A New World Typology of Cities and Systems of Cities

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Abstract The chapter proposes an overview of global urbanization since 1950, relying on the structural and dynamic principles of the evolutionary theory of urban systems and on the observations of some of the major financial linkages connecting cities. We analyze first an overview of the state of urbanization at the world scale using statistics collected and provided for all 195 nation-states of the United Nations. We then examine the extent to which the income level and human development index of countries are correlated with the urbanization rates. Trajectories of cities underline the booming cities including many Asiatic and African cities opposed to the relative declining cities. The total weight of emerging metropolises mostly located in Southern countries passed the total population of the other groups of relatively declining cities between 1980 and 2010. It is highly critical for the urban future that the large majority of urban citizens of the world (more than 60%) will be living in these emerging cities in 2030. It will require finding adapted ways to manage urban growth and ecological transition in these developing systems. This global approach finally leads to the partition of the world we used in the book to analyze more precisely the evolution of individual national or continental urban systems.

Keywords Urbanization · System of cities · Evolution · Cities' trajectories · Typology

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1 Introduction

Understanding the uneven evolution of urban systems in the contemporary world requires precisely positioning these systems in the complex structure of the worldwide urban system. In this study, we will not develop a new historical approach to urbanization to describe the complexity of the evolutionary dynamics of world urbanization (Zeigler et al. 2008; Scott 2012). Instead, to establish an actual portrait of world urbanization *beyond the center-periphery model* (Scott 2012: 52), we propose a grand overview of global urbanization since 1950, relying on the structural and dynamic principles of the evolutionary theory of urban systems (chapter "A New Urban Theory for Comparing Urban Systems" in this volume) and on the observations of some of the major financial linkages connecting cities (chapter "Urban Systems Between National and Global: Recent Reconfiguration Through Transnational Networks" in this volume). This process will allow us to summarize the major features of the urban landscape on the current world scale and define which subsets of cities can be expected to have comparable futures, either because they already have similar properties or because they are becoming increasingly interdependent through intense interconnections.

Among the several criteria that could be used for partitioning the urban world, the level of economic and human development of countries is an obvious candidate. However, the growth of cities has appeared in some cases and in some periods to be disconnected from economic development (Bairoch 1985). Despite this, a recent report of the World Bank (2009) insisted on the important driving role of cities in national and international developmental strategies. Another recent survey from Habitat (2012) demonstrated that in all countries, the level of human development achieved by major cities almost always surpasses the level reached by their own state (Fig. 1).

The ability of cities to produce higher growth and human development compared to rural places stems from more than their individual characteristics, services, and functions. Cities also take advantage of participating in the development of complex processes of socioeconomic networking both inside and outside their own functional area of daily influence. In this way, they specifically contribute to their respective

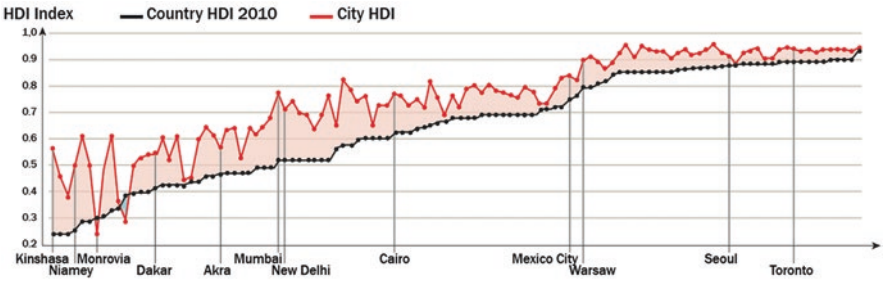

Fig. 1 Human development index of cities and their countries (©UN Habitat, 2012; redrawn by Rozenblat, 2017)

country's power, and inversely, they take advantage of this national power, which explains the differences of wealth observed between cities of the same population size, such as Cairo, Buenos Aires, and Paris (Polèse 2005, 2014). Unfortunately, comparable indicators of these abundant and diverse socioeconomic interactions are not available for all cities, but we can safely rely on demographic data to build a typology according to the urbanization trends observed at the state level during the last half-century. We know that despite the globalization process occurring through transnational and international networks, geographical proximity as well as national boundaries still matter for a number of transactions (Sassen 2012). We are also aware that huge income inequalities and qualitative differences are pervasive in this landscape and are even part of the intrinsic dynamics. We shall verify if the variability that exists among urban growth rates when measured at the level of individual cities is large and random enough to blur the limits of groups of similar country-states.

Using this global approach, we shall try to infer which partition of the world can be used to analyze further the evolution of types of urban systems in a coherent way. We shall analyze first an overview of the state of urbanization at the world scale using statistics collected and provided for all 195 nation-states of the United Nations (UN). The countries are characterized according to the stage they have reached in the urban transition, as measured by the share of their urban population (urbanization rate) and the recent trends in urban growth. We shall then examine the extent to which the income level and human development index of countries are correlated with the urbanization rates because this may determine the perspective for urban growth during the decades to come.

2 Urbanization and Development at the Nation-State Level: Urban Transition Stages

Defining urban population and urban localities and possibly aggregating them in geographically meaningful urban units when they overrun administrative boundaries or cover only a restricted part of the localities where the population is enumerated are a tricky exercise at the world scale. Although a number of urban databases are now available on the web, none seem to be as reliable as the statistics collected by the UN from 195 country-states. They have been progressively improved and harmonized and provide insights to the past as well as plausible predictions for the future.

We elaborated all the figures of this chapter from the data of the World Urbanization Prospect in 2014. Of course, the data are not strictly homogeneous (Brenner and Schmid 2014). In fact, the Population Division of the Department of Economic and Social Affairs of the United Nations elaborates these tables, collecting data produced by each country. Since the 1950s, this office published many recommendations to orient the measurement of cities by national statisticians. In the first stage, the division recommended the adoption of the concept of morphological urban agglomeration, which is perhaps not always the best way to measure city

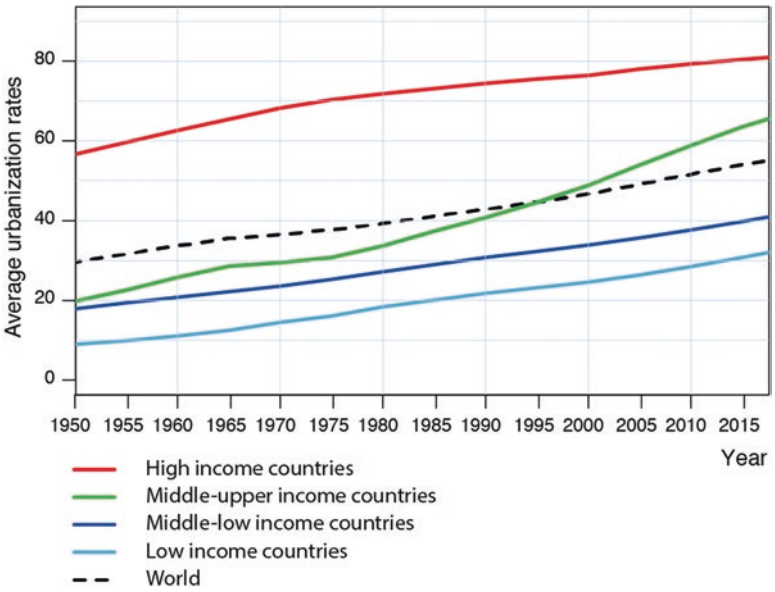

Fig. 2 Parallel development of the urbanization rate according to the income level of countries at the world scale 1950–2015 (©Rozenblat, 2016; Source: United Nation, World urbanization prospect, 2014)

sizes, but it is a better evaluation than taking into account only the central municipality, for which the delineation varies widely by country according to the territorial framework.

Since the 1990s, the United Nations office has also collected functional delineations of cities when available. Each country adopted specific variants of morphological or functional definition according to its own characteristics and constraints: the minimum threshold to consider a settlement as a city varies from 2000 to 10,000 inhabitants. The distances between buildings used to delineate the agglomeration vary from 50 meters to 200 – it may be acknowledged that the evaluation of urban phenomena is relative to the general context of population densities and movements. In addition, some countries have more or less intentionally produced bias in urban statistics that may overevaluate the growth of urban wealth, such as China not taking into account the population of migrants who live in cities without the corresponding urban *hukou* (Chan 2007). However, given all possible bias existing in any statistics and because specific studies explaining the national contexts in detail will be presented in the following chapters, we consider here that these statistics provide a useful overview of the general trends observable at the global scale.

In Fig. 2, we can compare the evolution of the proportion of the urban population to the total population (namely, the urbanization rate) at the world scale (dashed line), with groups of country-states classified according to their income level per inhabitant.

During the half-century period between 1950 and 2015, the share of the urban population in the world increased from approximately 30% to more than 50%. The curves in Fig. 2 follow a general trend toward a parallel increase in the proportion of urban population, regardless of the level of wealth of countries, which demonstrates the power of the so-called urban transition that propagates the urban economy and way of life throughout the world, regardless of the income level per inhabitant. The high-income countries seem to have reached the saturation point in the process of diffusion of urbanization for a few decades because the curve marks the first inflexion toward deceleration since the 1970s and tends to stabilize when the urban population reaches 80%. We note, on the contrary, that a subset of countries classified as "middle-upper-income countries" by the UN had a propensity to raise their urbanization much faster than the other groups. This group was also named *emerging countries* during that period. It includes major success stories that are significant at the world scale because they encompass very large and populated country-states (for instance, the so-called group of *BRICS*, Brazil, Russia, India, China, and South Africa) where urbanization boomed as their economies caught up with the wealthier countries. Brazil appears here to be an exception because, as in other South American countries, its urbanization took off much earlier under influences from a colonial Mediterranean country (see chapters "The South American Urban System" and "The Brazilian Urban System" in this volume).

The geographical expansion of the urbanization process because of its universality and spatiotemporal pattern was theoretically interpreted as an *urban transition* (Zelinsky 1971) as an analogy for the *demographic transition* and also assimilated to the spatial diffusion of innovation because it shares many properties with the famous model developed by T. Hägerstrand (1952). According to these models, although the transformation of the rural population and localities into urban areas through migration and natural growth may widely differ qualitatively and quantitatively over space and time, there is a rather inexorable trend in the process that may occur at different moments in time according to places. Globally, however, there is a delay between the industrialized countries, where it has happened since the beginning of the nineteenth century, and most of the less developed countries, where it started roughly after the 1950s.

We will focus on the last two stages of the process (1950–1990 and 1990–2015) using graphs that illustrate how in a transitional and spatially diffusing process a negative correlation is observed between the stage of urbanization already attained (as measured by the urbanization rate on the x-axis) and the evolution of this process (as measured by the rate of growth of the urbanization rate on the y-axis) (Fig. 3).

During the first stage (Fig. 3a), there is still a clear gap between the average level of urbanization in two distinct parts of the world. When countries are aggregated and averaged at the continental level, North America, Europe, Oceania, and Latin America all have more than 65% of their population concentrated in cities, whereas Asia and Africa lag behind with a proportion less than 40%, and even Asia has an urbanization rate well under the world average.

In 2015 (Fig. 3b), the situation was transformed because the urbanization process evolved, partly according to what could be predicted from the transitional and the

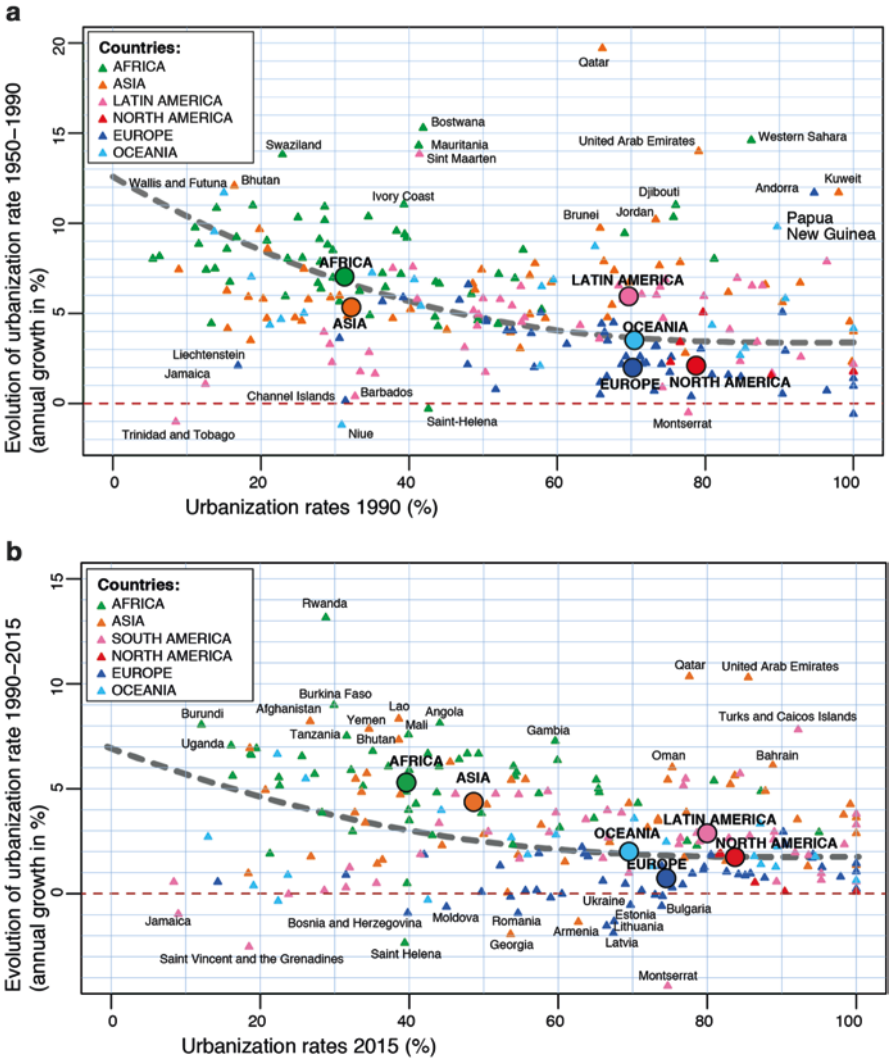

Fig. 3 Deceleration of urban growth rates with urbanization rates at the state level. (**a**) First stage 1950–1990. (**b**) Second stage 1990–2015 (©Rozenblat, 2016; Source: United Nation, World urbanization prospect, 2014)

diffusion models and partly as a surprise. The growth of urbanization rates has decelerated, and its variation measured at the country level has been considerably reduced: where extreme values could reach more than 15% per year during the preceding period and values above 10% are now very rare and limited to small territories. As predicted by a diffusion model, the process is now more homogeneous, but the continental situations have become more diverse: North and Latin America now appear to have a concentration of the highest urbanization rates, whereas

Europe and Oceania remain blocked below the threshold of an 80% urban population. Moreover, the most important change is in Asia, whose proportion of urban population jumped to over 50% due to a huge take off ahead of world average urban growth, whereas Africa, although maintaining approximately the same speed in the evolution of its urbanization rate, reached only an approximately 40% urban population.

Obviously, the same urbanization rate does not represent the same population size according to the country or the same dweller distribution between large, medium, and small cities of the national urban systems. The level and speed of the transition per se do not inform the necessity to elaborate new infrastructures and services planning or urban policies to address these rapid urbanization processes. They do not inform the capacity of the countries to finance and support the new dwellers' settlement and welfare. This sometimes leads to the overgrowth of large metropolises, exceeding their infrastructural and housing capacity, where slums hold more than 50% of the inhabitants, whether there is a high urbanization rate, such as in Brazil (more than 85% in 2015, see chapter "The Brazilian Urban System" in this volume), or a low rate, such as in India (less than 33% in 2015, see chapter "Diffuse Urbanization and Mega Urban Regions in India: Between Reluctant and Restrictive Urbanism?" in this volume).

3 Urbanization and Development

Of course, we are tempted to interpret the enormous urban growth that occurred in Asia since the 1990s by linking it with the rapid economic development of that region, especially in the two largest countries, China and India. Indeed, there is a general correlation between the urbanization rate and the income per capita when measured at the level of the 195 country-states of the world. The determination coefficient (R^2) between the two variables is very high (almost 0.5), which is rather rare in social sciences. This relation is well known but with slight fluctuations according to the year of measurement (World Bank 2009; Henderson 2002, 2003, 2010; Duranton 2014). One may wonder what this relation between economic development and urbanization means. Duranton (2014) asked, "How much of that extra 5 percent of GDP per capita is a consequence of this extra percentage point in the rate of urbanization?" (p. 3). In fact, the direction of the relation and its embeddedness in universal and uneven socioeconomic processes remain unclear. Duranton (2014) suggested that agglomeration economies, especially in large cities, and the level of education would produce positive productivity effects (both variables – the size and the education level – are linked, but not closely enough to introduce redundancy according to the author). Regarding the welfare aspect, "benefits from urbanization are not as big as increases in earnings suggest. When a population urbanizes, it becomes more productive, but this higher productivity comes at the costs of greater commuting costs and higher housing costs" (Duranton 2014: 11). Duranton suggests that a part of the relation is created by cities'

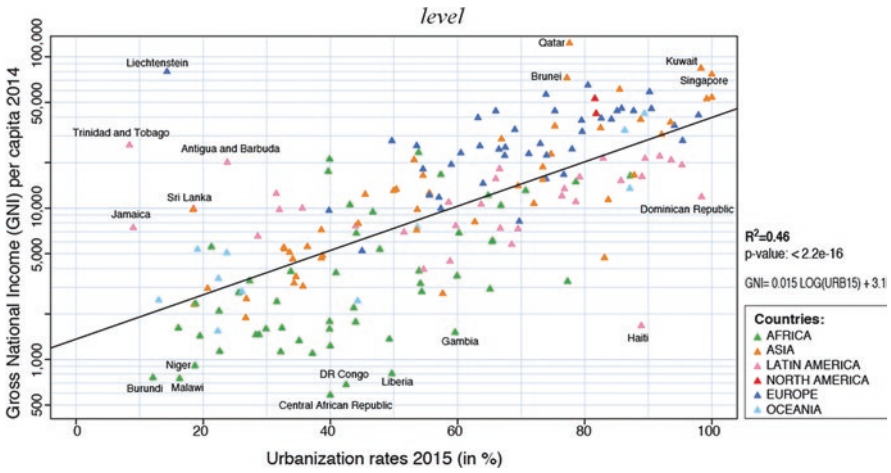

Fig. 4 Correlation between urbanization rates and the income level per capita at the state level (©Rozenblat, 2016; Source: United Nation, World urbanization prospect, 2014; United Nation, Human development report, 2014)

agglomeration economies fostering productivity, whereas the other part is the feedback loop of the productivity growth creating structural change in cities attracting a larger population toward cities. We suggest that in addition to useful computations adapted to the current economic situation, there is a more general explanation of the relationship between urbanization and economic growth, which encompasses many other aspects of the organization of societies (see chapter "A New Urban Theory for Comparing Urban Systems" in this volume).

That is why it can be understood that the story has had very different variations in the recent evolution of developing countries, with low levels of urbanization and GDP/inh., and in the more developed countries. To illustrate these variations, the graphical representation of this relationship (Fig. 4) has been enriched with an indication of the continental location of each country, which enables the visualization of the still sharp contrast between Europe and North America, which are fully urbanized, and Africa, which has a concentrated amount of the poorest and least urbanized countries, whereas the situations are more heterogeneous in Asia and Latin America.

Exceptions to the general relationship are anecdotal when highlighting the special case of small fully urbanized city-states (as Singapore) or some isolated small states (Liechtenstein) or islands (Trinidad and Tobago, Antigua and Barbuda), whose high incomes rely on attractive financial regulation; however, overall they illustrate on the lower side of the graph the difficulties of African states, whose development level is still far below what could be expected from their urbanization level. For example, in the Congo, Central African Republic, Liberia, and Gambia, despite their average urbanization rate, they share the same very low-income level as rural countries, such as Niger, Burundi, and Malawi.

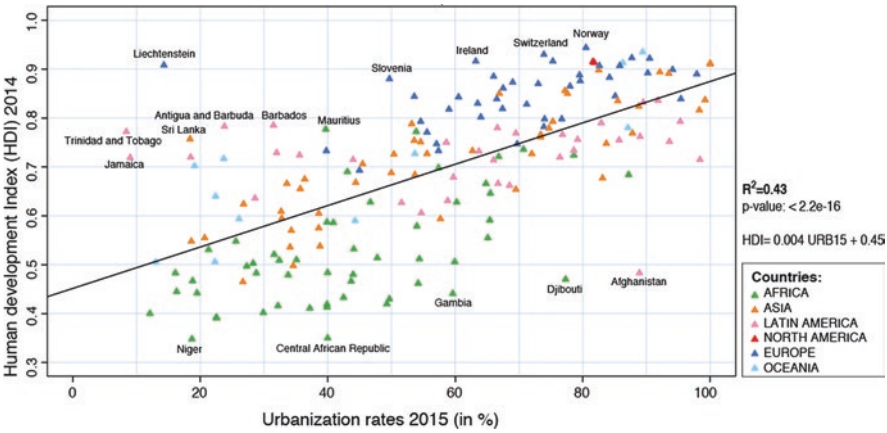

Fig. 5 Correlation between urbanization rates and the Human Development Index at the country level (©Rozenblat, 2016; Source: United Nation, World urbanization prospect, 2014; United Nation, Human development report, 2014)

The picture is not very different when considering the correlation between urbanization rates and the Human Development Index (HDI), which integrates not only the income level but also other attributes related to well-being and quality of life, such as population health and education (Fig. 5). The intensity of the relationship is also rather strong (the correlation coefficient is approximately the same as that with per capita), but there are interesting differences in the position of countries on the graph. The positive deviations from the general relationship are not explained by financial policies generating exceptionally high average levels of resources but mostly by types of social policies aimed at taking better care of "human capital."

Most of the European countries, even from the former Eastern part, and a few countries in Latin America appear above the regression line, whereas the Asiatic countries are more dispersed, highlighting the wide heterogeneity of the continent in that domain. All African countries are below the line, with almost none of them reaching the level of the world relationship. The expression "urbanization without development," which is typically used for characterizing the growth of cities in this continent, could be specified, as well as "urbanization with little human development." A single Asiatic country, Afghanistan, where war has prevailed for decades and women are not allowed to pursue education, has approximately the same important deviation between its urbanization rate and its HDI as African countries situated at much lower urbanization rates, such as Niger, Central African Republic, and Gambia.

The often-smooth progression of the urban transition together with the high levels of the correlation between income and human development indexes facilitates the design of a partition of countries at the world scale because we can be confident, at least for a few decades, of the quality of its description of the global urbanization pattern and its major variations as well as of its power of prediction for the next future. This reliability is linked to the universality of the urbanization process in

many of its properties. It enables the UN to improve the quality of its statistics despite difficulties in measurement and harmonization and provides attempts for more detailed descriptions at the level of individual urban units. We have to consider that level for ensuring the relevance of our partition of the world in large regions. It is necessary to check if the diversity of urban trajectories at that level does not contradict the major boundaries between systems of cities that we can draw using country-states or continents as basic territorial units according to their stage in the urban transition, development levels, and perspectives on future urbanization.

4 Differential Trajectories of Individual Cities

We can verify the relative homogeneity of regional urban systems by analyzing trajectories at the level of individual cities. UN statistics are provided not only at the country level but also at a finer scale for the largest urban agglomerations. Population figures are given in 5-year intervals from 1950 to 2030 (the figures after 2010 are projections).

We classified the trajectories of the 1692 urban agglomerations having more than 300,000 inhabitants in 2015 using the method of ascending hierarchical classification with chi-square distance on the population measured at 17 dates. We chose this method because it measures the evolution of urban population in relative terms (producing results that are similar to a cluster analysis that would be made on growth rates) and thus enables a comparison between cities that is not biased by their size: cities of the same class at each step of the classification have growth profiles that are very similar to cities of another class. Another advantage of the method is dealing with the actual population figures, which can be plotted directly to compare the growth trajectories of classes of cities on semilogarithmic graphs, where parallel segments (identical slopes) reflect equal growth rates.

We choose to display six classes that are clearly separated in two major groups (as visible on the classification tree) (Fig. 6). The growth profiles of each class are plotted in the legend of Fig. 6 according to the average population of cities in the class, in absolute numbers on the upper graph and according to the value of this average population divided by the total population of all cities *at each date* on the lower graph. This last measure represents the relative weight of the corresponding class of cities in the full set of the cities of the world larger than 300,000 inhabitants, allowing us to discriminate which among them gained or lost importance compared with the other cities.

The map in Fig. 6 exhibits the remarkable regional homogeneity of urban trajectories throughout the world. It also illustrates very well the major shift in urbanization that occurred at a world scale during the last 60 years and its very probable evolution over the next 20 years. If we would consider the set of 1692 urban units as an integrated "global" system of cities – as many authors could be tempted to think – our analysis would rejoin the first attempts by Cesare Marchetti (1980) to describe urban dynamics in such a system with the logistic substitution model. That

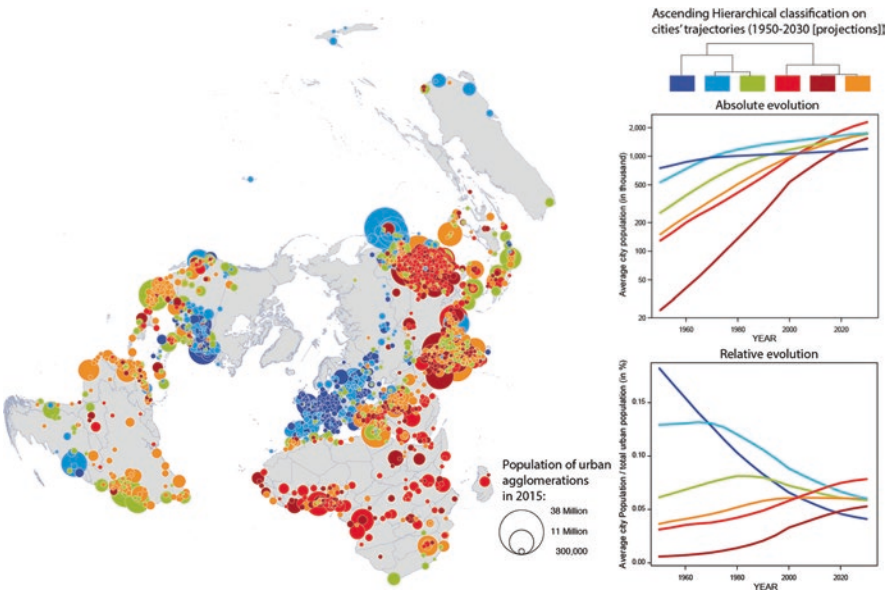

Fig. 6 Population trajectories of individual cities 1950–2030 (©Rozenblat, 2016; Source: UN, 2014)

model indicates that the market shares of any innovation that renews an existing domain of activity through a Schumpeterian "destructive creation" process are growing according to a logistic curve at the expense of the previous analogous products or services.

We can see here a kind of "substitution" among the places that concentrate urban populations (and the associated economic powers) in the world. All agglomerations in blue and green colors, which were on average the largest in the 1950s, have stabilized their population trajectories. Moreover, the class in dark blue has lost relative importance in the world urban system in a continuous way and to a more severe degree, whereas the two other classes did so later on and to a lower extent. Very large urban agglomerations of the developed world, such as New York or Tokyo as well as all European or Australian cities, belong to these relatively weakening classes.

At the opposite side are the booming cities of that period (two classes in red), including many Asiatic and African cities. Many became very large and now belong to the top list of world megapolises, such as Shanghai, Beijing, Guangzhou, Shenzhen, Delhi, Mumbai, Calcutta, Abidjan, and Lagos. They have not only huge population growth but also a large share of the economic activity of the planet, in absolute and in relative terms.

The less booming class of cities (in orange color on the map) is remarkable because they maintain their relative weight in the system throughout the period. Many of them are in Latin America, including very large agglomerations such as Mexico City, Sao Paulo, and Rio de Janeiro, as well as "second-tier" cities of Asia in countries where the demographic and urban transitions are more advanced (for

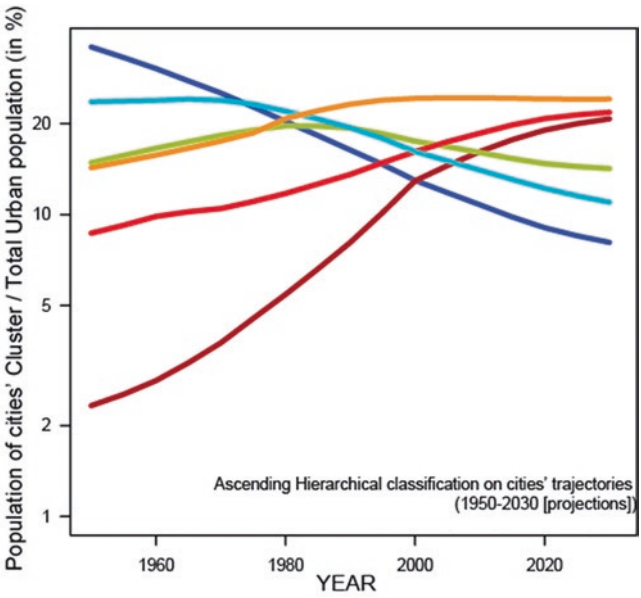

Fig. 7 Total weight of clusters of cities 1950–2030 (©Rozenblat, 2016; Source: UN, 2014)

instance, in the South of India, such as Bangalore or Chennai, Manila in the Philippines, or Cairo in Africa).

The total weight of the three groups of emerging metropolises mostly located in Southern countries (the three classes in orange, red, and dark red in Fig. 7) passed the total population of the three other groups of relatively declining cities (in blue and green) between 1980 and 2010. It is highly critical for the urban future that the large majority of urban citizens of the world (more than 60%) will be living in these emerging cities in 2030. It will require finding adapted ways to manage urban growth and ecological transition in these developing systems. Of course, urban models found in countries where the urban transition was done a few decades ago will not be transferable to this new stage of urbanization because it is happening in a new context of a *third-wave* capitalism residing "above all in digital methods of calculation, communication, and information storage" (Scott 2014: 107). In addition, the involved cities belong to countries that have weak power to handle the urban process: one of the biggest issues in most of these growing cities is this lack of national/regional capacities to offer institutional and material favorable terms, planning, regulations, and controls to address spontaneous urbanization (this may concern African cities, as well as East Asian cities, including Chinese cities (Wu et al. 2007), and most of the South American cities (see chapter "The South American Urban System"). Filling the gap would permit reducing slums and informal sectors in the national cities (Polèse 2014), if not further the development of more complete cognitive-cultural functions and increase the average well-being of urban citizens.

Each country/continent socioeconomic system creates its own urban framework's emanation, and the urban system approach will help provide better evaluation of the issues that each part of the world, according to its stage of urbanization, will face in the near future. In particular, the urban system approach, comparatively developed for each continental/national urban system, allows us to figure out how each of the urban systems reacts differently to actual global integration and thus determine more specifically the possible support of urbanization by middle-size or second-tier cities and secondary poles around metropolises.

What is striking on the map of Fig. 6 is the large spatial autocorrelation of cities belonging to the same classes, which confirms our hypothesis that the major determinants of urban growth and trajectories during the last 60 years will remain very constraining at least during the next 20 years and probably even later until the middle of this century, i.e., the *stage in urban transition and the national level of economic and human development*. These variables are still mostly contained in wide spatial envelopes that are defined by the countries and the large cultural and economic regions of the world. This can easily be explained by the simple *first law of geography* (as coined by Waldo Tobler 1970), which summarizes the universality of the gravity model or, in other words, the strict constraint hampering long distance spatial interaction that prevailed for centuries and that together with the effectiveness of state boundaries explains the smooth geohistorical pattern of many societal variables at the world scale today.

Of course, we know that huge variations inside countries do exist among people and between cities of different sizes. At that level of observation, the situations are far from homogenous, as will be demonstrated in most chapters of this book. In addition, as we can see on the map of Fig. 6, there are also exceptions to the grouping of classes of urban agglomerations in all continents. However, they are not as numerous, compared to the massively auto-correlated distribution of urban growth trajectories on which we can rely for subdividing the world into parts that will be significant for analyzing urbanization in greater detail in the subsequent chapters.

5 Conclusion: Exploring the Diversity of Systems of Cities at the World Scale

As a consequence of the amplified networking trends at all levels of the urban economy and societal practices, the former grid of national countries – i.e., high-, middle-upper-, middle-low-, and low-income countries – is no longer valid for providing relevant descriptions of urban systems in the world today. In addition, instead of a series of 195 descriptions of national urban systems – to take into account all UN countries who participated in the global launch of Habitat 3 in Quito in the fall of 2016 – we suggest enlarging the territorial envelopes encompassing cities that are already organized in highly connected networks (see chapter "Urban Systems Between National and Global: Recent Reconfiguration Through Transnational Networks" in this volume).

As they become more interdependent, cities participating in global networks have entered coevolution. For instance, Europe obviously has to be considered as forming a single system of cities; however, not all cities but rather only the largest or specialized cities are fully connected together, and external borders are not easy to delineate according to what would be a similar degree of porosity. It is not yet possible to draw full partitions or the regions of the world according to the logic of connectivity of their cities, mainly because of a lack of data on a sufficient variety of exchanges and also because of the heterogeneity of the type of exchanges and flows that influence urban trajectories.

Based on our analyses at the country and city levels in this first part of the book, national urban systems can be grouped into further sections of the book according, first, to the stage the countries reached in the urban transition and, second, to the highest level of interactions that we discovered in their global networks (forming communities):

- Part II is thus dedicated to *countries where urban transition is achieved* and where the metropolization process summarizes the story of the last 60 years: the cases of the United States, Canada, Europe, and Japan are detailed as major examples of this type of urban system.
- Part III describes the specific case of Latin America, whose *rather advanced urban transition* is mixed with more or less rapidly developing economies. The subcontinent is first analyzed as a whole, and then Brazil, the largest country of this area, is addressed in a specific chapter.
- Part IV groups together the *other countries of the so-called BRICS group*, whose urban transition is not as advanced as Brazil's but whose urban and economic growth has been exceptionally rapid in the last few decades: China, India, Russia, and South Africa each deserve a chapter that emphasizes their exceptional urban peculiarities.
- Part V finally groups all *countries with low- or medium-income levels and where urban transition lags behind*, including one chapter on Africa as a whole, another chapter focusing in on the region of the African great lakes, and a last chapter dedicated to Southeast Asia.

In all of the following chapters, the authors further develop the processes of urban system integration and evolution under the hypotheses of top-down and bottom-up processes since at least the 1950s:

- The top-down perspective will evaluate in each case how global trends and international agreements, such as the free trade zones affect the development of the urban system. Another critical issue is comparing the capacities of countries to regulate internal urban inequalities through decentralization policies, regionalization, and polycentrism.
- The bottom-up perspective will explain how some city-regions could emerge, under what conditions capital cities accumulate advantages during the time period and to what extent they managed to leverage their own country's or continent's urban system.

Both perspectives explain how, despite the decentralization of governance in many places, the centralization of economic development has led to the growth of urban hierarchies, increasing inequalities, and the difficulties related to offering equal opportunities for all citizens. The conclusion will summarize the good and bad experiences to extend the actual debate on the resilience of cities not only at the local urban scale but also at the scale of the systems of cities.

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