Building a global urban science

The study of cities needs to become more than the sum of its parts. An international Expert Panel investigates why, and how.

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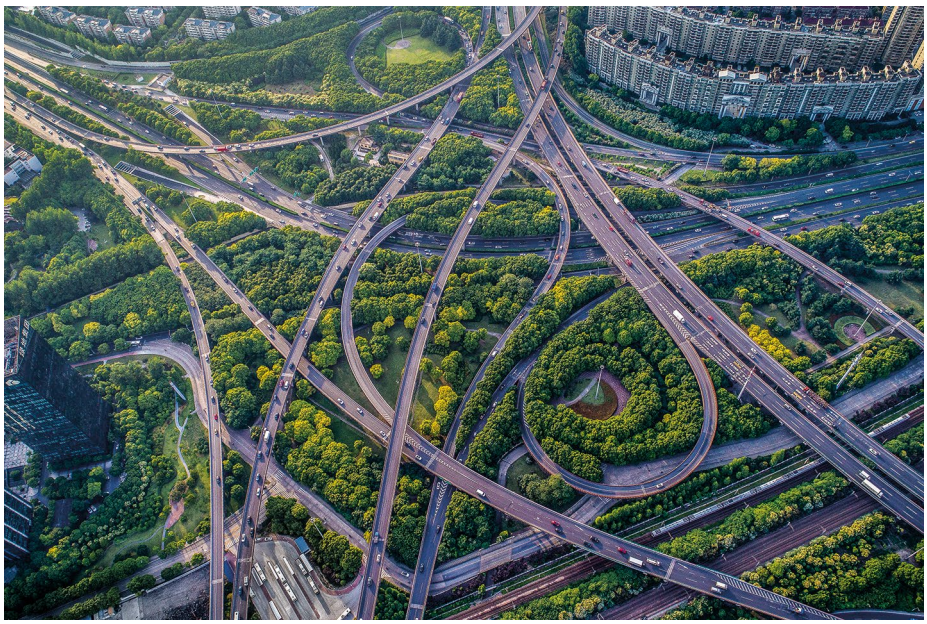
Cities have become central to ensuring a sustainable future. In each of the three main pillars of sustainability — economic, environmental, and social — urbanization now plays a key role. Urban areas generate more than 75% of global GDP, contribute to about 75% of carbon emissions from global final energy use, and are home to the majority of the world population, including over 863 million slums dwellers. Knowledge about our planet from an urban perspective has become central in understanding the present and future of our living conditions. This is now enshrined in the 2030 United Nations Sustainable Development Agenda, adopted by 193 member states in 2015, which includes a sustainable development goal (SDG) that focuses explicitly on urban areas (SDG 11; http://bit.ly/2A2Ih5O). Less than a year later, 170 countries agreed to a New Urban Agenda that highlights the importance of including an urban perspective in both national and international agreements and development implementation. While nations remain the formal signatories of UN agreements, city leaders have also been taking a centre stage across a multitude of global processes from the Paris Agreement on climate change to the Sendai framework on disaster risk reduction. While the world is slowly recognizing the central role that urban areas play in shaping global sustainability, so too are cities waking up to leading on global challenges. Yet academia is lagging behind. To harness the global momentum around these new initiatives, we urgently need to address two key matters: one is to forge new knowledge that responds to complex urban challenges, and the other is to accelerate uptake of urban science by practitioners.

As we argue here, achieving the first goal will require bringing together scholars from disparate fields and reorganizing existing knowledge domains that are currently compartmentalized and professionalized. Achieving the second goal will require transformation of current science–policy interfaces. These are pivotal shifts because urban systems are complex and multi-dimensional, and without a more synthetic and holistic enquiry, we run the risk of creating incomplete solutions. In order for urban science to be collectively greater than the sum of its parts, it needs to draw from all the sciences — natural, engineering, and social, as well as the arts and humanities — whilst linking directly into practice, and offering effective global assessments of the state of our planet's urban condition.



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This ethos was at the heart of the establishment in April 2017 of the *Nature Sustainability* Expert Panel on science and the future of cities (see Box 1), which gathers thirty international experts in urban research from across the academic spectrum to survey the challenge of science–policy interactions with respect to the composite global experience of urbanization. Building on the work of the panel, and summarizing key themes of its deliberations, we outline here the challenges and opportunities of developing a 'global urban science' that has reach across academia, meets pressing urban sustainability challenges, and enables more effective science–policy interfaces.

Science in the urban era

Historically, major shifts in the human condition have required new changes in science, and vice versa. The microscope, wars, and disease outbreaks are three such examples that changed the direction of science. Today the scale and speed of urbanization is pushing again the scientific frontier. At the turn of the twentieth century, the urban population was about 215 million, just 13% of the world population. Estimates by the United Nations Population Division suggest that there are currently over 4 billion global urban dwellers and that this is increasing by about 1 million every 10 days.

Policy communities across sectors and governance scales, from the local to the multilateral, often struggle to gather an adequate response to the pace or specificity of urban change. Some recognition of this has already emerged. International efforts in UN fora are now being followed by national and regional commitments to reform urban practice. Up to 35 Organisation for Economic Co-operation and Development nations have adopted national urban policies, the European Union has launched

its own 'EU Urban Agenda' (http://bit.ly/2BHUdY0), and countries such as China and Australia are in the midst of rolling out ambitious roadmaps for new strategies to manage urbanization trends and harness urban growth. The United States (under the Obama administration) and India have recognized explicitly the potential of urban-based technological revolutions, with plans for national 'smart city strategies'. Even on a historically un-urban continent such as Africa that has focussed on agriculture and downplayed investment in large-scale infrastructure or devolution of service provision, there is now a concerted focus on urban development. In Africa, one in every three countries has already a national urban policy process underway with an emphasis on infrastructure and jobs. Yet many of these initiatives often struggle with their evidence base and with the capacity to grasp urban change holistically as a radical shift. Given such growing spotlights on urban areas and their changes, building more and better knowledge for actionable and effective interventions is now imperative. Although 'the city' has long been a place of scientific inquiry and professional training, much of what is known and taught is inappropriate or inadequate to meet today's challenges.

Despite the steady growth of urban areas worldwide, urban research and education fall short in key respects. Across academia, urban knowledge is out-dated and underfunded[1]. Current research also tends to rely on selective samples, so we still know very little about the majority of urban settlements and challenges around the world[2]. Importantly, this imbalance is replicated geographically — between North and South, and between small and big cities — as much as thematically. Urban research grapples today with the same limitations of medical studies at their onset when they focussed only on selective categories of disease and subjects, and neglected important questions of gender, race and inequality. What we know, even about urban areas that are the object of much research, is limited. Small pockets of well-funded research domains are often aligned to opportunistic themes driven by industry, policy and market drivers beyond academia, such as climate change, resilient cities or smart cities rather than offering the wider coverage necessary for balanced interventions by practitioners. Overall, the comparative and complex nature of urban scholarship is not matched by adequate research outcomes, which remain effectively patchy.

At a global scale, transboundary threats such as natural disasters test regularly the effectiveness of urban research. Yet, whilst phenomena associated with the global escalation of scientific work on climate change have accelerated some progress on urban science, other significant problems like biodiversity loss or automation have made little or minimal headway into urban research. Collectively, urban scholarship remains ill-informed in the ways it can convey the full spectrum of major global urban changes, ranging from freshwater loss to the shifting burden of disease, all the way across social and cultural challenges[3]. Today's urban research, far from being a coherent 'urban science', remains trapped in the twentieth-century tradition of the systematic study of individual cities and the rise of specialized academic disciplines and professions associated with, amongst others, economics, health, planning, engineering and design. We are far away from understanding the fabric of urban systems that shape the way urban areas impact humanity, and vice versa. Current urban research on pressing international problems is rudimentary and fragmented at a time when the window of urban transformation demands robust, sophisticated and truly global urban research.

Putting urban science where it's needed

Beyond the need for a stronger interdisciplinary lens, urban research also needs to be adequately directed to real-problem applications. Today's urban science is segmented by disciplinary boundaries whereas solutions to real-world urban problems require integrated knowledge. Discrete research communities, ranging from hydrology, health sciences, criminology, or finance, are unable to jointly advise city planners or community leaders on the complex multi-dimensional nature of urban problems — or indeed on the most appropriate prioritization of urban solutions. So whilst there is a fundamental (global) urban science that needs building, injecting specialist expert knowledge into practice also requires institutional, political and managerial expertise alongside academic skills. Urban scientists need not be urban managers, but the two communities of research and practice need far better connections. Few scientists today are able to make sense of the party politics or the dynamics of governance that are an integral part of urban transformation. The third challenge has to do with the fact that the places where the best scholarship is being produced are not the places where knowledge is most needed to solve desperate urban problems. Although there may be universal urban conditions, much operational knowledge is place specific, and urban scholars (and the experts they train) tend to be reticent to offer advice if they are unsure about how their research applies to context-specific problems they haven't directly studied.

Rectifying the parlous state of urban knowledge production and dissemination is not just a matter of scaling up and doing more studies on more topics or including more cities. Given the centrality and complexity of cities, it is clear that we

Box 1 | The UCL–*Nature Sustainability* Expert Panel on Science and the Future of Cities

Urban scholarship and practice are at a critical juncture, and yet the contribution of science to shaping the future of cities is often flawed by poor academia–practice interfaces. To redress these limits and advance the development of more integrated (cross-disciplinary) and policy-engaged research on cities, *Nature Sustainability* and the City Leadership Lab at University College London have established a ground-breaking Expert Panel (http://bit.ly/2jMa7si) focused on the state of urban research and its science–policy nexus, gathering thirty international 'urban science' experts from across a wide spectrum of disciplines. This article offers an introduction to the panel's deliberations, highlighting the need for a global urban science.

The Expert Panel members are M. Acuto (University College London (UCL)); A. Allen (UCL); S. Attia (University of Cairo); X. Bai (Australian National University); M. Batty (UCL); L. Bettencourt (University of Chicago); E. Birch (University of Pennsylvania); H. Bulkeley (Durham University); M. Cardama (Cities Alliance); C. Ebikeme (International Council for Science); T. Elmqvist (Stockholm University); Y. Elsheshtawy (UAE University); I. Kickbusch (Graduate Institute Geneva); S. Lwasa (Makerere University); J. McCann (Imperial College London); P. McCarney (University of Toronto); T. McPhearson (New School); S. Parnell (University of Cape Town); S. Patel (Society for the Promotion of Area Resource Centers); M. Pelling (King's College London); E. Pieterse (University of Cape Town); C. Ratti (Massachusetts Institute of Technology); A. Revi (Indian Institute of Human Settlements); R. Sampson (Harvard University); D. Satterthwaite (International Institute of Environment and Development); K. Seto (Yale University); R. Sennett (New York University; London School of Economics); N. Tyler (UCL); and Y. Zhu (Chinese Academy of Sciences).

will need to ask fundamentally different questions as well as better link scholarly contributions with practice. Even the major centres of urban research excellence are unable (or unwilling) to effectively push a new research agenda that is adequate to the scale of the challenges cities face today. This is not to say that at present all urban work is not valuable, but urban science requires a fundamental shift of research paradigms, together with a reorganization of the institutional forms that bring experts together into research teams. We propose the reorganization of urban data systems, urban education, urban research, and the science-to-practice continuum. Each of these reforms will present particular challenges, but all will be needed to provide a step change in the way urban knowledge is produced, both at city scale and at the level of the territorial, economic, ecological and political systems of cities, and ultimately to secure progress towards a transition to sustainability.

Urban science for global sustainability

Against the backdrop of rising urban challenges and their complexities, a renewed urban research agenda will be based on a stronger connection between all the traditional sciences, humanities, politics and practice. It must embrace the diversity of urban disciplines, and recognize effective interdisciplinary combinations that equally allow for a global outlook, insights into issues of inequality and justice, and for a prioritization of effective advice to urban policymakers[4]. Building effective science–policy interfaces for urban challenges will require different modes of operating from traditional fields such as engineering or artificial intelligence, where there are recognized ontologies and epistemologies and professional certification clearly defines the community of experts. Rather than simply professionalizing urban science to better managing cities, this will require an even more fundamental up-skilling of scientists to speak to politics, and of policymakers to read science[5]. Building a global urban science also requires, just as does research on ecosystems, a much clearer recognition and explicit inclusion of the variation in urban conditions. Equally, this requires global scientific work not to be blind to 'critical' social science currents, questioning issues of power, politics and justice. It will also have to develop a much better sense of the complex local, national and global governance structures underpinning our urban era, whilst striving to offer far more regular and interdisciplinary versions of the all-too-rare global urban assessments[6].

Revolutionizing urban research to meet the demands of the twenty-first century requires fundamental reorganizations of the mandate, scale and location of institutions that generate urban knowledge. Of course, it is important that parts of scientific inquiry around cities still zoom in and focus on specific urban dimensions, and that global assessments still allow for granularity needed for instance to understand the global urban burden of disease. Yet this should not hinder efforts towards reproducibility (and therefore accountability) in urban research if ultimately we want to produce a balanced and comprehensive knowledge through the collection of diverse topical and geographical data within urban science[7]. Such reconsideration of the basis to build a globally focused urban science whilst not hindering applied specialisms will need cross-scale, cross-topic and cross-location studies that require vastly different skills and analytical methods. All of the new urban work will need to deal directly with issues of politics, prioritization, unintended consequences and co-determinants.

A serious effort at developing an urban science that can grapple with issues of the policy relevance, prioritization, unintended consequences and co-determinants of urban change is vital today more than ever. This is a roadmap no individual urban research tradition can undertake on its own. It is an agenda for reform that starts with opening a systematic and globally oriented dialogue across different kinds of expertise; the agenda undergoes a humble attempt at acknowledging our scientific limits, but also acknowledges the immense opportunities opened up by our common urban future. ❐

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