencias y Desafíos en Temas de Contaminación del Aire para América Latina y el Caribe. Presentation held at the Foro sobre la Aplicación Regional de Desarrollo Sostenible en América Latina y el Caribe, Santiago de Chile, January 19 and 20 2006.

SINIA (2007), Evolución de la calidad del aire en Santiago, 1997-2004. http://www.sinia.cl/1292/articles-39731_recurso_1.pdf3.

____ (2010), Disposición final de residuos sólidos de Lima Metropolitana en rellenos sanitarios, según distrito, 2006-2007. http://sinia.minam.gob.pe/index.php?idEstadistica=3.

SINIM Database (2009), Sistema Nacional de Informacion Municipal. www.sinim.cl.

SISS Superintendencia de Servicios Sanitarios (2009), Informe anual de coberturas urbanas de servicios sanitarios 2008. Santiago de Chile.

Sistema de Informacion Energética (SIE) (2010), Ventas de energia electrica por región. http://sie.energia.gob.mx/sie/bdiController?action=login.

Secretaría del Medio Ambiente del Distrito Federal (SMA) (2004).

____ (2008), México City Climate Action Program, 2008-2012. Summary.

____ (2008b), Inventario de emisiones. Gases de Efecto Invernadero. Zona Metropolitana Valle de México 2006.

____ (2008c), Inventario de Emisiones de Contaminantes Criterio. Zona Metropolitana Valle de México 2006. http://www.sma.df.gob.mx/inventario_emisiones/index.php?op=cc.

____ Corena (2009), Áreas protegidas del Distrito Federal, 2007 INEGI. www.sma.df.gob.mx/corena/descargas/ conservacion/anp/caracteristicasanp.pdf.

____ (2009), Tercer Informe de Trabajo. Octubre, 2008 - Septiembre, 2009. http://www.sma.df.gob. mx/sma/links/ download/archivos/3er_informe_sma/3er_informe.pdf.
Sommerhoff, Gerhard and C. Weber (1999), Mexiko. Darmstadt: Wissenschaftliche Buchgesellschaft.
Suarez, José (1998), Parque automotor aun es principal factor contaminante: In: El Comercio, Lima, April 24, 1998. D-7.
Suárez, Francisco and Ruben J. Lombardo (2004), Pitting the polluted against the flooded: water resource management in Tigre, Buneos Aires. Environment and Urbanization 16: 185-198.
Subsecretaria de Urbanismo y Vivienda. Direccion Provincial de Ordenamiento Urbano y Territorial (N.N.), Lineamientos Estratégicos para la Región Metropolitana de Buenos Aires.
Svampa, Maristella (2001), Los que ganaron. La vida en los countries y barrios privados. Buenos Aires: Biblos.
Svampa, Maristella (2005), La sociedad excluyente. La Argentina bajo el signo del neoliberalismo. Buenos Aires: Taurus.
Teixeila, Paulo (2004), Slum upgrading in São Paulo and lessons in Brazil. http://www.citiesalliance.org/doc/events/2004/ppf-durban/slum-upgrading-São-paulo.pdf.
Tella, Guillermo (2005), Rupturas y continuidades en el sistema de centralidades de Buenos Aires. In: M. Welch Guerra (Ed.): Buenos Aires a la deriva. Transformaciones urbanas recientes. Buenos Aires: biblos. 29-73.
Thuillier, Guy (2005), El impacto socio-espacial de las urbanizaciones cerradas: el caso de la Región Metropolitana de Buenos Aires. In: Eure 31 (93): 5-20.
Tokman, Andrea (2006), El Minvu, la política habitacional y el crecimiento excesivo de Santiago. In: A. Galetovic (Ed.): Santiago. Dónde estamos y hacia dónde vamos. Santiago: CEP. 489-520.
Toledo, Ricardo (2008), Infraestructura, metrópolis y medio ambiente: cuestiones de gobernabilidad y regulación a partir del caso de la Region Metropolitana de São Paulo. En: Gloria Yañez Warner et al. (Ed.): Ciudad, Poder, Gobernanza. Santiago de Chile: Colección Rideal / Geo Libros No. 9: 431-455.
Torres, Haroldo et al. (2007), São Paulo peri-urban dynamics: some social causes and enviromental consequences. In: Environment & Urbanization. 19(1): 207-223.
Transantiago (2009), Acciones Medio Ambientales. http://www.transantiago.cl/web2005/cont19.htm.
____ (2009b), Proyecto GEF. http://www.transantiago.cl/web2005/cont22.htm.
Trumper, Ricardo (2005), Automóviles y microbuses: construyendo neoliberlasmo en Santiago de Chile. En: R. Hidalgo, R. Trumper y A. Borsdorf (Ed.): Transformaciones urbanas y procesos territoriales. Lecturas del nuevo dibujo de la ciudad latinoamericana. Serie GEO Libros. Santiago de Chile: 71-82.
UN Habitat / ROLAC (2005), El rostro de la pobreza en las ciudades de América Latina y el Caribe.
UN Habitat – United Nations Human Settlements Programme (2003), Global Report on Human Settlements 2003. The challenge of slums. London: Earthscan. http://www.unhabitat.org/.
____ (2003b), Slums of the World: The face of urban poverty in the new millennium? Monitoring the Millennium Development Goal, Target 11: World-wide Slum Dweller Estimation. Working Paper. Nairobi.
____ (2004) The State of the World's Cities. Globalization and Urban Culture. London: Earthscan.
____ (2004b), Urban indicators guidelines. Monitoring the habitat agenda and the Millennium development goals. http://ww2.unhabitat.org/programmes/guo/documents/urban_indicators_guidelines.pdf.
____ (2006), The State of the World's Cities. The Millenium Development Goals and Urban Sustainability. London: Earthscan.
____ (2007), Global Report on Human Settlements 2007. Enhancing Urban Safety and Security. London: Earthscan. http://www.unhabitat.org/.
____ (2008), State of the World Cities 2008-2009.
____ (2009), Planning Sustainable Cities: Global Report on Human Settlements 2009.
____ (2010): São Paulo: A Tale of Two Cities
UN – Population Division (2004), World Urbanization Prospects. The 2003 Revision. New York.

UN Stat – United Nations Statistics Division (2009), Environment Glossary. www.unstats.un.org/unsd/environmentgl/.

UN Stat – United Nations Statistics Division (2009b), Millenium Development Goals-Indicators. www.unstats.un.org/unsd/mdg/data.aspx.

UN Stat – United Nations Statistics Division (2010), Statistical Databases. Social Indicators. http://unstats.un.org/unsd/demographic/products/socind/default.htm.

UN –DESA (2006), World Urbanization Prospects: The 2005 Revision. Department of Economic and Social Affairs. Population Division. New York.

UNDG – United Nations Development Group (2003), Indicators for Monitoring the Millennium Development Goals. New York. Definitions, Rationale, Concepts and Sources. http://mdgs.un.org/unsd/mdg/Resources/Attach/Indicators/HandbookEnglish.pdf.

United Nations Development Programme (UNDP) (2004), Reducing Disaster Risk. A Challenge for Development. New York: UNDP Bureau for Crisis Prevention and Recovery. http://www.undp.org/bcpr/whats_new/rdr_english.pdf.

____ (2006), Human Development Report 2006. Beyond scarcity: Power, poverty and the global water crisis. New York.

____ (2009), Human Development Report 2009. Overcoming barriers: Human mobility and development. New York.

____ (2004), Methodology for the Preparation of GEO Cities Reports. Application Manual. Version 2. México D.F.

UNESCO (2004), Global education digests, 2004. Comparing education statistics across the world. Montreal.

UNESCO (2009), World heritage list. http://whc.unesco.org/en/list. Download May 7th 2009.

Universidad de Lima, Programa de estudios generales (2002), Parque automotor como problema ambiental.

Universidad Nacional de Colombia (2009), RedBogotá.com. Velocidad y tiempo de recorrido. www.redBogotá.com/endatos/0200/02-050-transporte/02.05.01.01.03.htm.

Urban Age Program Database (2009), http://www.urban-age.net/10_cities/_data/data_SP.html.

Urban Age Program (2009), Cities and Social Equity. Inequality, Territory and Urban form. London School of Economics and Political Science. London.

Uribe Botero, Eduardo (2005), The Water Treatment Plants of the Bogotá River. Case Study. Documento CEDE 2005-8. Electronic Edition. http://economia.uniandes.edu.co/es/investigaciones_y_publicaciones/cede/publicaciones/documentos_cede/2005/the_water_treatment_plants_of_the_Bogotá_river. Download: May 14th 2009.

Uribe-Mallarino, Consuelo (2008), Estratificación social en Bogotá: de la política pública a la dinámica de la segregación social.

Van Dijk, Jan; John van Kesteren and Paul Smit (2007), Criminal Victimisation in International Perspective Key findings from the 2004-2005 ICVS and EU ICS. Tilburg University, UNODC; UNICRI: Den Haag.

Varela Lima, Adriana (2007), Kennedy y Tunal I: modelos experimentales de vivienda. In: J. C. del Castillo Daza et al. (Ed.), Áreas residenciales en Bogotá. Bogotá: Universidad Nacional de Colombia. 154-161.

Veeduría Distrital de Bogotá (2003), Indicadores de condiciones de vida y aire de Bogotá, 2002 http://www.veeduriadistrital.gov.co/es/grupo/g289/ATT1214430069-1.pdf.

Veeduría Distrital de Bogotá (2008), Condiciones de Seguridad en Bogotá 2007. www.veeduriadistrital.gov.co Download: 16.12.2008.

Velasquez Barrero, Luz Stella (2005), Sostenibilidad Urban en América Latina. Metodologiea de Planificación y Medda de la Sostenibilidad de Ciudades Medianas de America Latina. Manizales.

Velez, Hildebrando (2006), Servicios públicos Colombia: Cuestión de democracia. In: Beatriz Mártinez Ruiz, et al. (Ed.): Por un modelo público de agua: Triunfos, luchas y sueños. Editorial Viejo Topo. Corporate Europe Observatory. 113-119.

Vidal-Koppmann, Sonia (2008), Dinámica de las urbanizaciones cerradas en la reconfiguración de la periferia metropolitana de Buenos Aires. In: P.C. Xavier Pereira and R. Hidalgo (Ed.):

Producción inmobiliaria y reestructuración metropolitana en América Latina. São Paulo: FAU USP. 137-165.
Villavicencio B., Judith and Pedro Hernández Santiago (NN), Vivienda social y sectores de bajos ingresos en la Ciudad de México: un encuentro imposible.
Vincent, Bill (2008), Sustainable transport in LAC. Successes and future challenge. Paper presented in Manila, September 10th, 2008.
Walsh / GNC (N.N.), EIA Redes Secundarias de las Otras Redes de Distribución en Lima y Callao. Download 06.01.2009.
Welch Guerra, Max and Paula Valentini (2005), Torres jardín en Buenos Aires. Proyecciones de una tpologia habitacional. In: M. Welch Guerra (Ed.): Buenos Aires a la deriva. Transformaciones urbanas recientes. Buenos Aires: biblos. 74-95.
Williams Montoya, Jhon (2009), Globalización, dependencia y urbanización: la transformación reciente de la red de ciudades de América Latina. In: Norte Grande 44: 5-27.
Winchester, Lucy (2006), Desafíos para el desarrollo sostenible de las ciudades en América Latina y El Caribe. In: eure 32 (96): 7-25.
Winchester, Lucy (2007), Harmony and Dissonance between Human Settlements and the Environment in Latin America and the Caribbean. ECLAC and UN Habitat Cooperation for the Preparation of State of the World's City Report 2008/09. Sustainable Development and Human Settlements Division, ECLAC.
Winchester, Lucy (2008), La dimensión económica de la pobreza y precariedad urbana en las ciudades latinoamericanas. Implicaciones para las políticas del hábitat. In: Eure 34 (103). 27-47.
World Bank, The (2000), Cities in Transition. World Bank Urban and Local Government Strategy. Washington D.C.
____ (2005), Key Development Data & Statistics. Country Profile.
____ (2007), The little green data book, 2007. Washington.
____ (2007b), World Development Indicators, 2007. Washington.
____ (2008), Global City Indicators Program Report. Part of a Program to Assist Cities in Developing an Integrated Approach for Measuring City Performance.
____ (2009), Reshaping Economic Geography. World Development Report, 2009. Washington.
____ (2010), World Development Indicators & Global Development Finance. Database. http://databank.worldbank.org.
World Health Organization (WHO) (2009b), Health Status Statistics: Mortality http://www.who.int /healthinfo/statistics/indunder5mortality/en/.
World Health Organization Europe (2005), Effects of air pollution on children's health and development. A review of evidence. Bonn.
World Health Organization (WHO) (1999), Guidelines for Community Noise http://www.who.int/docstore/peh/noise/Commnoise4.htm.
World Resources Institute (1996) World Resources 1996-1997. The urban environment. New York: Oxford University Press.
Yáñez Warner, Gloria (2008), Gobernabilidad y mercado de trabajo de mujeres: el buen gobierno ¿una salida posible? In: Gloria Yáñez Warner et al. (Ed.): Ciudad, Poder, Gobernanza. Santiago de Chile: Colección Rideal / Geo Libros Nº 9. 353-380.
Yañez, Gloria; Rehner, Johannes and Oscar Figueroa (2010), Redes empresariales e informales en el mercado inmobiliario de Santiago de Chile. In: Scripta Nova: Revista electrónica de geografía y ciencias sociales, 14 (331).
Yepes, Guillermo and Klas Ringskog (2001), Estudio de Oferta y Demanda Servicios de Agua Potable y Alcantarillado, Lima y Callao.
Zona Inmobiliaria (2010), Precio de viviendas en Santiago casi no ha variado en ocho años Lunes, 4 de enero del 2010. http://www.zonainmobiliaria.cl/.
Zuluaga Nieto, Jaime (2002), Guerra prolongada, negociación incierta: Colombia. In: R. Briceño-León (Ed.), Violencia, Sociedad y Justicia en América Latina. Buenos Aires: CLACSO. 339-367.
Zurita, Felipe (2006), ¿Nos estamos ahogando en basura? In: A. Galetovic (Ed.): Santiago. Dónde estamos y hacia dónde vamos. Santiago: CEP. 373-392.

Annexes

Annex 1

TABLE A-1
INTERNATIONAL EXCHANGE RATES
(Local currency / US$; current value; periods average)

	2001	2002	2003	2004	2005	2006	2007	2008
Argentina	1.00	3.06	2.90	2.92	2.90	3.05	3.10	3.14
Colombia	2299.63	2504.24	2877.65	2628.61	2320.83	2361.14	2078.29	1967.71
Peru	3.51	3.52	3.48	3.41	3.30	3.27	3.13	2.92
Mexico	9.46	9.34	9.66	10.79	11.29	10.90	10.90	10.93
Chile	634.94	688.94	691.40	609.53	559.77	530.28	522.46	522.46
Brazil	2.35	2.92	3.08	2.93	2.43	2.18	1.95	1.83

Source: World Bank Data Base.

TABLE A-2
INTERNATIONAL EXCHANGE RATES PPP
(Local currency / US$ ppp)

	2001	2002	2003	2004	2005	2006
Argentina	0.62	0.79	0.89	0.94	0.98	1.3
Colombia	708.18	742.32	785.63	815.09	829.55	1 080.6
Perú	1.50	1.48	1.51	1.54	1.56	1.5
Mexico	6.58	6.82	6.98	7.09	7.18	7.1
Chile	297.21	303.75	312.88	319.67	326.22	333.3
Brazil	0.91	0.98	1.12	1.19	1.23	1.4

Source: http://www.imf.org.

Annex 2

List of abbreviations

ACUMAR Autoridad de Cuenca Matanza, Riachuelo (Buenos Aires).

AMS Area Metropolitana Santiago (= Metropolitan Area of Santiago).

APERC Asia Pacific Energy Research Centre

AySA Agua y Saneamientos Argentinos S.A.

BCH Banco Central Hipotecario.

BOD Biological Oxygen Demand.

BOT Built Operate Transfer.

BRT Bus Rapid Transit.

CAR Corporación Autónoma Regional.

CASEN Encuesta de Caracterización Socioeconómica Nacional (Chile; = National Survey of Social and Economic Characteristics).

CDHU	Companhia de Desenvolvimiento Habitacional e Urbano.
CDM	Clean Development Mechanism.
CFE	Comisión Federal de Electricidad (Mexico) (Federal Electricity Comission).
CNE	Comisión Nacional de Energía (Chile) (= National Energy Comission).
COHAB/SP	Companhia Metropolitana de Habitacao de Sao Paulo.
CONAF	Corporación Nacional Forestal (Chile).
CONAM	Consejo Nacional del Ambiente (Perú).
CONAMA	Comisión Nacional del Medio Ambiente (Chile).
CONPES	Consejo de Política Económica y Social (Bogota).
CPTM	Companhia Paulista de Trens Metropolitanos (Sao Paulo)
CVM	Caja de vivienda militar.
CVP	Caja de vivienda popular.
D.F.	Distrito Federal.
DANE	Departamento Administrativo Nacional de Estadística (Colombia).
DAPD	Departamento Administrativo de Planeación Distrital (Colombia).
DIGESA	Dirección General de Salud Ambiental (Perú).
DLR	German Aerospace Centre.
DNP	Departamento Nacional de Planificacion (Colombia).
DSDHS	Division on Sustainable Development and Human Settlements.
EAH	Encuesta Anual de Hogares (Argentina).
ECLAC	Economic Commission for Latin America and the Caribbean.
ETOSS	Ente Tripartito de Obras y Servicios Sanitarios.
FAO	Food and Agriculture Organization of the United Nations.
FDI	Foreign Direct Investment.
FIPE	Fundaçao Instituto de Pesquisa Econômica; Universidade de Sao Paulo.
FLACSO	Facultad Latinoamericana de Ciencias Sociales.
FONAM	Fondo Nacional Ambiental (Perú).
FONAVI	Fondo Nacional de Vivienda.
GBA	Gran Buenos Aires.
GDF	Gobierno del Distrito Federal.
GEF	Global Environment Facility.
GEM	Gender Empowerment Measure.
GFZ	GeoForschungsZentrum Potsdam.
GORE	Gobierno Regional (Santiago).
HDI	Human Development Index.
HZI	Helmholtz Centre for Infection Research.

ICLEI	International Council for Local Environmental Initiatives.
ICT	Instituto de Crédito Territorial.
IGBE	Brazilian Statistical Institute (Brasil).
IGM	Instituto Geográfico Militar (Chile).
IHDP	International Human Dimensions Programme.
INC	Instituto Nacional de Cultura (Perú).
INDEC	Instituto Nacional de Estadística y Censos (Argentina).
INE	Instituto Nacional de Estadística (Chile).
INEGI	Instituto Nacional de Estadística y Geografía (Mexico).
INEI	Instituto Nacional de Estadística e Informática (Perú).
ISI	Institute for Scientific Information.
ITCZ	Intertropical Convergence Zone.
IVC	Instituto de Vivienda de la Ciudad.
JAL	Junta Administradora Local.
MAVDT	Ministerio del Ambiente, Vivienda y Desarrollo Territorial.
MDG	Millennium Development Goals.
MINAM	Ministerio del Ambiente (Perú).
MINURVI	Ministros y autoridades máximas de vivienda y urbanismo de América Latina y el Caribe.
MINVU	Ministerio de Vivienda y Urbanismo (Chile).
NBI	Necesidades Basicas Insatisfechas (Unsatisfied Basic Needs).
NGO	Non Governmental Organisation.
NGV	Natural Gas Vehicle.
NSCC	National Strategy of Climate Change (Mexico).
OAU	Observatorios Ambientales Urbanos.
OEI	Organización de Estados Iberoamericanos para la Educación la Ciencia y la Cultura.
OHSA	Ocupational Health and Safety Act (USA).
PACCM	Programa de Acción Climática de la Ciudad de Mexico.
PAN	Partido Acción Nacional (Mexico).
PDARM	Plan de Depollution Atmosférica para la Región Metropolitana
PDE	Plano Director Estratégico.
PEA	Población económicamente activa.
PET	Población en edad de trabajar.
PICCA	Programa Integral contra la Contaminación Atmosférica en el Valle de Mexico.
PITU	Integrated Urban Transport Plan (Sao Paulo).
PNA	Política Nacional Ambiental (Perú).
PNUD	Programa de Naciones Unidas para el Desarrollo.

PNUMA	Programa Naciones Unidas de Medio Ambiente.
POT	Programa de Ordenamiento Territorial.
PPP	Purchasing Power Parity.
PRD	Partido de la Revolución Democrática (Mexico).
PRI	Partido Revolucionario Institucional (Mexico).
PROAIRE	Programa para Mejorar la Calidad del Aire en el Valle de Mexico.
PROCLIM	Programa de Fortalecimiento de Capacidades Nacionales para manejar el Impacto del Cambio Climático y la Contaminación del Aire (Perú).
PROCONVE	Programa de Control de la Contaminación del Aire por Vehículos Automotores (Brazil)
PRONAMA	Programa Nacional de Movilización por la Alfabetización (Perú).
PTAR	Planta de Tratamiento de Aguas Residuales.
PUA	Plan Urbano Ambiental.
R&D	Research & Development.
RHM	Risk Habitat Megacities Research Initiative.
RMS	Metropolitan Region of Santiago.
RMSP	Metropolitan Region of Sao Paulo.
SABESP	Companhia de Saneamento Básico do Estado de Sao Paulo S.A.
SAyDS	Secretaría Ambiental y de Desarrollo Sustentable (Argentina).
SEADE	Fundação Sistema Estadual de Análise de Dados (Brasil).
SEC	Superintendencia de Electricidad y Combustibles.
SECTRA	Secretaría de Planificación de Transporte (Chile).
SEDAPAL	Servicio de Agua Potable y Alcantarillado de Lima.
SEDUVI	Secretaría de Desarrollo Urbano y Vivienda (Mexico).
SHD	Secretaria de Hacienda Distrital (Bogota).
SINIA	Sistema Nacional de Información Ambiental (Chile).
SINIM	Sistema Nacional de Información Municipal (Chile).
SISS	Superintendencia de Servicios Sanitarios (Chile).
SPCC	Special Program of Climate Change (Mexico).
STM	Secretaria dos Transportes Metropolitanas (Sao Paulo).
SUBDERE	Subsecretaría de Desarrollo Regional y Administrativo, Ministerio del Interior (Chile).
UCCI	Unión de Ciudades Capitales Iberoamericanas.
UGEC	Urbanization and Global Environmental Change.
UGRHI	Unidades Hidrográficas de Gerenciamento de Recursos Hídricos.
UN Habitat	United Nations Human Settlements Programme.
UNAM	Universidad Nacional Autónoma de Mexico.

UN-ECLAC	UN Economic Commission on Latin America and the Caribbean.
UNESCO	United Nations Educational, Scientific and Cultural Organization.
UNFCC	UN Framework Convention on Climate Change.
VOC	Volatile Organic Compounds.
WHO	World Health Organization.
ZEIS	Zonas Especiais de Interesse Social.
ZMCM	Zona Metropolitana Ciudad de Mexico (= Metropolitan Zone of Mexico City).
ZMVM	Zona Metropolitana Valle de Mexico (= Metropolitan Zone of the Mexico Valley).
ZODUC	Zonas de Desarrollo Urbanos Condicionado (Chile).