Complex-city: urban dynamics as underappreciated territorial intelligence for ensuring sustainability.

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Abstract:

For sustaining the expected population growth and development capacities of our world and facing climate change we must improve our way to inhabit the planet by integrating the diversity of local responses to these global concerns. A better knowledge of localized urban dynamics and a significant progress in the design of simulation models are both necessary to integrate more "territorial intelligence" into governance practices at all geographical levels.

Many predictive discourses about the possible impacts of climate change on human societies insist on huge new migration flows representing local responses to global threats as rising sea level or severe droughts or increasing frequency of natural hazards. But considering world dynamics should not be restricted to measuring the local impacts of global constraints. What is already observed is a much more complex dynamics including top down and bottom up processes: adaptation to climate change and resource scarcity intricate international agreements and new global regulations as well as a full diversity of initiatives aiming at finding local solutions for a better management of the recommendations required by the global ecological transition.

A second element of complexity is introduced by the high diversity of humankind's habitat all over the planet, quantitatively and qualitatively. Human concentrations are distributed in some 60 000 urban nodes whose size vary from ten thousands to several tenths million inhabitants and whose income per inhabitant is highly unequal, between towns and cities as well as inside cities. This factor is not enough taken into account in global models for measuring emissions, assessing vulnerabilities or promoting mitigation solutions. A third aspect of complexity is the universality of urban dynamics that may appear indifferent to political, economical or cultural systems, (it may result from the huge number and range of interactions governing urban development), but this quite autonomous dynamics is always relative to the different types of times and spaces where these interactions occur and thus explains why urban systems exhibit remarkable and recognizable path-dependent features.

Improving theories and models for the framing of possible urban future has become an emergency in our world. In the GeoDiverCity project we have both analyzed general processes of urban dynamics and specificities of urban systems in different regions of the world, as Europe, United States, of the BRICS (including Brazil, Russia, India, China and South Africa). We have developed a multilevel modeling framework where cities are heterogeneous territorial agents whose population and wealth trajectories result from spatial interaction of variable range for a variety of urban functions. Cities are also more or less depending on the resources and development stage of their environment. The introduction of

new urban attributes and processes or environmental description in the models, according to a parsimony principle, is enlightened by validation protocols that appear not only at the end but during the whole elaboration of the models. The validation process relies on evolutionary algorithms and distributed computing resources whose access is facilitated on the OpenMOLE simulation platform.

Such models may help to better understand why systems of cities have their own dynamics. Over history urban systems appear as a remarkable societal technology that was invented independently in different regions of the world and that has ensured the adaptation of human habitat to dramatically changing conditions of production, transportation and political and social life since post-Neolithic times. We call this ability “territorial intelligence”. Until now this dynamics leading towards more and more concentration of urban population in a few huge metropolis or even megalopolises seems to be beyond any global political or economic control, that the recently revealed scarcity in energy and resources renders yet necessary. Future scenarios using our simulation models could introduce new principles of urban interaction for changing the governance at each territorial level. Over the course of history, interactions between cities have progressively been at least partially redirected from fight and predation towards mere rivalry and trade, under the form of economic and cultural competition. The context of ecological transition could be an opportunity to test a further shift towards “coopetition” including emulation as well as more cooperation. This would be concretizing a further stage in the territorial intelligence of human societies.