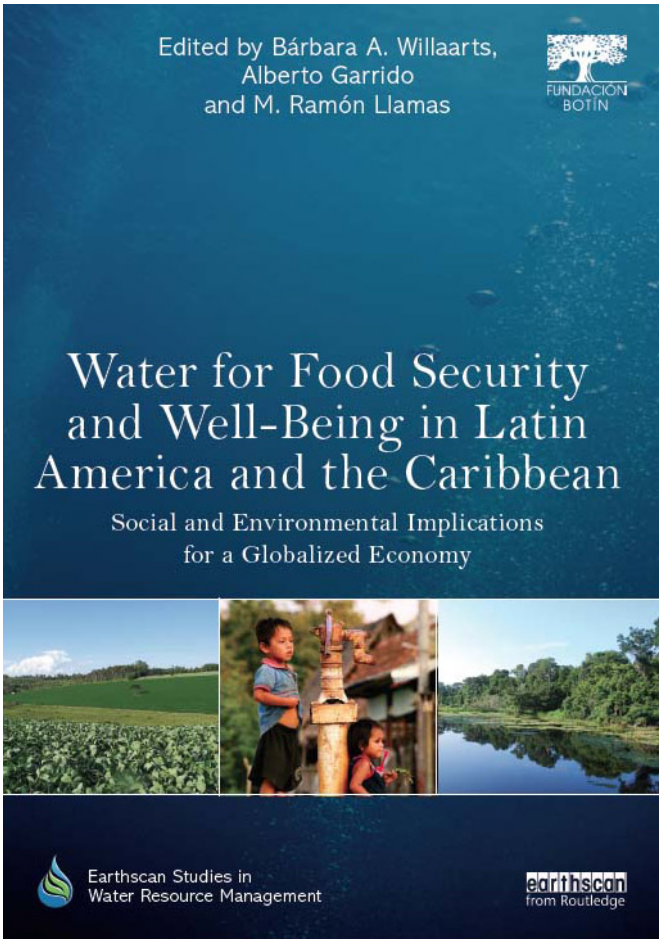

Chapter 4

Socio-economic megatrends for water and food security in Latin America

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4

SOCIO-ECONOMIC MEGATRENDS FOR WATER AND FOOD SECURITY IN LATIN AMERICA

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Highlights

- The chapter provides an overview of the main socio-economic megatrends for Latin American and Caribbean (LAC) countries and how these link to water and food security. Main trends include the demographic transition (population growth, urbanization and migration), development model (income growth, income inequality, poverty and the informal economy), and the impact of globalization (trade liberalization, consumption patterns, food security and health). Other trends are the role of technology and climate change.

- Population will continue to increase, although at a slower pace due to the low fertility rate. LAC is the second most urbanized region in the world. It is a region where the urbanization pattern has been rapid, poorly planned and is causing a growing number of social problems. LAC shows all the signs of international migration processes. Nearly 20 million people live outside the country in which they were born and migrants are especially vulnerable since they are more exposed to risks. Urbanization and migration have changed societies in LAC, their needs and the way the population use their natural resources.

- During the last twenty years LAC's per capita growth rate was 1.6%. High commodity prices are leading to some countries to intensify exports of primary commodities making the region more vulnerable to the global economy. LAC displays poor evidence in terms of reducing poverty given its economic growth. Distribution of wealth is the most important issue for a region which globally is one of the most unequal. The informal economy is growing and informal jobs can reach very high levels.

- Market-oriented reforms adopted during the 1990s have not helped to achieve structural challenges. In many LAC countries the correlation between economic growth and trade openness is weak and trade liberalization has not improved income distribution, neither has it reduced poverty. Trade has changed the dietary patterns of LAC societies thus affecting the use of water. Even though undernourished population has declined, 49 million people are still suffering from hunger.

- LAC is undergoing demographic, epidemiological and nutritional transitions. The latter is characterized by a decrease in malnutrition and an increase in obesity due to dietary changes. The health sector faces two challenges: solving traditional problems of infectious diseases and maternal-child mortality, and combating diseases arising from development: chronic-degenerative, senile and mental illnesses, HIV/AIDS and obesity.

- Information and Communication Technology (ICT) may help to guarantee food and water security in LAC. Agriculture can profit from the use of these technologies, improving water-meters and many areas of the food production chain. The participatory approach of water users connected via ICT may create new pathways for water security. LAC countries must increase investment in Research and Development (R&D) which is on average around 0.6% versus 2.3% for OECD.
- Climate change is another phenomenon to consider for socio-economic trends in LAC, due to the high vulnerability of many regions. Increase of some diseases, food insecurity and a growing perception that access to drinking water might be at stake, are some of the potential impacts from climate change. Floods and droughts are and will continue affecting agriculture in particular countries.
- Latin American trends have to be modified. Measures orientated towards achieving a fair income distribution, public policies oriented towards more vulnerable groups of the population, a model of growth supported by domestic markets, formalization of the informal economy, investment in science and technology and policies for improvement and conservation of natural resources, would be key goals to target and report on future socio-economic megatrends to guarantee water and food security.

4.1 Introduction

Latin America is a continent that has experienced dramatic and largely positive changes over the last twenty to thirty years. Development, political stability and an increased global political role bear witness to these changes. This chapter will review these deep dramatic socio-economic changes, identifying, however, some important pending issues and trends for the future. It therefore provides an overview of the main socio-economic and demographic transformations megatrends of Latin American and Caribbean countries (LAC) and as far as possible how these link to water and food security. It will look at the rapid evolution over the last decades regarding what we consider the main 'megatrends'. First, the demographic transition: population growth, urbanization and migration; second, income growth, inequity, poverty and the informal economy; third, changing lifestyles, trade liberalization, consumption patterns, and health; fourth, scenarios on the role of technology and the emergence of vulnerability due to climate change. Finally, we identify some main challenges in terms of socio-economic megatrends for water and food security.

Population growth, although slowing down, could place increasing pressure on resource use in general and especially through a change in consumption patterns and an

increase in food production, an activity that competes with other economic activities for land and water use. Demographic trends and economic growth patterns have produced large differences in economic and social equity, as well as the sustainability of resource use. In recent years, due to a reduction in external demand, growth in the region has been driven mainly by the expansion of the domestic market, stimulated by subsidy policies in most countries.

Economic growth in LAC was 3.9% in 2013 and is projected to be 4.4% in 2014 (UN projections); in 2012 a significant slowdown ended with a Gross Domestic Product (GDP) increase of 3.1% due to the fall in the export sector of non-food and feed sectors, showing the fragility of the current development model that depends on the demand from uncertain and volatile foreign markets for raw commodities.

The global economic crisis of 2008 affected the terms of trade of the region; with the exception of hydrocarbons (oil), whose prices remained stable, and oilseeds, whose prices increased (CEPAL, 2012a). Most industrialized countries in the region face strong competition from Asian economies, which generates a perverse dependence on the demand for low-value added commodities that affects the development of the manufacturing industry. Additionally, LAC faces environmental problems derived from an extraction of natural resources focused on intensive agriculture (biofuels, food and feed production for export), a model based on the use of high quantities of water and agro-chemicals which has impaired water quality and poses a risk to human health. In addition to soil and water pollution, the loss of biodiversity has also been accelerated due to the pressure from mining, forestry, heavy fishing, urbanization and infrastructure development.

The moderate demographic growth, the relatively steady economic progress mirrored through some indicators of human well-being, can present noticeable differences between countries, regions within the same country or between different levels of income. Some emergent health problems such as obesity affect the population at all different levels of income in most countries of the region. LAC is becoming an exporter of primary materials, principally food (and thus virtual water) that contributes to global food and water security but does not necessarily represent the best development model for the region and for its own food and water security.

4.2 Main drivers

4.2.1 Demographic trends and transitions

This section aims to highlight the trends of the demographic transition in LAC. The tendencies of three main topics are analysed: population growth (fertility and ageing), urbanization and migration. The evolution and tendency of these factors has and will have a crucial influence in the growth rate of the demand for food and therefore, in the scale and intensity of natural resources use. Water, as well as other natural resources, is under the stress from the requirements of an increasingly younger population whose consumption habits are radically changed by urbanization processes and migration.

4.2.1.1 Population growth

In the 20th century, countries of LAC, which currently represent almost 9% of the world population, saw their populations grow at a very high pace. For example, by mid-century most of the countries grew by as much as 3% (Miró, 2006). Later in the 20th century this trend had reversed, and population growth in LAC is slowing significantly.

According to the Economic Commission for Latin America and the Caribbean, ECLAC (CEPAL, 2012b), in 2012 there were 603.1 million inhabitants in LAC and the population is predicted to continue growing despite the sustained low fertility rate. This is due to a relatively high concentration of people of reproductive age, coming from periods when fertility was higher, meaning births exceed the number of deaths.

The regional average of the total fertility rate (TFR) was 5.9 children per woman in the period between 1950 and 1955, but has steadily decreased since the second half of the 1960s to the present. From1965–1970, the TFR in the region fell by 59% with huge variations among countries, ranging from 20% to 70%. Fertility in LAC in the 1950s and 60s was only surpassed by Africa (6.8 children per woman) and was above the world average of 5.0 children per woman. Currently, the regional value is below the global 2.5 children per woman and resembles the figures seen in Europe forty years ago.

The decline in regional fertility has been sustained, but there are still differences in the current level of fertility between countries. The total fertility rate of Guatemala for the 2005–2010 period is the highest in LAC with an average of 4.15 children per woman and nearly threefold that of Cuba, which is the lowest with an average of 1.49 children per woman

Given the impact of fertility on population projections, the Population Division of the United Nations recommends developing three evolution scenarios for this variable. In the case of mortality and international migration there is only one hypothesis for future changes. In the case of fertility, the most plausible hypothesis is designated as *recommended or media,* while the other two hypotheses for the top and bottom strips of the recommended are also estimated. With the *media or recommended* hypothesis, in 2050 fertility would be 1.85, a figure below the replacement level of 2.2 that is likely be achieved in the period 2015–2020. However, the population would continue growing to 760 million inhabitants in 2050; with the high scenario it would reach 900 million people.

Nowadays the population pyramid of LAC has a rectangular base representing the age group of 40 years (70% of the population of the region). People over 65 (7% of the population) gain relative importance, but the top is still narrow compared with 28% of people under the age of 15. Projections show a decline in varying degrees of the population under 15 years, an increase in the population over 65 years and a thickening of the pyramid between these ages. The region's population will grow older, but despite the decline in the population under 15 years, it will continue presenting a young age structure, allowing for the population to grow as forecasted.

4.2.1.2 Urbanization

LAC is the second most urbanized region in the world, with 79.1% of its population living in cities (UN, 2011); when in 1950 the urban population was less than 42% (CEPAL, 2002). LAC is more urbanized than an average high-income country.

Both megatrends of population growth and urbanization have caused many social changes in recent years. Cities have witnessed and partly helped generate a middle class whose importance has caused substantial changes in transport patterns, habitats and consumption. This urbanization trend is rooted in the early 20th century and is deepening. In Argentina, Chile, Venezuela, Uruguay and Puerto Rico at least nine out of ten people live in urban settings (Table 4.1).

Table 4.1 Evolution of urban population, percentage living in urban areas by region (1925–2000)

REGIONS	1925	1950	1975	2000
World	20.5	29.7	37.9	47.0
Most development regions	40.1	54.9	70.0	76.0
Less development regions	9.3	17.8	26.8	39.9
Africa	8.0	14.7	25.2	37.9
Latin America & Caribbean	25.0	41.4	61.2	75.3
North America	53.8	63.9	73.8	77.2
Asia	9.5	17.4	24.7	36.7
Europe	37.9	52.4	67.3	74.8
Oceania	48.5	61.6	71.8	70.2

Source: year 1925: Hauser and Gardner (1982); years 1950–2000: UN (2011)

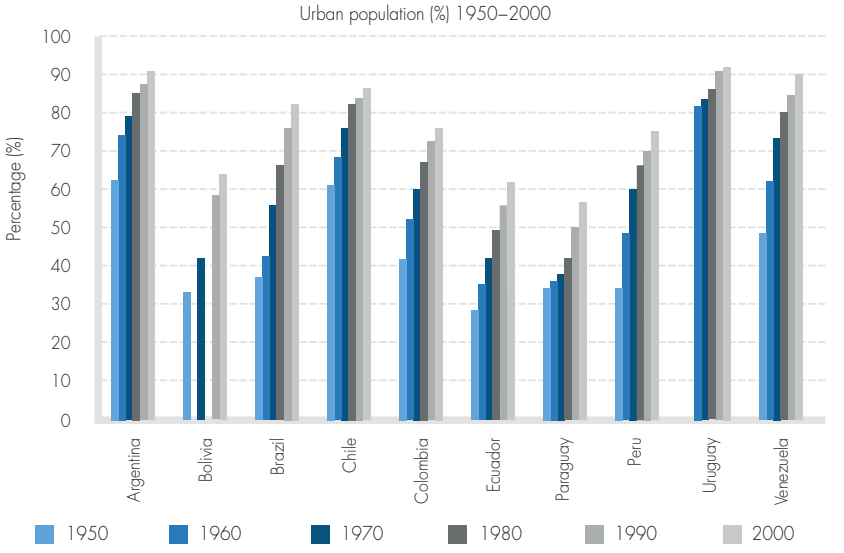

Figure 4.1 Trends in urban population between 1950 and 2000. *Source: CEPAL (2006).*

This pattern of urbanization that has prevailed in LAC has been rapid and poorly planned, not creating an ideal spatial distribution of the population, which is concentrated in large cities. In 2005, there were sixty-seven cities with more than one million inhabitants and four 'megacities' with more than 10 million (Mexico City, São Paulo, Buenos Aires and Rio de Janeiro). These 'megacities' are characterized by inequality, and social problems with a segregated profile in spatial and social terms.

However, the current trend is somehow different. Since 2000, the average annual growth of the urban population is less than 2%, which is a fairly normal population growth (UN-Habitat, 2012). Moreover, the growth of medium-sized cities is an opportunity to overcome the urban problems of the larger cities on the continent.

Often, population growth in urban centres outpaces the ability of utilities to provide adequate services such as water and sanitation. In the absence of piped water systems, communities in these areas meet their water needs through a combination of different sources and means. According to the Global Water Partnership (GWP, 2012) the challenge in LAC is to accelerate the incorporation of the mobile population into informal settlements in order to ensure the formal structure of housing and water and sanitation services. Thus the phenomena of urban transition, the formalization of the economy and water security are all linked. Meanwhile the opposite also holds: rapid urban growth exacerbates the problem (see Box 4.1).

Box 4.1 Slums and access to piped water

Considering that LAC is the second most urbanized region in the world (after North America), the case of slums is extremely pertinent. As can be seen in Figure 4.2 there seems to be a strong correlation between having a high number of people living in slums and overall lack of access to piped water.

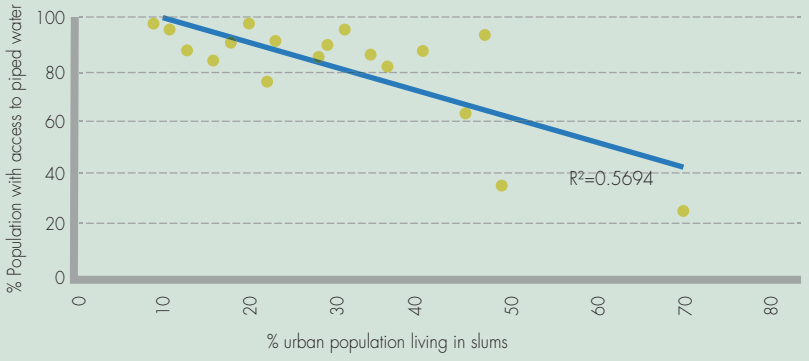

Figure 4.2 Population living in slums and population with access to piped water. *Source: own elaboration based on data from: UN-Habitat, (2012), UN-DESA data (2011) and WHO-UNICEF (2013).*

4.2.1.3 Migration

International migratory processes are motivated by economic, social, cultural and political factors. Recently, studies have also included environmental factors. The total migrant population has been calculated as 3% of the total inhabitants of the planet and 13% of them (about 25 million) were born in LAC. It could be seen as a minor phenomenon but it has a true significance not only in quantitative terms, but also in its impact on social and economic life for both the migrant's country and the host country (CEPAL, 2003).

The Report on Migrations in the World 2010, published by the International Organization for Migration (IOM, 2011), reveals that the number of international migrants increased 11%, from 191 million in 2005, to 214 million in 2010. The Report also indicates that the number of domestic migrants was 740 million in 2009; implying that globally the number of domestic and international migrants is close to 1,000 million, a figure likely to keep increasing (Domínguez-Guadarrama, 2011).

LAC is the scene of intense migration processes that have changed societies in many ways. In this region, all the different types of modern international migration have taken place, from the migration of LAC people (the most visible feature), to immigration, return, irregular migration, forced displacement and the search for shelter, plus the flow of remittances, skilled migration and the presence of dense communities abroad (*ibid.*).

According to the Department of Economic and Social Affairs of the United Nations, in 2010 six out of ten migrants live in developing regions, three-quarters of migrants are concentrated in only twenty-eight countries, and one in every five lives in the United States (UN, 2011). But it is important to point out that only 37% of global migration is from developing countries to developed countries. Most of the displacement takes place between countries in the same category of development.

Furthermore, in LAC nearly 20 million people live outside the country in which they were born and three-quarters of them move to the United States, mainly from Mexico and the Caribbean. From 1970 to 1980, this migration grew two and a half fold, and then duplicated between 1980 and 1990. In 2010, the United States hosted around 43 million foreign nationals, representing 13.5% of the total US population (World Bank, 2011). Results of the 2010 Census indicate that Hispanics made up 16.3% of the total population and that the population increased from 35.3 million in 2000 to 50.5 million in 2010 (Pew Hispanic Center, 2011).

Canada, Spain, United Kingdom, Japan and Australia are other countries where Latin American migrants often go. Spain has recently turned into the second destiny for regional migration; in 2001 there were 840,000 people from South America (mainly from Ecuador) living in Spain and in 2009, one in three foreigners resident in Spain were from LAC (2,479,035 registered) (CEPAL, 2011).

LAC migration has been also intraregional, due to geographic and cultural proximity. In the 1970s, the number of intraregional migrants was near 2 million; in the 1980s and 1990s it grew slowly but by 2000, migrants numbers reached 3 million and by 2005 almost 4 million (3,800,000). At the beginning of the 1990s, most of the immigrants

were from outside the region but in 2010, the majority came from the same region, most of them living in Argentina and Venezuela. Costa Rica was the main destination for Central American migrants (CEPAL, 2012b; IOM, 2012).

Throughout its history, Argentina has received immigrants from all its neighbouring countries: Paraguay, Chile, Bolivia, Uruguay and Brazil. This is the case of Venezuela too, where migration was stimulated by the internal conditions such an economic growth and political stability. Immigration in these two countries is higher than emigration. Recent data shows Argentina, Brazil and Chile as the three South American consolidated regional migration receptors. In Brazil, the number of foreigners has experienced strong growth in the past decade: 961,867 in 2010 and 1,510,561 in 2012.

Bolivia, Colombia, Ecuador, Paraguay and Peru maintain a profile mainly for emigration. Within the region, the Bolivians have a strong presence in Argentina and Brazil, Colombians in Ecuador and Venezuela, Paraguayans in Argentina (325,046 in 2001 and 550,713 in 2010), the Peruvian in Argentina (88,260 in 2000 and 157,514 in 2010) and Chile (39,084 in 2002 and 130,859 in 2010) (IOM, 2012).

Inter-urban flows, moving from one city to another, account for the largest volume of population movement within countries of the region. In Mexico, for example, between 1995 and 2000, 70% of the transfers between municipalities were urban–urban type, while rural–urban migration reached 14%. Internal migration is closely related to regional inequalities. In establishing territorial disparities relevant to migration, labour markets play a major role, especially in regard to wages and unemployment in the different zones. There is no evidence, however, that migration reduces the severity of regional inequalities (CEPAL, 2006).

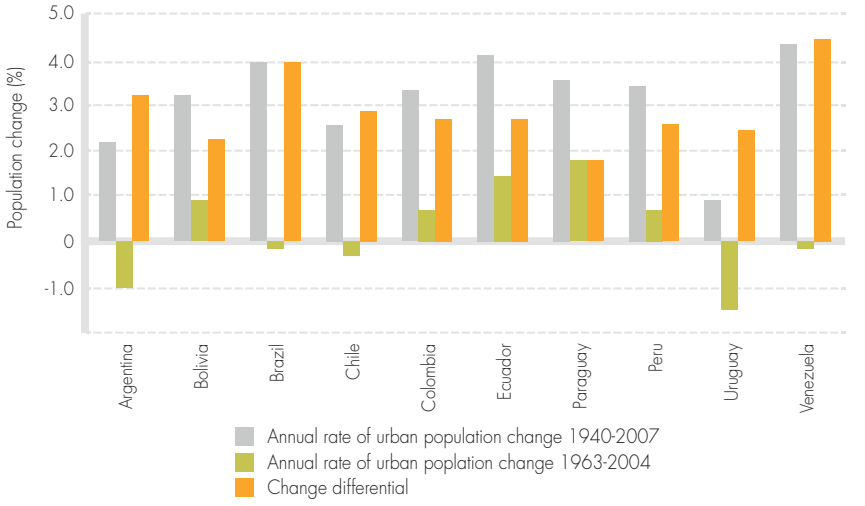

Figure 4.3 Annual rate of urban–rural population change (%). *Source: own elaboration based on data from CEPAL (2006)*

Trade and economic cooperation agreements in LAC (see Chapter 5) such as MERCOSUR (Common Market of the South), CAN (Andean Community of the Nations) and UNASUR (South American Nations Union) have also favoured migration due to its recognition of the importance of the free movement of people (CEPAL, 2012b). Recently, there has been interest in researching the effects of natural disasters; the environment and climate change on migration (see Box 4.4). For example, over 1 million people were estimated to have been displaced due to Haiti's earthquake in 2010 (IOM, 2009).

Even though during the last few years a human rights approach has been progressively introduced into the national and international debate, migrants are very exposed to situations which prevent the exercise of these rights, both during the journey and upon arrival at their destination. These situations include slavery, prostitution, abuse, gender violence, discrimination, expulsion, lack of social support networks and barriers in access to basic health services. In general, this vulnerability is worse in the case of border migrants (CEPAL, 2012b).

4.2.2 Development, income growth, income disparity and poverty

In terms of economic development, LAC was a relatively wealthy region at the start of the 19th century (Millennium Project, 2012). In fact, some countries of LAC were richer than the nascent USA. The Dominican Republic, Mexico and Peru had universities almost one century before Harvard was founded. Haiti was a very wealthy colony in 1800, richer than many parts of the USA. LAC was on a par with most of Europe, and it was richer than Africa, China, India and Japan. At the beginning of the 20th century, Argentina was still one the ten wealthiest countries in the world, and many poor Chinese and Japanese migrated to richer LAC countries like Brazil, Mexico and Peru. However, by the beginning of the 21st century, LAC fell behind, and many countries in East Asia had overtaken it in terms of economic growth. If current trends continue, China will overtake LAC in terms of GDP per capita by the 2020s (Figure 4.4).

Economic growth in LAC in the last thirty years has been modest (in per capita terms) and the varying growth regimes are due to the shocks the region has faced during that period. During the 1970s, shocks were associated with the collapse of the Bretton Woods exchange rate parities and oil-price increases. Throughout the 1980s the region confronted the debt crises and high inflation which was followed by a period of slow and unstable growth and macro-economic instability. Market-oriented reforms were adopted by several LAC countries during the 1990s; however, the slow growth cycle has lasted more than two decades. The different per capita growth rates of seven LAC countries during these periods are presented in Table 4.2.

During the last twenty years (1990–2010) LAC's per capita growth rate has been 1.6% and, of the seven economies studied, only Chile, Costa Rica and Peru exhibit more vigorous growth rates (Figure 4.5). The per capita growth rates observed in LAC throughout the 1980–2010 period also coincide with slower per capita growth in the world economy during the same period.

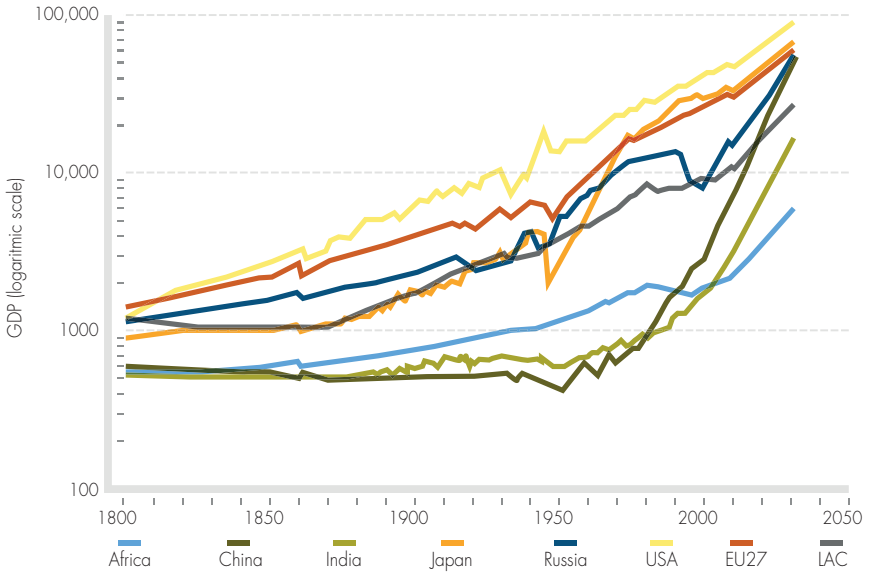

Figure 4.4 Comparative Evolution of GDP per Capita (GDP, logarithmic scale). (Historic and Projections: 1800–2030). Note: The GDP per capita projections are an extrapolation to 2030 using the same growth forecast 2011–2015 by the IMF. *Source: Millennium Project (2012).*

Table 4.2 Real per capita income growth 1960-2010

PERIOD	LESS THAN ZERO	0%–1%	1%–2%	2%–3%	ABOVE 3%
1960–1980			Chile, Peru	Argentina	Brazil, Costa Rica, Colombia, Mexico
1980–2010	Argentina, Peru	Brazil, Costa Rica, Colombia, Mexico			Chile

Source: own elaboration on basis of CEPAL (2005).

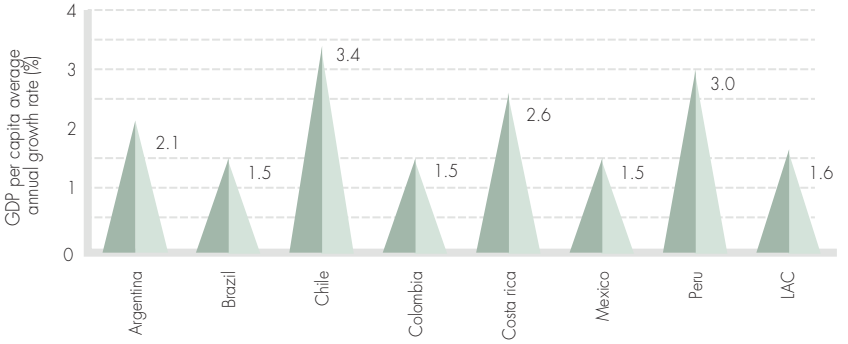

Figure 4.5 GDP mean annual growth rate, period1980–2010. *Source: own elaboration based on UN data.*

LAC's GDP growth for 2013 was projected to be 3.9% and 4.4% in 2014, but growth volatility is a real possibility. In Brazil, for instance, consensus forecasts for 2012 moved from 3.3% in January to 1.6% in October and drastic corrections are being registered for Argentina (Gurría, 2012). The region still has to tackle many structural challenges in order to turn stability into long-term growth. For example, high commodity prices are leading some countries to favour an economic model based almost exclusively on primary commodities, and this is making the region vulnerable; Chile is an example of this tendency.

Solimano and Soto (2006) found a direct relationship between each country's real GDP per working-age person and 'total factor productivity' (TFP) and the efficiency and rate of the use of capital and labour. Figures 4.6 and 4.7 analyse what appears to be a decoupling in some countries between GDP growth, water consumption and population growth. At LAC scale, this decoupling between population growth and GDP per capita increase and annual freshwater withdrawals seems clear (Figure 4.6). However, a detailed country analysis shows different trajectories (Figure 4.7). While in some countries (Argentina, Peru, Colombia, Costa Rica and Chile) decoupling is a clear, i.e. higher GDP per capita and less water consumption, in other countries (Brazil, Colombia and Mexico) there is no clear trend.

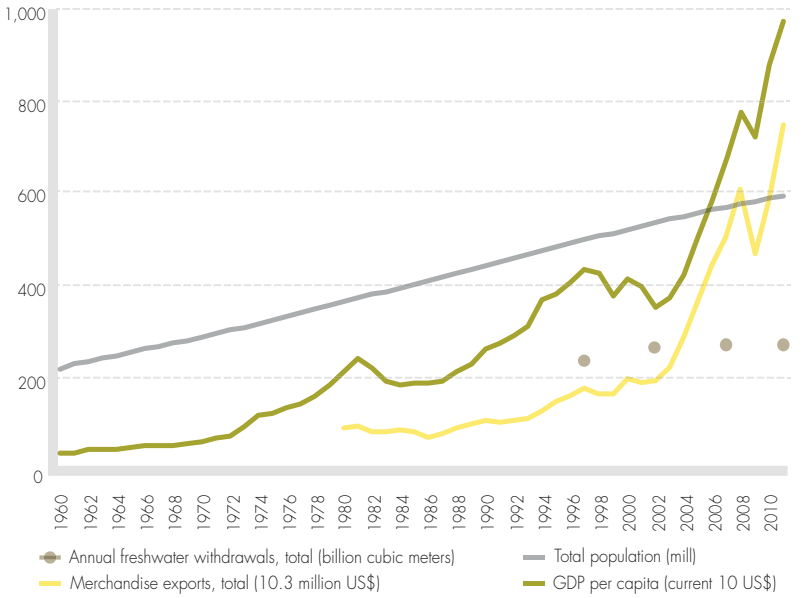

Figure 4.6 Population growth in LAC (1990–2000), Water consumption in LAC (1990–2000) and Evolution of GDP (1990–2000). *Source: own elaboration based on data from World Bank-World Development Indicators database (Population and GDP per capita), FAO-AQUASTAT (Annual freshwater withdrawals) and IMF-World Economic Outlook Database (Total merchandise exports).*

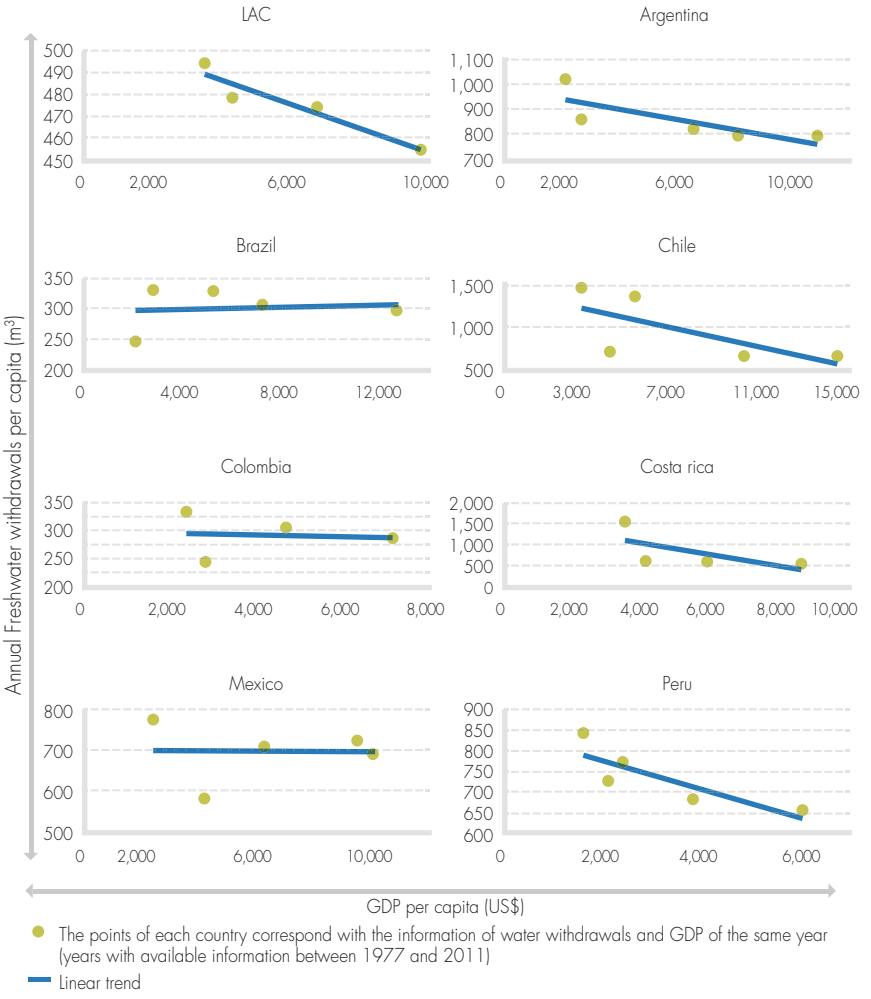

Figure 4.7 Annual freshwater withdrawals per capita vs GDP per capita (1977–2011). *Source: own elaboration on data from FAO-AQUASTAT and World Bank-World Development Indicators database.*

4.2.2.1 Beyond GDP: human well-being progress

GDP is an important variable but certainly not the only relevant indicator to measure progress. An analysis based exclusively on GDP would be too simplistic. Thinking beyond GDP we can use a Society–Technology–Economics–Ecology–Politics (STEEP) approach, the Human Development Index (HDI) developed by the United Nations Development Program and other variables. Table 4.3 shows some of the variables included during the Latin America 2030 study on Scenarios (Millennium Project, 2012). It is useful to analyse the, best and worst values for each variable, both in LAC and for the rest of the world.

Table 4.3 Comparative Best and Worst Cases for International Indexes for the year 2010 using the STEEP (Society–Technology–Economics–Ecology–Politics) approach

VARIABLE / INDICATOR/INDEX	WORLD WORST	LATIN AMERICAN WORST	WORLD AVERAGE	LATIN AMERICAN AVERAGE	LATIN AMERICAN BEST	WORLD BEST
Society: HDI (from 0 worst to 1000 best)	0.140 (Zimbabwe)	0.404 (Haiti)	0.624	0.704	0.783 (Chile)	0.938 (Norway)
Technology: E-Readiness index (from 0 worst to 10 best)	2.97 (Azerbaijan)	3.97 (Ecuador)	4.30	5.40	6.49 (Chile)	8.87 (Denmark)
Economics: GDPc (PPP, Thousand US$ 2010)	340 (Congo)	1,121 (Haiti)	10,711	11,188	19,600 (Puerto Rico)	88,232 (Qatar)
Environment: CO_2 emissions per capita (Tons/person)	55.5 (Qatar)	6.0 (Venezuela)	4.6	3.7	0.2 (Haiti)	0.0 (Mali)
Politics: Corruption index (from 0 worst to 10 best)	1.1 (Somalia)	2.0 (Venezuela)	3.3	3.6	7.2 (Chile)	9.3 (Denmark)

Source: Millennium Project (2012).

Notes: (1) The best and worst values correspond to the latest information of the countries with available data in 2010. (2) The Latin American and world averages and based on population-weighted values

The analysis of educational, health or employment indicators also offers relevant information to measure progress in contrast to pure GDP metrics. As Table 4.4 shows, LAC citizens today have greater educational, health and employment opportunities compared to twenty years ago but key issues like wealth distribution and gender equality are pending targets. Regarding health, important progress has been achieved. Life expectancy has increased in all regions, particularly in the Amazonian, Mesoamerican and Caribbean countries. The current rate of life expectancy surpasses 73 years on average. Sanitation facilities and access to safe water source have also increased in most regions but challenges remain in improving access to water and sanitation in rural and peri-urban areas. Schooling rates are also progressing; between 95 to 97% of LAC population complete primary school. Important progress has been reached concerning employment. Nevertheless, the female employment rate (50%) is still far below the men's average (over 70%) and employment vulnerability (unpaid family work or self-employment) has increased for both men and women. Despite this socio-economic progress, income distribution has not improved across all regions. The GINI index has only decreased in the Amazon region and in Mesoamerica. In the other regions it has either increased or remained stable in time. Likewise, the share of the wealth among the richest has increased while it has decreased among the poorest, widening the distance between those that have accrued most of the money and those who have less.

Table 4.4 Trends of human well-being across different regions of Latin America and the Caribbean (LAC) in the last two decades

	DIMENSION	AMAZON		ANDEAN		CARIBBEAN		MESOAMERICA		SOUTH CONE	
	INDICATOR	1988/ 1992	2008/ 2012	1988/ 1992	2008/ 2012	1988/ 1992	2008/ 2012	1988/ 1992	2008/ 2012	1988/ 1992	2008/ 2012
EDUCATION	Rate of males completing primary education (% of relevant age group)	95	91	78	96	95	95	73	95	81	100
	Rate of females completing primary education (% of relevant age group)	88	84	81	97	95	95	71	95	79	100
HEALTH	Life expectancy at birth (years)	63.	71	71	73	70	74	68	75	73	76
	Population with access to improved sanitation facilities (%)	68	81	59	66	84	83	66	79	77	89
	Rural population with access to improved sanitation facilities (%)	33	64	32	48	81	81	53	71	56	74
	Population with access to improved water source (%)	89	94	80	89	91	93	81	92	84	94
JOBS AND EQUITY	Female population employed 15+ (%)	35.8	39.9	35.7	50.6	40.7	48	33.6	43.5	39.4	46.3
	Male population employed 15+ (%))	72.1	70.3	75.9	76.5	65.9	67.3	77.9	77.8	75.7	73.3
	Vulnerable female employment (% of female employment)	34.1	22.5	37.4	42.1	18.4	31.1	28.6	31.3	27.6	28.4
	Vulnerable male employment (% of male employment)	31.4	27.1	31.3	34.5	22.5	40.7	39.9	27.2	22.4	27.8
WEALTH	GDP per capita (constant 2,000 US$)	2,032	2,812	2,258	3,003	6,631	8,498	2,312	3,503	4,020	6,910
	GINI index (1–100)	60	55	46	53	45	48	54	51	46	49
	Income share held by highest 10%	47	43	35	41	35	38	39	40	36	38
	Income share held by lowest 10%	1	1	2	1	2	1	1	1	2	1

Source: own elaboration based on data from World Bank-World Development Indicators database

4.2.2.2 Income growth and poverty reduction

The link between national economic growth and poverty reduction is well known, although it is different for specific countries, each with its own cultural and political history. Due to the negative association between growth and the incidence of poverty,[1] some analysts and international agencies support the recommendation that governments focus on growth in order to alleviate poverty (e.g., Dollar and Kraay, 2001, Ravallion, 2004).

1 Statistical analysis has shown that the poverty-reduction elasticity with respect to national income growth has been in the range of 2 to 3.5 percent (Ravallion, 2004)

The debate about growth and poverty is particularly relevant in LAC where countries show poor evidence in terms of poverty reduction over the last fifteen years given their economic growth. Argentina experienced an important increase in poverty during the 1990s, despite having a growing economy during the same period. Poverty significantly decreased in Brazil during the first half of the 1990s, driven by economic growth and improvements in income distribution; however, since 1995, poverty reduction has slowed. There is a positive trend in the reduction of the population below the poverty and indigence line, for the cases of Chile, Brazil, Peru and Colombia, and less constant reduction trends for Mexico, whereas Costa Rica seems fairly stable (Figures 4.8 and 4.9).

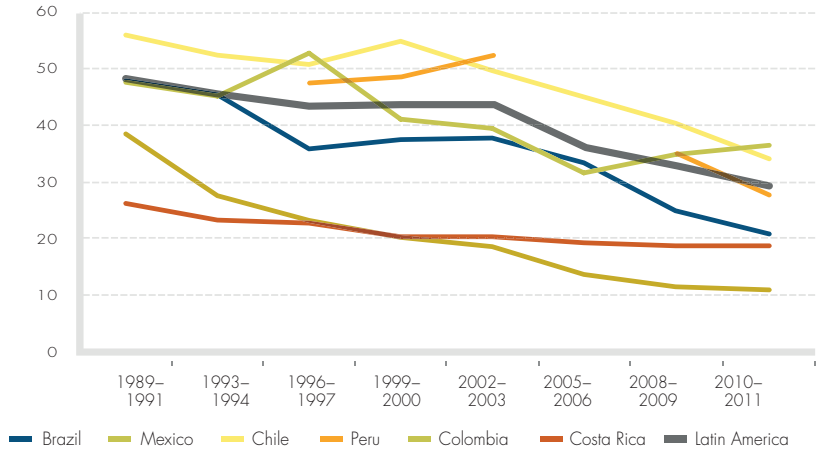

Figure 4.8 Percentage of population below poverty line. *Source: own elaboration based on ECLAC (2012).*

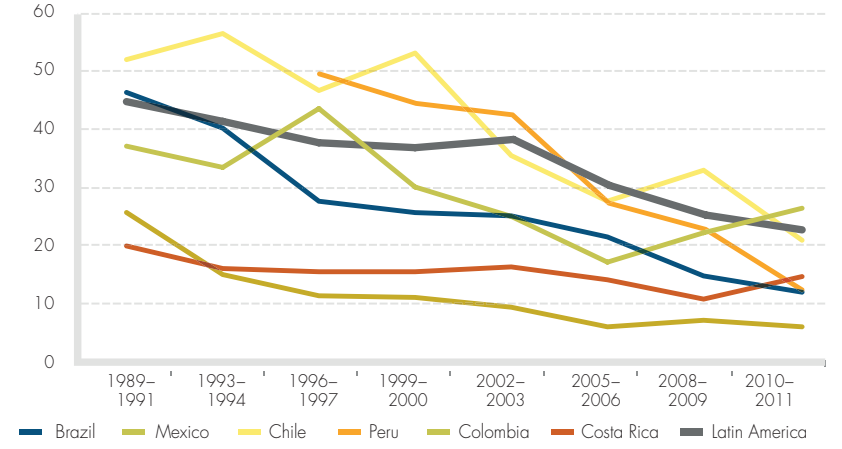

Figure 4.9 Percentage of population below indigence line. *Source: ECLAC (2012).*

Chile is a successful story of consistent poverty reduction, from 5 million people below the poverty line in 1990 – approximately 40% of the population – to 2.5 million in 2009 – i.e. about 15%. The rate of extreme poverty also decreased fast, from 13% of

the population in 1990 to 3.7% in 2009. The performance of the Andean community economies in terms of poverty reduction has not been so consistent. Poverty has decreased in Peru, whereas in Colombia current poverty levels are equivalent to those of two decades ago. Costa Rica has the lowest poverty rate among Central American countries, and the poverty line is close to 20% while extreme poverty has fallen to almost 7%. Mexico does not have a good track record for poverty reduction; poverty rates recorded during the 2000s are not significantly different from those of the 1990s. Box 4.2 shows how water poverty plays out in LAC, calculated on the basis of research conducted by Lawrence et al. (2003).

For the particular case of Latin America, the most important aspects are not GDP per capita and the reduction or increase in poverty, but the distribution of wealth. GDP per capita has increased in most cases (Figure 4.11) yet things look very different when considering income distribution (Figure 4.12). The income share held by the highest 20% sub-group of population has reduced for the cases of Argentina, Brazil and Colombia, but it is less clear for the cases of Mexico or Chile (Figure 4.12a). In contrast, the income share held by the lowest 20% sub-group of the population has increased in Colombia, Argentina, Brazil and Peru, but it is less marked in countries like Mexico or Chile (Figure 4.12b).

Box 4.2 Water poverty index in LAC

The water poverty index (WPI) is calculated based on a series of parameters related to resources, access, capacity, use and environment. 'Resource availability' is measured taking into account availability but also quality. 'Access' refers to the human access to water, including distance to a safe source, time needed for collection, access for irrigation, etc. 'Capacity' refers to the effectiveness of people's ability to manage water, whereas 'use' refers to the amount of water used for productive uses like agriculture, industry or urban water supply. Lastly, 'environment' accounts for the integrity and flow of ecosystem services provided by freshwater ecosystems. Globally, Finland has the highest WPI score (79) and Haiti the lowest (35). As Figure 4.10 shows, WPI varies across LAC countries, with scores ranging from 55 to 69. Countries with the lowest WPI values are Paraguay, El Salvador, Mexico, Nicaragua and Guatemala. Meanwhile Chile, Ecuador, Uruguay, Costa Rica and Panama have the highest scores. It is striking that countries that do not have the highest rain indexes do not have the lowest WPI. That means that good management is crucial for achieving the best water use given a particularly water resource endowment. For instance, Peru's water resources are slightly more abundant than those of Chile, but Chile has higher levels of the population with access to clean water and sanitation coverage. On the other hand, there are regional differences in each country, especially in the bigger ones: Mexico, Brazil, Argentina or Peru, which have very humid regions and also very dry ones. In these countries water management has to be tailored for each hydrological region to reduce water poverty.

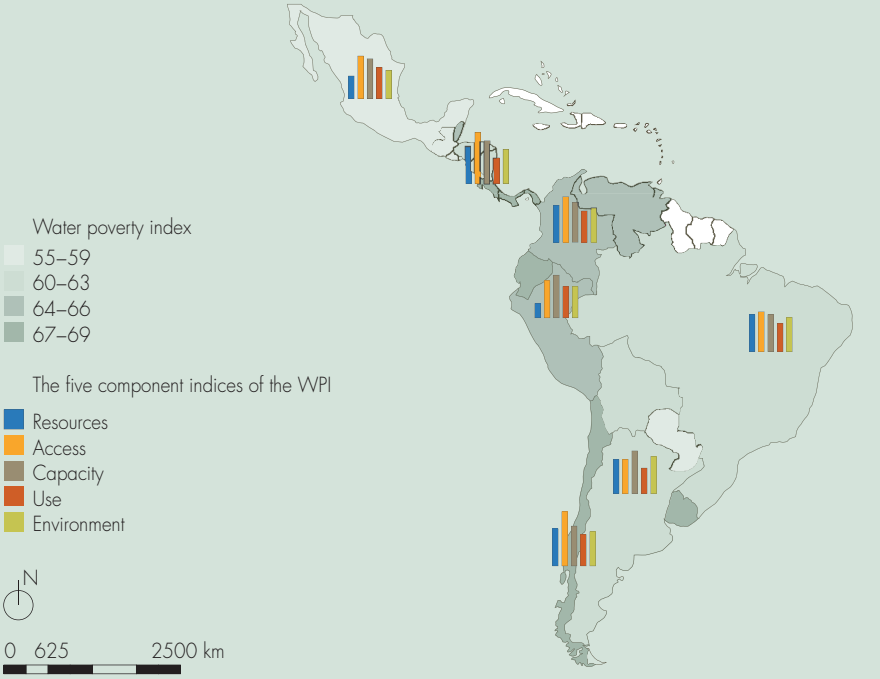

Figure 4.10 Water Poverty Index in LAC countries. *Source: own elaboration based on data from Lawrence et al. (2003).*

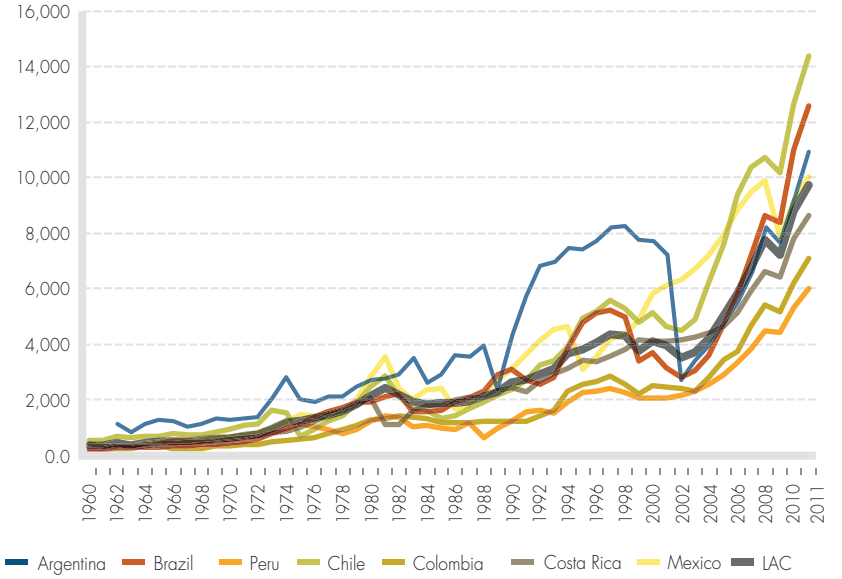

Figure 4.11 Annual GDP per capita growth (expressed in current US$) for the time period 1980–2010. *Source: own elaboration based on data from World Bank-World Development Indicators Database.*

a)

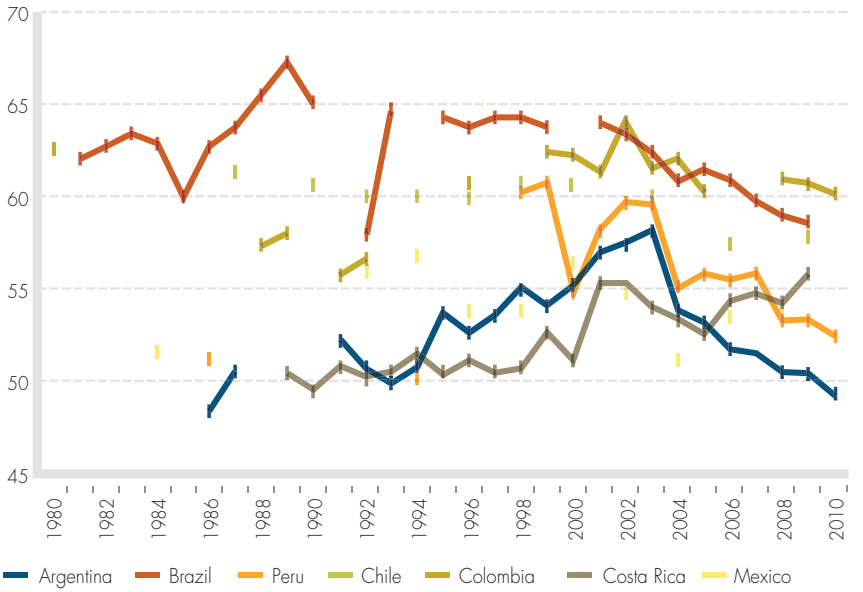

Figure 4.12a Inequality in income distribution. Percentage of the income share held by highest 20% subgroup of population. *Source: own elaboration based on data from World Bank-World Development Indicators Database.*

b)

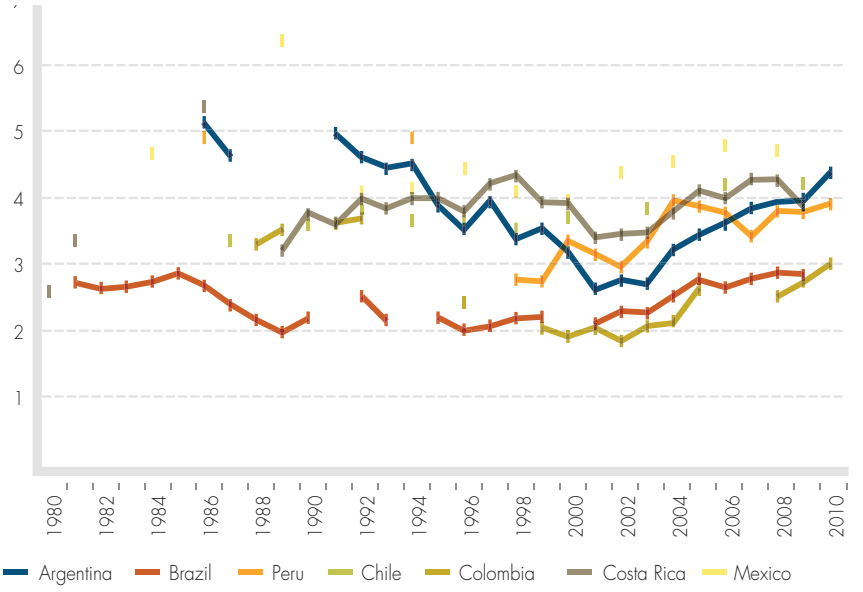

Figure 4.12b Inequality in income distribution. Percentage of the income share held by lowest 20% subgroup of population. *Source: own elaboration based on data World Bank-World Development Indicators Database.*

4.2.2.3 The informal economy in water and food security

The informal economy and its activities are the 'unregistered economic activities that contribute to the officially calculated GDP' (Schneider, 2002). The informal economy contributes to the country's economy but these activities are informal in terms of registration, tax payments, operating licenses, employment conditions and regulations (Becker, 2004). The informal economy represents a transition period that would under normal development paths disappear once countries achieved sufficient levels of economic growth and modern industrial development (Becker, 2004). There is now, however, increased evidence that the informal economy can no longer be considered as a temporary phenomenon. The informal economy has a more fixed character in LAC and this is particularly the case for those countries where incomes and assets are not equitably distributed[2] (Figures 4.12a and 4.12b).

In terms of employment, estimates show that non-agricultural employment as a share of the informal workforce is 57% in LAC. Meanwhile GDP estimates of the contribution of the informal sector (i.e. not the informal economy as a whole, but only informal enterprises) indicate that the contribution of informal enterprises to non-agricultural GDP is significant, representing 29% for LAC (Flodman, 2004). As can be seen in Figure 4.13, the share of informal jobs in total employment can be high, reaching in some cases very high levels like Bolivia, Honduras, Paraguay or Peru, but also pronounced in countries like Colombia, Mexico or Argentina.

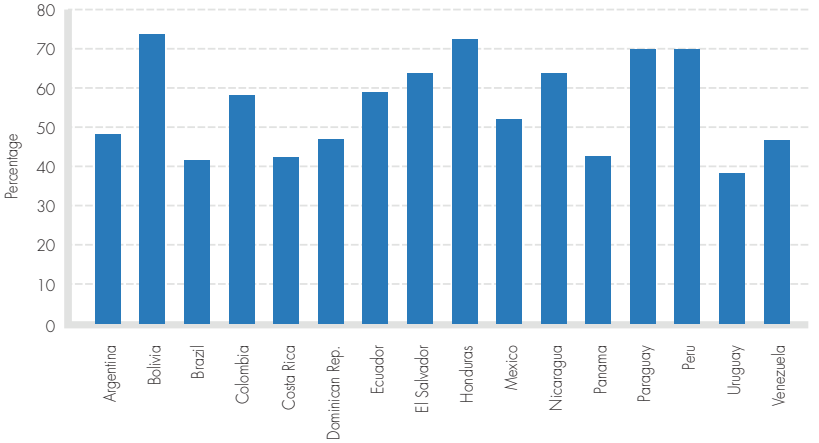

Figure 4.13 Informal employment and the informal economy as part of GDP. *Source: own elaboration based on data from Herrera et al (2004).*

A modern approach to informality does not see informality as an all-or-nothing, but as degrees of informality and formality, along a spectrum where a number of factors can impact its evolution. Informality can become a potential nascent entrepreneurial sector for

2 As Becker (2004) states 'if economic growth is not accompanied by improvements in employment levels and income distribution, the informal economy does not shrink'.

growth and innovation or instead a structural problem of under-development and poverty. The majority of informal economy activities provides goods and services, whose production and distribution are legal. LAC has abundant metals, foods and energy resources, and without strong institutions (Millennium Project, 2012), there are risks of criminalization of the economy, and lack of personal safety due to deep social inequalities. Hence the importance of realizing the potential the informal economy has for water and food security in LAC.

4.2.3 Trade liberalization, consumption patterns, food security and health transition

4.2.3.1 Trade liberalization

Over more than four decades, LAC countries have signed agreements and regional integration treaties of different types. The integration aims to remove barriers to free interconnection of the economies in order to increase their production capacity, trade, and investment; that is, to drive economic growth (Guerra-Borges, 2012). There are significant integration structures in the region, including the General Treaty of Central American Integration, the Latin American Integration Association (ALADI), the Southern Common Market (MERCOSUR), the Andean Community and the newly created Union of South American Nations. There are also treaties and other trade agreements of different levels such as the North America Free Trade Agreement signed between Canada, the US and Mexico, or the fifty-eight free trade agreements signed between Chile and other nations. During the 1980s and 1990s, the region undertook deep processes of structural reform: the reduction of state functions, deregulation, and privatization of state enterprises, among others. Trade liberalization (TL), a central component of the reforms, began with a unilateral reduction of tariffs but nowadays includes complex provisions including labour and environmental issues (IICA, 2009).

One question that it is important to discuss is whether trade and trade liberalization benefit the poor in LAC. Trade–poverty linkages are complex and diverse, but according to orthodox mainstream economic theory and empirical findings, they can be divided into a few important pathways: (a) trade-induced growth; (b) effects of trade on prices, income and consumption patterns; (c) effects of trade on wages and employment. Chapter 5 discusses all these pathways in detail. Buitagro (2009) points out that even though trade liberalization has been considered a key element in economic growth and development, indiscriminate trade liberalization strategies have not been beneficial for low- and middle-income countries. Empirical studies conducted in LAC have shown little correlation between trade liberalization, economic growth and poverty reduction (Buitagro, 2009).

Between 1985 and 2000 all economies in the region experienced important TL. Exports increased fivefold in Mexico, tripled in Argentina and doubled in Brazil. A low growth, the unequal distribution of income, and in recent years the high volatility of agricultural prices, has increased society's vulnerability and prevent poverty reduction, especially in the agricultural sector, the most opened in the economy (Table 4.5).

Table 4.5 Merchandise trade in selected countries of LAC (% of GDP)

	1990–2000	2010
ARGENTINA	18	35
BRAZIL	17	19
CHILE	46	61
COLOMBIA	25	31
COSTA RICA	79	64
MEXICO	59	60
PERU	36	45

Source: World Bank-World Development Indicators.

4.2.3.2 Changes in consumption and dietary shifts

Evidence of a change in the dietary patterns of LAC societies have been found since the 1980s. The consumption of fats, animal products, processed foods, fast food and non-alcoholic beverages has increased while cereals, fruits and some vegetables and tuber consumption has diminished. For Regmi (2001), a change in diet occurs gradually and is the result of income growth, urbanization, changing prices, the rise of the processed food sector, changes in the age structure of the population and awareness of food security, among other factors. Morón and Schejtman (1997) and Rastoin (2009) add the 'terciarization' of the agro-food sector and the impact of advertisement.

Regmi et al. (2008) recognize that the global expansion of industries, agribusiness services and supermarket chains, modifies food prices and shapes tastes and diets, tending to standardize how food is produced, distributed and consumed worldwide. For Bermudez and Tucker (2003) food supply is the mechanism by which modernization affects the Latin American diet and the transition or 'convergence' occurs in different social and economic conditions. This has caused a double problem of public health: malnutrition, due to the prevalence of poverty and unequal income distribution, along with obesity and chronic degenerative diseases, result of more 'refined' diets. More use of water and its pollution are collateral problems of dietary changes.

According to the Pan-American Health Organization (PAHO, 2012) at the regional level a detrimental change in nourishing patterns rapidly unfolded. Between 1984 and 1998, the purchasing of refined carbohydrates and sodas increased by 6% and 37% respectively (Rivera et al., 2004).

Box 4.3 The Mexican case

The study by Santos-Baca (2012) corroborates the results of Bermudez and Tucker (2003). She found that the reduction in animal food consumption was created by a reduction in milk intake, a phenomenon that some researchers associate with the increase in soft drink consumption (Rivera et al., 2008: 175). Cereals and legumes

particularly beans, which was the basis of the Mexican diet, have reduced their importance. Maize remains the most consumed cereal but the consumption declined 18% from 1992 to 2010, when its price increased 53%. Wheat is the second most important cereal consumed but in much smaller quantities than corn; however, wheat spending is similar to that of corn. The average amounts of consumed fruits and vegetables (sources of essential vitamins and minerals), fell from 0.74kg in 1992 to 0.61kg in 2010; those amounts represent 70% and 66% respectively of the quantity recommended by FAO: 400g per person/day. Beverage consumption, except bottled water, increased 37% between 1992 and 2010, due to the significant increase in the consumption of soft drinks. Consumption of sodas increased 40%, and processed juices and nectars increased 141%. Mexico has the second highest per capita consumption of soft drinks in the world. Unlike in developed countries where changes occurred because of modernization, food transition in Mexico from 1992 to 2010 is characterized by the deterioration in food intake (Figure 4.14).

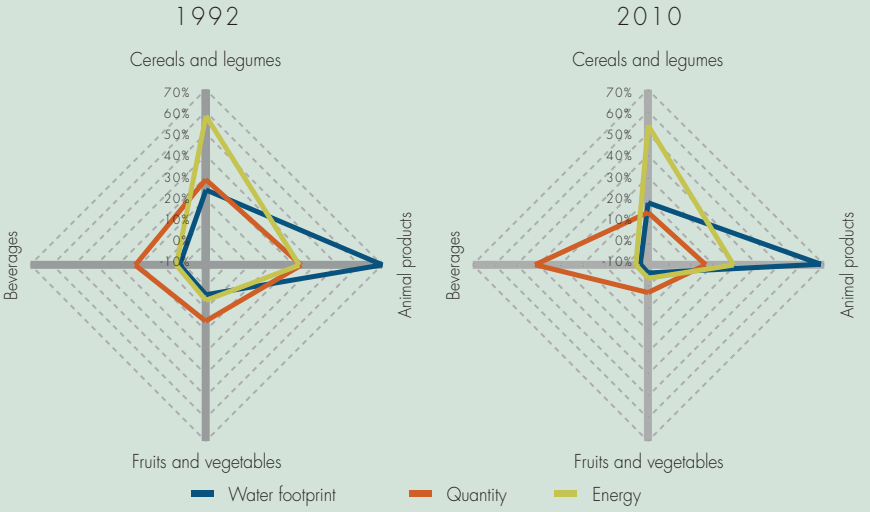

Figure 4.14 Mexican food consumption pattern. Quantity, energy, water footprint of main food products. 1992 and 2010. *Source: own elaboration with data from INEG (1992, 2010), Mekonnen and Hoekstra (2010a, 2010b) and Ercin et al. (2011).*

4.2.3.3 Food security

Hunger currently affects 49 million people living in LAC. This means that 8.3% of the population of the region does not consume the necessary daily calories. Between 1990–1992 and 2010–2012, the undernourished population declined by 16 million people (24.9% over the period), but still an unacceptable number of people are suffering from hunger (FAO, 2012).

The trend in hunger reduction has slowed from 8% between 1990–1992 and 2007–2009, to 2% in 2010–2012. This is the result of the world economic crisis and the slower economic growth in the region but also due to structural problems. The number of hungry people in LAC declined from 57 million in 1990–1992 to 49 million in 2010–2012. The increase in commodity prices and the drought of the last three years have added 3 million people to the category of the poor. Countries like Bolivia and Paraguay, but also Peru, Ecuador and Colombia display hunger problems according to the indicator of chronic malnutrition in children under five years old (FAO, 2012).

On the other hand, adequate calorie consumption does not mean adequate nutritional conditions. Nutrition problems arise from insufficient vitamins and intake of other essential micronutrients. The nutritional problems of the region are not only about hunger in the sense of insufficient energy consumption. Malnutrition caused from inadequate diets which provoke health problems related to nutrients deficiency can also lead to obesity problems (FAO, 2012). According to FAO (2012) Cuba, Argentina, Chile, Mexico, Uruguay and Venezuela have managed to eradicate the scourge of hunger. The case of Brazil is outstanding with the reduction of hunger in absolute and relative terms. The prevalence rate of malnutrition in the total population, and in children under five, diminished from 1999–2000 to 2010–2011. In Peru and Brazil this decrease is very strong but their levels remain high, particularly in children under five years.

4.2.3.4 Health transition

LAC is currently undergoing important demographic, epidemiological (PAHO, 2012) and nutritional transitions (Rivera et al., 2004). The demographic transition is characterized by a reduction in fertility and mortality rates, the increase in life expectancy and by population ageing (PAHO, 2007a and b). The nutritional transition is characterized by a decrease in the prevalence of malnutrition and an increase in obesity, which is a risk factor for chronic diseases such as cardiovascular disease, diabetes and cancer (Pi-Sunyer, 2002). The epidemiological transition is characterized by a triple burden of disease comprising: *infectious diseases*, whose prevalence is declining; *chronic diseases,* registering a rapid increase, and *external causes*, related to accidents and violence.

The drivers of the nutritional transition are complex and multi-causal. Important determinants are the process of urbanization and economic growth, technological changes and innovations that lead to reduced physical activity at work, in leisure and in transportation, and changes in nourishing patterns and dietary intake, with particular emphasis on the increased consumption of processed foods with high-energy content.

The nutritional transition has evolved at different rates in LAC (Barría and Amigo, 2006). Nevertheless, they all display a twofold pattern. On the one hand, there is a diminishing tendency in the prevalence of low weight and height. On the other hand, there is a tendency in the increase in caloric intake, information which has been captured by all surveys of food availability per country (Rivera et al., 2004). Coupled with an increasingly sedentary lifestyle, the result has been a dramatic increase of obesity in many

LAC countries. These are risk factors for morbidity and mortality from diabetes mellitus, hypertension and myocardial infarction, among others.

The health sector in LAC faces a number of challenges: solving problems of infectious diseases and maternal-child mortality, and combating the changes in the disease profiles arising from development and changes in diet; the increase of chronic-degenerative, senile and mental diseases, HIV/AIDS and obesity. Mortality from transmissible diseases and perinatal period decreased while chronic and degenerative diseases linked to external causes (violence, accidents and injuries) have increased. Infant mortality has fallen and the change in age structure has led to an increase of deaths among older adults (Arriagada et al., 2005; CEPAL, 2005).

Obesity is now a widespread growing health problem. Changes in dietary patterns (excessive caloric consumption), sedentary lifestyles, and heavily advertised products with excess fats, salts and sugars, have triggered a rise in obesity (Olaiz-Fernández et al., 2006). Prevalence of hypercholesterolemia found in two cross-sectional samples of adult men and women living in Santiago de Chile increased dramatically in just five years, from 34% in 1987 to 42.5% in men and 46.1% in women in 1992. In Mexico, the mortality rate from diabetes mellitus is 12%. An analysis from 1980 to 1998 of age-adjusted standardized mortality rates for acute myocardial infarction (AMI), diabetes mellitus and hypertension showed a rapid increase of 53% for AMI, 62% for diabetes and 55% for hypertension (Olaiz-Fernández et al., 2006).

In LAC obesity prevalence in adults is high and accounts for over 20% of the population: in Mexico, 33%, Venezuela 31%, Argentina 29% and Chile 29%. The prevalence in children is also concerning. In 2010, more than 2 million under five years old in South America were classified as overweight or obese, more than a million in Central America and approximately 300,000 in the Caribbean. Barría and Amigo (2006) found there is a prevalence of more than 6% of the child population in five countries. Surveys showed that child obesity exceeds 6% in Argentina, Chile, and Peru (Olaiz-Fernández et al., 2006).

The three causes of death (myocardial infarction (AMI), diabetes mellitus and hypertension) have different causes and risk factors. Undeniably, genetics has its influence, but the relationship between these diseases and obesity, poor diet and lack of physical activity is strong and well established in the literature. An important observation about the epidemiological trends in LAC is that obesity and communicable diseases are affecting the populations of all socio-economic levels. Moreover, several studies have found a negative relationship between socio-economic status and prevalence of obesity (PAHO, 2011). Also socio-economic status appears to be positively related to physical activity (Monteiro et al., 2002). These results confront the misconception that obesity is a feature of wealthy populations.

4.3 Other drivers

4.3.1 Scenarios of technological change 2030

A study on potential scenarios for LAC for 2030 was undertaken in 2012. According to the Scenario 1 'Mañana is Today: Latin American Success' of the Latin America 2030 study by the Millennium Project[3] (see Figure 4.15) breakthroughs in science and technology around the world will play a key role. No matter where these advances originated, they will spread quickly throughout the planet. Imagine a scenario in LAC for 2030 where the WTO and Internet 7.0 will help ensure that knowledge moves fast from country to country. Technology will continue improving and synergies among nanotechnology, biotechnology, information technology, and cognitive science (commonly known as NBIC technologies) shall boost technology value and efficiency whilst lowering costs. However, some people could complain about too much technology and unintended consequences like over reliance on technological solutions and furthermore feasible scenarios where socio-political instability and economic constraints become barriers for technology deployment. However, this is one of four possible scenarios for LAC in 2030. These scenarios highlight the role of ICT and technology as game changers, compared to megatrends (NIC, 2008). However, these game changers will probably not materialize without political leadership and vision to address the issues raised earlier in terms of development challenges and opportunities.

4.3.2 Socio-economic impacts of technological change

Information and Communication Technology (ICT) may be the most developed aspect within the NBIC technologies and the best example to analyse their expected impact. ICT has become a key feature in modern life and has proliferated across many sectors, providing new challenges and opportunities. Cell phones that used to be a luxury product can now be bought at an affordable price which has fuelled a rising global ICT market (Figure 4.16).

In 2012, the 2G connection technology (GSM/EDGE) was used by 80% of mobile phones in LAC, although a fast deployment of 3G technologies is foreseen, and the latter should be dominant by 2018 (ERICSSON, 2012). If economic development and consumer demand allow this forecast to be fulfilled, the percentage of individuals using the Internet could skyrocket from 35% in 2011 (16.5% in 2005) to an interval between 70 and 80% in 2018, not far away from the current figures of America's most developed countries, the US and Canada, with approximately 85% (ITU, 2013).[4]

3 www.proyectomilenio.org

4 ITU (International Telecommunication Union) is the United Nations specialized agency for information and communication technologies – ICTs.

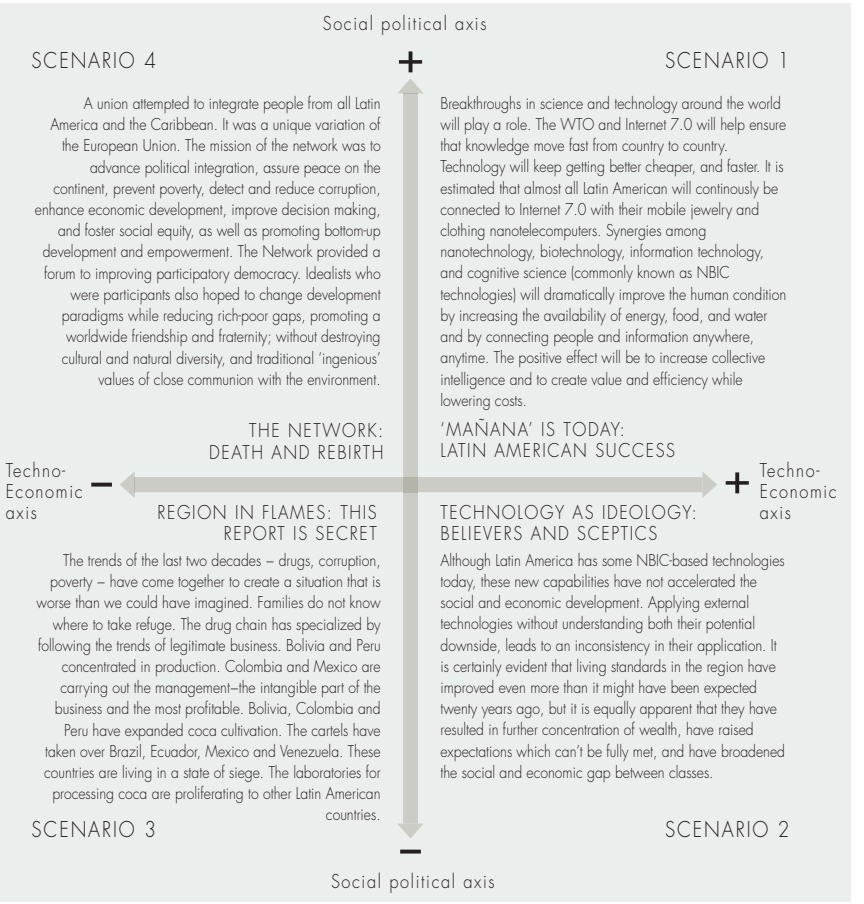

Figure 4.15 Development scenrios for Latin America 2030. *Source: own elaboration based on data from the Millenium Project (2012).*

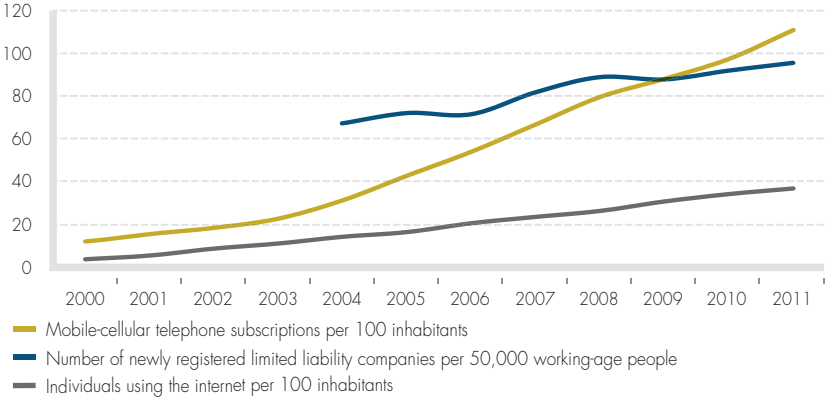

Figure 4.16 Trends in entrepreneurship and access to information and ICT worldwide. *Source: own elaboration based on data from ITU (2013).*

Thus, in many rural areas of some LAC countries, the breach is greater in basic matters such as access to safe water or water disposal systems than in access to up-to-date ICT. Concerning food security, both public and private sectors are embracing the potential of ICT (World Bank, 2011; Vodafone & Accenture, 2012), concluding that a significant increase in agricultural income can be achieved through their use. The so-called e-agriculture is gaining relevance, taking advantage of ICT to promote new possibilities and alternatives and improve many of the areas related to the food production chain, covering issues as varied as financial services, transportation, commerce and marketing, traceability and quality assurance, storage or training, as well as all activities related to crop management, including the optimization of water management. Farmers can benefit from initial/wider access to credit, logistic and commercial support, building visibility, improving the quality of their products and gaining in capacity and education. Also, farmers can obtain expert agronomic advice, key information on weather forecasts, diseases control or best cultivation practices according to the phenological status of plants.

Concerning water security in LAC, the percentage of people with no access to safe water has successfully decreased from 22.6% in 1980 to 5.8% in 2010. A projection made for 2030 (Millennium Project, 2012) estimates this figure will only reach 3.9%, since most of these people live in rural areas where water plans are difficult to implement. An extended use of ICT could help change this trend. Modern water-meters as well as the fostering of a participatory approach by water users connected via ICT are creating new pathways for water security. As an example, the use of innovative crowd-sourcing approaches via text messages and/or the installation of low-cost performance sensors (Hope, 2012) are allowing the appliance of scale economies to hand-pump construction and maintenance, while increasing transparency of the efficiency and effectiveness of investments.

Technology brings new opportunities and challenges for farmers' capacity building: firstly, promoting online education and training for farmers; secondly, strengthening cooperativism and finally, opening new employment niches, markets and commercialization channels.

However, it would be over simplistic to exalt the role of technology while losing sight of the underpinning structural changes that are needed. For example, the priority of education is fundamental to be able to make the most of these technological opportunities. As can be seen in Figures 4.17, 4.18 and 4.19, the trends in this respect are mixed in relation to primary, secondary and tertiary education, which cautions against the ability to realize the full potential of ICT if no parallel investment is made in education and training.

A further challenge for LAC countries is the need to increase investment in Research and Development (R&D), which is on average around 0.6% of GDP while the same ratio for OECD countries is approximately 2.3%. In order to increase and sustain growth, the region must raise productivity levels to improve competitiveness, which in turn depends on increased innovation and R&D.

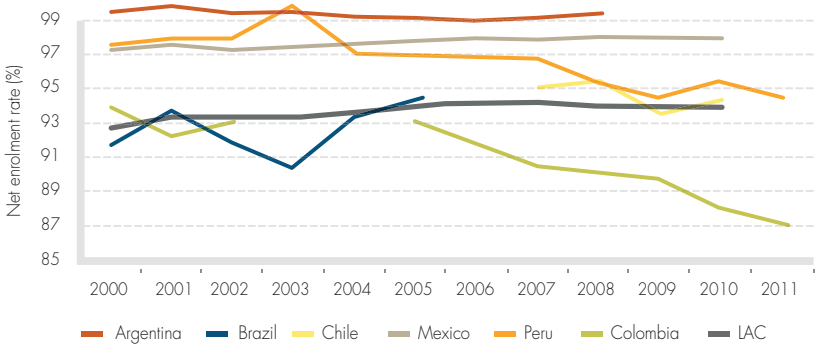

Figure 4.17 Net enrolment rate in first-level education (%). *Source: own elaboration based on data from UNESCO Statistics.*

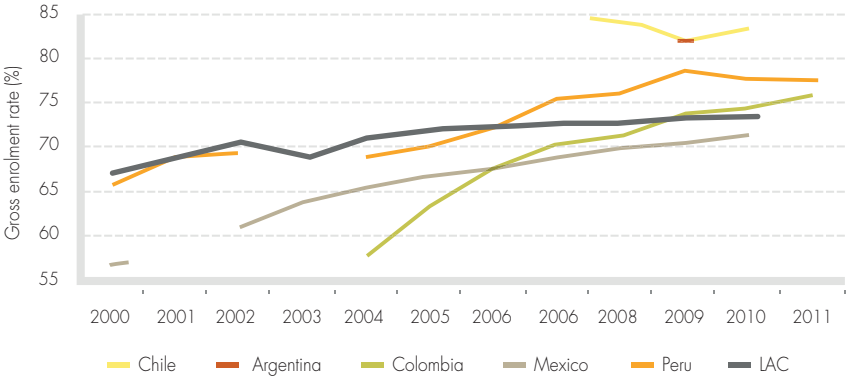

Figure 4.18 Net enrolment rate in second-level education (%). *Source: own elaboration based on data from UNESCO Statistics.*

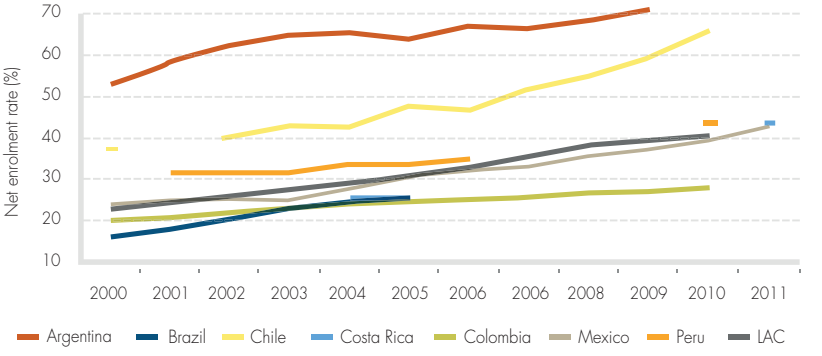

Figure 4.19 Gross enrolment rate in third-level education (%). *Source: own elaboration based on data from UNESCO Statistics.*

4.3.3 Vulnerability to climate change in LAC

Another trend to consider in the future is the potential impact of climate change. Assessing the vulnerability to climate change implies determining the magnitude of adverse effects on the social, economic and ecological systems, its sensitivity to stress factors and its capacity to cope or adapt to the stressor. The Fourth Climate Change Assessment Report of the IPCC (Parry et al., 2007), defines vulnerability as '*The degree to which a system is susceptible to, or unable to cope with adverse effects of climate change, including climate variability and extreme events*'.

The need for improved decision making has motivated an expansion in the number of climate-change impacts, adaptation and vulnerability (CCIAV) assessments and methods in use over the last decades. CCIAVs are undertaken to inform decision making about the degree of risk associated with climate change impacts, so that the most appropriate and cost-effective policy responses can be adopted. The National Communications (NCs) developed by the LAC parties supporting the implementation of the UNFCCC can be classified as a mixed vulnerability and adaptive-based CCIAV. NCs follow mainly a bottom-up approach, where vulnerability to climate is addressed largely as a problem of climate variability within the countries. As Carter and Mäkinen (2011) argue the great majority of assessments that follow this bottom-up approach are found in developing countries, where vulnerability to present-day climatic variability is commonly perceived to be more of a threat than long-term climate change. Table 4.6 summarizes the outcomes of the vulnerability assessments of twenty NCs in LAC countries. The social, economic and environmental risks differ greatly across countries. Nevertheless, social and environmental vulnerability is currently perceived as high in all LAC regions.

In relation to social vulnerability in LAC, the most frequent impacts are related to the increase of diseases, food insecurity and a growing perception that access to drinking water might be at stake. Also, migration linked to worsening climate conditions has been reported, although it is yet unclear whether climate is a driver of such migration flows (see Box 4.4). An increase in the frequency of malaria and dengue fever has also been reported. Food insecurity risks are related to the increased occurrence of the El Niño Southern Oscillation (ENSO) phenomenon and associated with extreme events (e.g. droughts, floods). In 2009/2010 a severe drought affected agricultural areas of Guatemala causing the loss of 100% of the harvest. National production of maize, bean and rice only dropped on average 1.5%; yet over 145,000 people needed emergency food assistance. In 2007/2008, Bolivia was affected by La Niña, which caused floods, droughts, frost and hail-storms, across the whole country. Rice crops losses reached up to 25% and prices of the main basic products rose sharply with a strong negative impact on the price and access to food especially in urban areas. Changing climatic conditions are also affecting water access, like, for example, the case of Chile's glacier Echaurren Norte, one of the most important sources of drinking water for the metropolitan area of Santiago.

Table 4.6 Social vulnerability assessment to climate change in Latin America. Note: Values refer to the percentage of countries reporting vulnerability to the different impacts. Grey cells represent impacts affecting less than 50% of the countries; yellow between 50–75%; and brown cells account for impacts affecting more than 75% of the countries.

	IMPACTS		VULNERABLE COUNTRIES (%)				
			MESOAMERICA	SOUTH	AMAZONIAN	ANDEAN	FREQUENCY AVERAGE
SOCIAL	Higher risk of diseases		75	75	100	100	88
	Unsafe access to drinking water		88	50	33	60	58
	Damages to infrastructures (dwellings, protection areas)		50	25	67	40	46
	Impact on food security		75		67	40	61
	Migrations		50	50	67		56
	Increase in poverty		38				38
	Human losses caused by natural disasters				33		33
ENVIRONMENTAL	Changes in the hydrological cycle and water quality		63	75	33	20	48
	Coastal erosion and coastline retreat		25	60	100	20	49
	Changes in ecosystem productivity and biodiversity loss		75	50	67	60	63
	Higher risk of fires		25	25	67		63
	Salinization		38	25	100		39
	Increase in pests		25		33		29
ECONOMIC	Agriculture	Reduction in water availability	75	25	33	20	38
		Reduction in crop yields	88	25	67	80	65
		Damage to agricultural infrastructures	13			20	17
		Soil erosion and desertification	25			20	23
		Loss of agrodiversity		25		20	23
		Loss of harvests	13			20	17
		Decrease in aquaculture production	38		33	40	37
		Losses in livestock production	38		67		53
	Energy	Lower hydropower generation	38	75	100	20	58
		Damages to energy infrastructures	50	25			8
		Excessive reliance in fossil fuels	13	50			32
		Risk to invest in biofuels		25	33		29
		Increase in energy demand		25			25
	Minery	Reduction in water availability		25			25
	Tourism	Damages to tourism infrastructures	50	25		20	32

Source: own elaboration based on the (NCs) National Communication Strategies of twenty LAC countries (UNFCC, 2013).

Box 4.4 The nexus between climate change and migration

The climate change-migration relationship is as yet unclear. Extreme weather shocks have been associated with migration processes at the micro-level, although no clear macro-trend has been observed. So far no projection exists regarding expected 'environmental migrants' (Wilbanks et al. 2007) and some authors argue that environmental migration might be a 'myth'. Global estimates of environmental migrants –25 million according to Myers and Kent (1995) – are outdated and have been the subject of debate. In LAC no concrete figures exist despite the high frequency of meteorological events that occurred over the last century (see Figure 4.20). In Mesoamerica, storms and floods are the most frequent hazards, whereas in South America, floods prevail. Nevertheless, droughts have caused the largest impacts on the South American population.

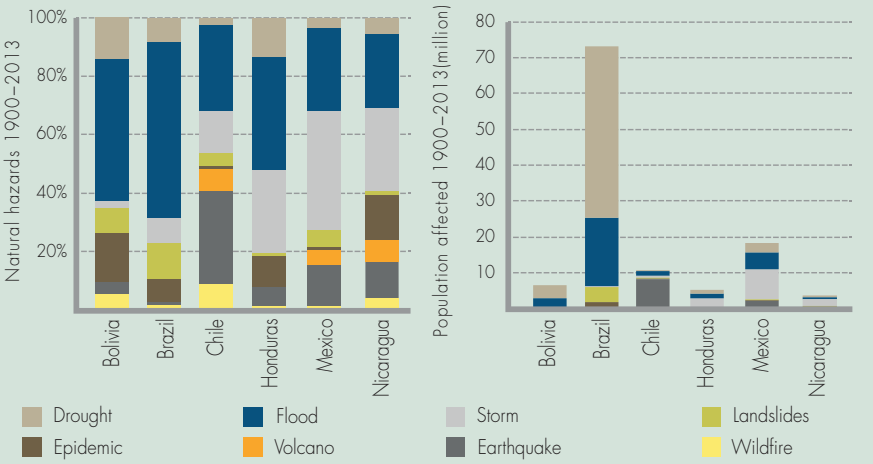

Figure 4.20 Type of natural hazards and population affected in selected countries in Latin America. *Source: own elaboration based on data from the EM-DAT database (2013)*

People often speak of the rural poor as the main victims of migration associated with climate change. In the case of LAC the impact should be observed at a much slower pace given its high degree or urbanization. The highest rural population in LAC is concentrated in the less developed countries, which thus increases the social vulnerability and the risk of migration. The most likely impacts of climate change in LAC may include damage to coastal areas consequently impacting tourism infrastructure and generating migration of local populations to safer areas and the reduction of glaciers, which could affect the Pacific cities and their water reserves. The effects of climate change on migration will be very different in countries like Bolivia or Paraguay, without coasts, than in the Turks and Caicos, the Cayman Islands and the Bahamas, which have a 100% of its population below the10 metres elevation mark.

4.4 Conclusions

This chapter has identified the main socio-economic trends in LAC and Caribbean (LAC) and their direct and indirect consequences for water and food security. In relation to water security, the LAC population will continue to grow, despite the decrease in the fertility rate, with changes in lifestyles and the growth of the middle class which will increase the demand for water services and food, as well as external demand for producing agricultural commodities for export. As was shown, LAC has experienced a modest level of development in terms of per capita gross domestic product; centred around a fairly intensive use of water resources due to its economic model based on primary goods, recently triggered by the high prices in the international markets.

One of the main issues is whether this economic growth has been decoupled from increased water use. Since the model has been based on a re-primarization of the economy and exports, issues arise regarding the potentially large (green) virtual water of food exports. The other issue relates to poverty and water; water and sanitation in LAC in general has progressed well, in relation to the Millennium Development Goals, particularly in urban areas. LAC is the second most urbanized region in the world, including sixty-seven cities with more than 1 million inhabitants and four 'megacities' with more than 10 million (Mexico City, São Paulo, Buenos Aires and Rio de Janeiro). Sometimes it is hard to provide sufficient water services, with problems emerging from the relatively large informal economy and informal settlements, as well as from dispersed rural areas which could be left behind.

With regard to trade and food sovereignty, related to water security, linkages with price volatility in the case of LAC deserve a more detailed study in order to better understand the inter-linkages due to the economic models adopted in some of the emergent LAC economies. In LAC, the inequitable distribution of income could make it much more difficult to establish potential cross subsidy schemes, e.g. for the urban poor or even in rural areas. Thus equity remains a central pivotal issue for water and food security.

Water and food security confront important challenges imposed by globalization. Trade liberalization, increasing demand from countries such as China for primary goods, compounded with changes in consumption patterns also prompted by urbanization, the increase in per capita income and advertising have changed societal priorities and the way natural resources are used. New dietary patterns based on animal and agriculturally industrialized products require more water and raise issues of food security in terms of the nutritional quality of the 'modern diet'. As a result, health trends reflect the emergence of diseases like obesity and diabetes.

The democratization and adoption of ICTs could present a window of opportunity for water and food security, because of their cost, popularity and access are likely to increase exponentially. Water management in rural areas could be revolutionized through new instruments that can generate more accurate and visible data and information, essential to pinpoint better planning and use of water (and food) resources. The use of ICT can

also help to support environmental and biodiversity conservation and further to avoid environmental, social and human harm for future generations.

Rural development could be supported by new technologies in the agriculture and food value chain, access to markets and financial services. There are barriers for ICT uptake in agriculture such as farmers' education and training (illiteracy or lack of technical skills), the lack of awareness and understanding of ICT and also the cost of deployment of some new technologies.

In order to guarantee water and food security faced with the potential impacts of climate change in socio-economic terms, it is important to define long-term targets for CC mitigation, to identify vulnerable regions and groups, prioritize research and adaptation, and to invest in adaptation and mitigation measures. Social and environmental vulnerability is high in all LAC regions where the most frequent impacts are related to increasing diseases such as malaria and dengue fever, food insecurity and a growing perception that access to drinking water may be at risk. Extreme events such as droughts and floods are affecting agricultural areas in many countries and in some cases access to water.

Latin American trends can, however, be modified. Measures orientated towards achieving fair income distribution, public policies orientated towards more vulnerable groups of population, a model of growth sustained on domestic markets, formalization of the informal economy, investment in science and technology and policies for improvement and conservation of natural resources would be key goals to prioritize and thus allow progress to be made on future socio-economic megatrends in order to guarantee water and food security into the future.

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