The Little Book of

CITY PRINCIPLES AND PRACTICE

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"*Your values are what you consider important, literally what you "value". Principles are what allow you to live a life consistent with those values. Principles connect your values to your actions; they are beacons that guide your actions, and help you successfully deal with the laws of reality. It is to your principles that you turn when you face hard choices*".
Ray Dalio (ND)

Acknowledgements

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What this little book tells you

Over half the world's population live in cities and we expect this trend of people coming into cities to continue in the coming decades. However, that does not mean that cities just have to become bigger. Some of these changes will see declining populations in cities that already exist, whereas in other cases, wholly new cities will be developed. In either extreme – and in the majority of cases in between – there will be a need to ensure that cities become fit for the purpose of enabling people to thrive. This means designing cities *for* people.

We believe that these 'cities for people' must be designed and actively managed, and this means that cities need to make decisions and act accordingly to guarantee that the changes needed actually happen before anything undesirable takes place. To guide those decisions, cities need to have a vision that reflects public interests and the needs of society and the planet as a whole. However, it is not the cities that make decisions: it is the people within them that need to do this. Therefore, we need a way of ensuring that the people who live in cities can create a common vision which they can accept – even if they don't necessarily agree with it – as a good direction of travel for the 'city community'. That vision then has a set of principles that will guide any future decisions that those people may make.

In this Little Book, we briefly describe our theoretical starting point and then describe the research we carried out: future visioning workshops, interactions with planning agencies in cities in Latin America and studying cities that excel in terms of liveability. Finally, we discuss the high-level, fundamental urban principles that we identified from our research and we show the route that could be taken from a vision and principles, to the practice of designing and operating a city in which people can live and experience a sustainable improvement in their quality of life. Our approach aims to uncover urban principles that can be applicable to any city in the world as well as specific from one city to another according to the city context and other aspects, such as its maturity level, governance structures and capacity, and political and economic systems, among others.
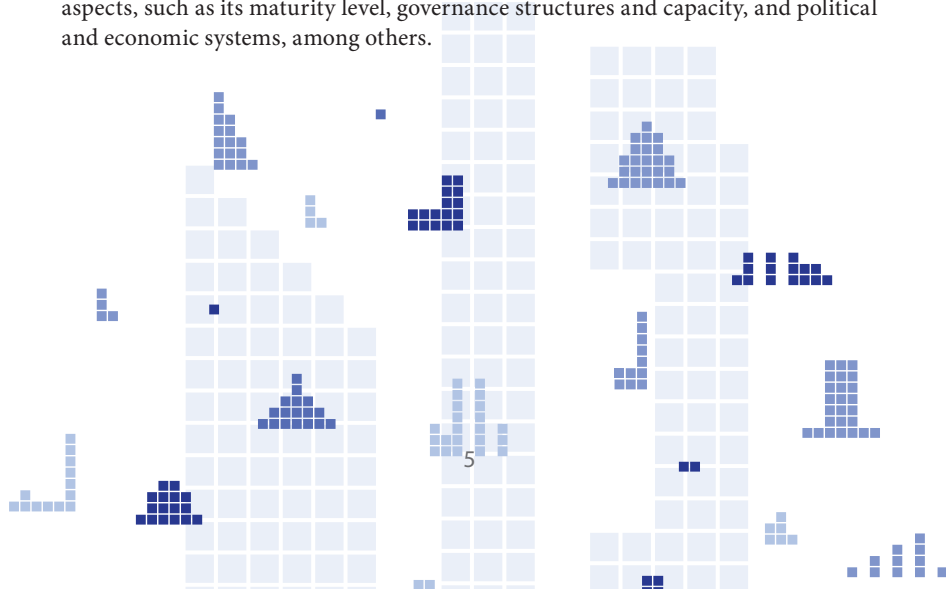
1. Introduction

"Cities have the capability of providing something for everybody, only because, and only when, they are created by everybody"

(Jane Jacobs 1963).

Transforming the engineering of cities means recognising that the engineering of cities has traditionally used top-down approaches alongside personal and vicarious experiences; understanding the needs of society via collective governance has been lower on the list of priorities. This approach starts from the legacy from previous generations and either seeks to integrate new solutions or destroys the local fabric and imposes solutions. Examples of both include canals, railways, roads, gas pipes, electricity cables, optical fibre cables and wireless networks.

In the past, growth and development was the favoured economic model in cities, which paid little attention to the growing shortage of resources or the local, regional, national and international environmental damage being caused by engineering solutions. There is now a growing awareness that this should change. However, the ways in which we need to deliver change beyond small-step, small-stage, incremental solutions are not immediately obvious. There is a fear in the current global markets that any country undergoing *radical* change will lose out financially; that is, their global competitiveness will suffer unless all countries change in the same manner and to the same degree. We are concerned that this is a recipe for inaction, so one of the research challenges of this project was to understand how radical change could be implemented in such a way that is socially and economically acceptable to all.

Radical change implies changing the engineering of cities from its core principles. This kind of transformation means questioning the whole rationale for 'engineering' and what it means in the 21st and 22nd centuries. That incremental shift from the legacy of previous generations isn't going to work if we're concerned with meeting our present and future needs, so we needed to generate a completely new way of thinking about what we mean by 'engineering'.

Considering a radical approach for transforming the engineering of cities requires

us to question the basic concepts, methodologies and definitions used for thinking about cities and how to plan them. Most importantly, in the context of our research, we understand cities and engineering in the following ways:

1. A city is a collection of people, and there is an obligation to create a way of living that allows all people and communities to thrive. To do this, people need to create the infrastructure – both hard and soft, and both short and long-term – systems and processes that enable this thriving to evolve for the benefit of future generations, and thus the perpetuation of the species and planet.

2. Engineering is considered as *the action of working artfully to bring something about* (see Oxford English Dictionary). So transforming the engineering of cities requires ingenuity to understand how humans live and thrive in a societal context so that we can transform the design, structuring, building and functioning of the different systems that make up a city.

Transforming the engineering of cities is about bringing creativity and innovation to solve the challenges that cities face today and anticipate those that could arise in the future. In our approach, the ingenuity for thinking about the future city is reflected in the following four propositions:

1. A radical vision is the root of the city: without a root, the city cannot thrive. Therefore, we believe a city cannot begin to exist as an entity without an overarching vision of its purpose. From this starting point, we can begin to understand what the city must create in terms of its most fundamental constitutive elements.

2. This vision drives a set of *high-level urban principles* that define the future city in terms of *what* it must deliver, rather than *how* it would deliver it.

3. These urban principles are cross-cutting and serve as the foundation for a chain of reasoning in the city context.

4. These principles materialise from whatever disciplinary knowledge exists that might help to manage complex systems and achieve desired outcomes in cities.

2. Why do we need to transform the engineering of cities?
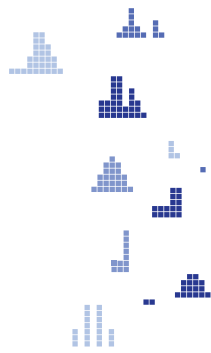
The purpose of cities is people and this has been reflected in engineering, which in turn has been shaped by the challenges of different eras. Once people started to settle, after a lengthy period as nomadic hunter-gatherers, and prior to the Industrial Revolution, most activities related to human life were centralised at or near to home. Subsequently, houses (and neighbourhoods) were designed for diverse functions, such as addressing the basic needs of its residents like facilitating health care, providing energy, industry, and education, among others. The Industrial Revolution centralised all of these activities in another place, thus requiring people to move to the place and live in ever larger numbers where the industry was located. As a consequence, cities expanded, networks were created and new functions were defined (Larson, 2012).

The desire for industrial progress during the 19th century created big centres in which economic functions of production, consumption and others were concentrated. The consequences of such centralisation were not foreseen, but soon became apparent: the chronic spread of diseases, like cholera, resulting from absent or inadequate

sanitation became a national disgrace. In response, cities were engineered to address the demand for utilities, like clean water and waste management, through the supply of single-purpose, centralised networks that operated entirely independently of each other. This approach took advantage of economies of scale, abundant resources and open access to public goods, such as water and the atmosphere (Suzuki, Dastur, Moffatt, Yabuki, & Maruyama, 2010). An example is Bazalgette's water treatment system in London.

As the constraints of the supply-demand model changed, 20th century engineering focused on cost-efficiency – achieving more at less cost – with almost no consideration of other unintended consequences. However, urban living in the 21st century is evolving rapidly and increasing in complexity as technology changes. In the first two decades of the 21st century, the technology has shifted towards personalisation. Moreover, from an engineering perspective, constraints on our quality of life keep changing: limited resources, non-open access to public goods such as the atmosphere etc. So, too, has the understanding of the supply-demand dynamic: the Jevons Paradox argues that a more efficient supply generates more "guilt free" demand (Glaeser, 2011). For example, smart(er) phones and their associated applications, online purchasing and delivery, and advances in manufacturing mean that products can be designed exclusively for a particular customer. Advances in information and communications technology have increased information flow and are allowing new economic and business models, such as zero marginal cost, sharing economy and social trends, such as collaborative consumption. Millennials' preference for experiential goods are appearing, once again, as a response and enabler of the technology of the era. However, existing infrastructures and systems of cities, including professional training, governance and institutional structures, have developed based on solutions that evolved for a different world. This means that new technologies that are developing at an overwhelmingly fast pace are imposing further pressure on the already-strained urban systems, resulting in people facing common difficulties associated with resource scarcity, institutional capacity, accounting frameworks, limited infrastructure capacity and inequality.

The engineering of cities needs ingenuity to transform its systems to address the increasing complexity of urban services and promote sustainability and liveability in cities. These changes are currently being reflected in concepts like smart cities guided by the Internet of Things (IoT) and big data, circular economy cities and eco-cities, among others. But these new models have created unintended consequences as well: look at the impact on rent prices of Airbnb or the impact on congestion, the

use of road networks and employment conditions of mobility platforms such as Uber. These new models and their associated challenges will therefore distort society unless cities have the tools to be able to address them more dynamically and effectively. Based on our analysis of successful transformations and innovation in cities, but also in companies, we identified that having a vision of high-level principles is key to enabling a process of societally driven change. The principles act like a magnet of shared goals that bring different interests together by allowing a common direction to be identified and decisions to be made and prioritised through an assessment of projects, plans and actions.

3. The process of transforming engineering
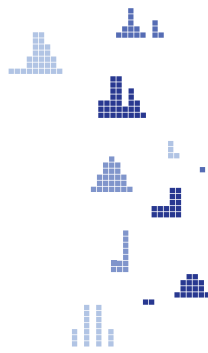
In another paper,[1] we discussed the case studies of three cities that have transformed themselves because they had an overarching vision that generated principles for subsequent decision-making: Copenhagen (Denmark), Barcelona (Spain) and Curitiba (Brazil). In that analysis, it became clear that each city had benefitted from a high-level vision driving the way it sought to go forward. That analysis built on the work within the project based on Medellín (Colombia), which has radically transformed itself over the past 30 years or so. It seems clear from these analyses that for transformation to occur, as opposed to merely development, such a high-level vision is a necessary precondition and that the development of guiding principles to shape progress at a more detailed level is the next requirement. Without the vision, the principles make no sense; without the principles, any subsequent action will risk being meaningless, or, worse, counterproductive. Transforming the engineering of cities means starting with the overarching vision for the city.

[1] Ortegon & Tyler (2016) Constructing a Vision for an 'Ideal' Future City: a conceptual model for Transformative Urban Planning, *Transportation Research Procedia* 13 pp 6 – 17

3.1 Method

The principles that constitute the preferable future vision described in this Little Book were derived from the study of a city that underwent a major transformation (Tyler 2013).[2] These principles are:

1. The city should encourage people to have mutual respect for each other (the 'courteous city')

2. The city should have activities that enable people to thrive and that these should be accessible to everyone (the 'active and inclusive city')

3. The city should have a sense of belonging to its inhabitants and that they should feel responsible for it and its future (the 'public and aesthetic city')

4. The city should promote and deliver health to all its inhabitants and the environment (the 'healthy city')

5. The city should evolve through time to continue to support future generations of inhabitants (the 'evolving city').

They were then suggested as opening principles at a series of nine visioning workshops held with experts from different sectors in London (and one in Lancaster). The main visioning exercise in the workshops was designed to explore a preferable future vision, presented initially as 'something rather better than just a Liveable City'. The nature of this type of visioning exercise allowed the preferable future vision to have some *probable* elements (what is likely to happen, based on trends), some *plausible* elements (what could happen, based on existing knowledge), some *possible* elements (what might happen, based on assumptions about the construction of new knowledge) and some *potential* elements (what would happen if unexpected phenomena of high impact took place) (Voros 2003). Making the vision associated with strong assumptions that can overcome present constraints is what gives the vision its true, transformational qualities. Figure 1 illustrates how such possibilities expand as time progresses and how preferable visions embrace elements of probable, plausible, possible and potential futures.

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[2] Tyler N (2013) *A Vision for Cities: the five-cities model*, ARGNote 1(5), http://tinyurl.com/5-citymodel
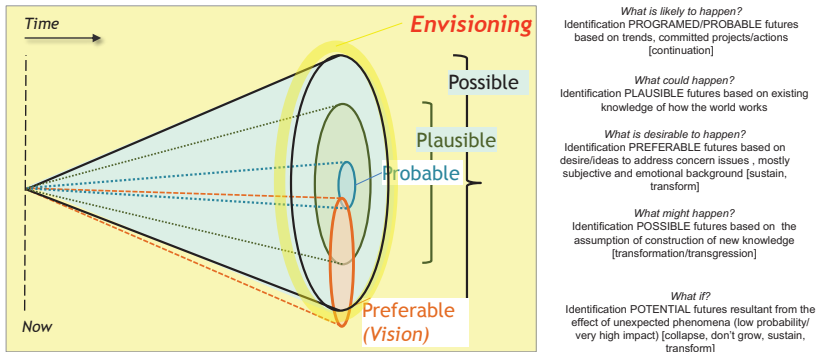
Figure 1. A conceptual image of the increasing possibilities for technology in the future (based on Voros 2003)

3.1.1 Workshops

The workshops were set up either with sectoral groups, such as retail, education, health, transport and heritage, or in some cases, with mixed groups from different perspectives of the city, like city officials, public transport operators, residents, retailers, consulting engineers and architects.

Each of these workshops consisted of four exercises, carried out in a combination of small groups and collective discussions between all participants and the facilitators.

3.1.1.1 Introduction

The concept of future cities, including the concept of being people-centred, was introduced to the participants and the concept of 'envisioning' was introduced so that all participants were comfortable, or at least familiar, with the idea of a super-sectoral, multidisciplinary, high-level vision and principles. Bearing in mind that the participants in each workshop were drawn from a single sector, it was important that they realised that their views would be pooled with others in the final analysis. This prevented them from either trying to second-guess another sector or from thinking that other sectors were not being included.

3.1.1.2 Clearing the mind

The current way of thinking about future possibilities is that many professional actors often constrain their thinking by what they deem as 'feasible' in terms of their present-day constraints and activities. Therefore, we felt it was important to clear their minds of what they thought they might be able to do so that we could investigate what they would like to do if such constraints had been removed. The process started by asking them to define all the negative scenarios they could think of so that these could be removed from further discussion during the creative process of the visioning exercise.

3.1.1.3 Discussing futures

Having removed the existing barriers to progress from discussion, we then turned to the future. This required a realistic consideration of, 'What would happen if we did …?'. Working in small groups, the participants discussed future visions so that they could come up with one on which the whole group could agree. In some cases we had to go through a process of reducing their vision statement to a (very) few words that captured the essence of the vision without starting to indicate how the vision would be enacted.

3.1.1.4 Creating an example of the vision in practice

Finally, the participants were asked to create a representation of a future city that fit with their agreed vision. This was done in the form of a physical model; when there was sufficient time, this included models of different scales for the city, such as regional, local, and neighbourhood. This enabled the participants to see how their vision could be represented through different kinds of action, such as the location of activities, the design of a local street network or the detailed urban design in a neighbourhood space. However, each of these actions was part of a process, geared to ensure that the actual actions to be undertaken fit together to reach the vision by means of adhering to the high-level principles from the courteous city, the active and inclusive city and so on. The purpose of this exercise was not to generate a design for the city, but to help the participants sharpen the formulation of their vision in light of the thinking required to produce such a design.

3.1.2 Analysing the outcomes

To analyse the outcomes of the workshops, we began by recognising that a city is a system of systems. Core to this recognition is the need to have a systemic consideration and understanding of the several elements tangled around urban issues. We also needed to remember that, in order to attain a vision for a city, we must go beyond normal sectoral perspectives, such as housing, transport, employment etc., and place the sector-based principles above the sectoral interests and constraints.

The visioning exercises would give us an idea of how a future city, or more specifically, future city systems, could be thought about and enacted according to the principles that were discussed earlier. Hence, in an attempt to simplify the analysis, we identified core components of the city and used these components as a starting point to categorise the emerging views from the visioning workshops.

The city's core components then need to be arranged according to these principles: how exactly do we make a city in which people have mutual respect for each other? The components can be understood as the anatomy of the city, all the structural constituents of which interact to enable urban life. This approach breaks the larger city system into smaller, more manageable, constituent parts. This categorisation aims to provide a framework to encompass all the components of the city at the same level of importance. This means both tangible and intangible components needed to enact the principles are identified. So what are these components?

3.1.2.1 The core components of the city

Figure 2 shows the outcome of an analysis of the statements made by the various sectors during the visioning workshops relating to the goals and aspirations and soft infrastructure. Figure 3 shows a similar outcome in relation to hard infrastructure and functional systems.

Between them, Figures 2 and 3 show the nature of the analysis of statements made by workshop participants. These are then summarised more fully in Table 1. Having people, their organisations and interactions at the centre, a city can be described in terms of four core components: i) Goals and purpose; ii) Functional, or service systems, including the ecological system; iii) Soft Infrastructures; and iv) Hard Infrastructure.

Using the city's core components as the common unit of analysis, we joined all that was being said by the different sectors with the objective of creating a more

Figure 2. Initial structural analysis of comments about a generic city: Goals and Aspirations, and Soft Infrastructure

Figure 3-. Initial structural analysis of comments about a generic city: Hard
Infrastructure and Functional Systems

City

- Hard Infrastructure
  - buildings — quality — poor built quality in fast growing cities
  - infrastructure — failure — risk of failure or damage of infrastructure like pipes and pipelines -e.g. due to natural disasters-
  - energy — capacity — still relying on national grid and more power stations
  - housing — affordability — housing unaffordability creates slums all accross city
  - urban form — densification — excesive hight overtakes green space and creates over-crowding
  - built environment — design — streets unable to respond to needs of cyclists and pedestrians
  - business — retail diversity — lack of retail diversity -too many big-
    - retail — retail as commodity not a service but only transaction
  - food — adaptation — lack of adaptation of crops and other food staples
    - affordable fossil fuels run out

- Functional Systems
  - Ecosystem — resources — water and energy scarcity because of overconsumption
    - warfare over resources and scarcity
    - environment — all natural environment lost and irreversible impacts
    - climate change — impacts on supply chains
  - energy — pollution — noise too many planes and trains and nobody walks
    - choices — energy politicised no public debate over energy choices
  - utilities — resilience — supply failure and insufficiente resilience of utility networks
  - safety — on street — less perceived safety on high streets due to changes in demographics leads to less retail use
  - security — breakdown — risks of telecommunications breakdown
    - emissions — fail to reduce CO2 emission and climate change make transport and all systems fail
  - transport — freigth — no air freight to ship products
    - public transport — relying on old technology -combustion engine-
    - poverty — poverty in transport make people and regions economically and culturally left behind
    - gridlock — excesive traffic

1:11

Table 1. City components

Component	Description
People's organisations	The network of interactions amongst individuals and groups of people, and between these people and their urban environment, to create urban processes based on their aspirations, interests, needs and capabilities.
Goals and aspirations	The main element of the city is people and the society. Both have aspirations and goals associated with wellbeing, happiness and health. These goals and aspirations are channelled through the overarching principles in order to aim towards the vision. The principles are higher level than the goals and aspirations of the people in order to ensure that the societal gain overrides personal ambition. A person might have aspirations, which are purely selfish, but the principles require their aspirations to also be directed towards the wellbeing of the society within which they live. Thus, it is the urban principles that shape the personal aspirations towards a sustainable, desirable, future city and underlie all the processes, services and operations included in the other components.
Functional systems and Ecological systems	These systems refer to the set of connected things that work together for a particular purpose. In this conceptualisation of the city components, functional systems enable the city to deliver the urban principles by providing services, such as electricity, water and transportation, or deliver fundamental services or public goods, such as education, health care and social care, security or justice. One of the most relevant systems of the city anatomy is the Ecological System, related with ecological and biological functions and services, and natural environment flows and forms. This system includes elements such as the air, the water, the ecosystem, which enjoy a multidirectional interaction with people.
Infrastructures: Hard and Soft	Infrastructure means 'that which supports a structure'. So, rather than considering it only as the hardware that supports the functioning of a city, we also need to consider the soft infrastructures. These are different from the ecological systems because they are adapted, manufactured or developed by people for specific ends, whereas ecological systems are largely contained within the natural world within the urban context. There is, of course, an overlap, for example, where a natural resource is used for a developed activity, such as the use of a river for transport, or vice versa. *Soft Infrastructures* are the structures that support society, its people, ethos, beliefs and moral standing; they are the dynamic components that regulate, facilitate or catalyse interactions and urban processes, functionalities and services. *Hard Infrastructures* are the physical, tangible elements that support the performance of the functional systems and people's organisations to achieve certain functionalities. The hard infrastructure represents the manufactured (traditional) capital, and include buildings, communications systems, transport systems and utility network structures.

Source: Authors based on (Robinson, 2012), (City Protocol Society, 2015), (Suzuki, et al., 2010), (Tyler, et al., 2013)

comprehensive view of the challenges for a future city. The labels capture the essence of the comments, but the description is either a textual quotation from the workshop or a paraphrased text if several comments referred to the same idea.

3.1.2.2 Practice - Pathways

The urban principles discussed above can give you an idea of what you might want to achieve and the conditions under which that achievement can be judged, but not necessarily about *how* to get there. Therefore, some guidelines regarding pathways and processes for reaching those future urban principles need defining. For this purpose, we have identified processes and pathways that were salient from the discussions of the visioning workshops during the stages of designing the future liveable city. These pathways and processes also resonate with the strategies implemented by some exemplary cities in urban transformations, which are leading the movement towards liveability in cities:

Connectedness and connectivity of distributed and integrated networks. With 'transport poverty' as an element that can make people and whole regions left behind economically and culturally, integrated, multi-modal, inclusive mobility is seen as a means for enabling equal opportunities. Similarly, for energy networks, there are several solutions at different scales that can be useful if successfully integrated, such as tidal, home-generated energy and smart tiles.

Systems that work at a local level, but connect to the wider network. This applies to the structure of the city, with cities formed of a network of 'villages' or neighbourhoods. Within each 'village', things are designed to be self-sufficient, easy-to-reach and encourage active travel and convenient access to public transport to promote healthier lifestyles.

In relation to the city structure, *blue and green infrastructure are both great creators of opportunity and wellbeing.*

New business models or ways of producing and consuming services and goods that promote sharing, collaborating and the emergence of 'prosumers'. 'Prosumer' is a concept introduced by Alvin Toffler in relation to production and consumption, where consumers act also as producers of the goods or services they consume (Toffler 1980). One example of production is the possibility of generating energy and harvesting water at the house- or flat-scale using renewable energy sources. For consumption, house- or neighbourhood-scale manufacturing enabled by

technologies like 3D printing could replace the need to buy ready-made items, and will allow the production of highly customised items. These underpinning pathways and processes appear across different scales and city systems, from individuals sharing ideas and data digitally to engage or to exchange skills; to neighbourhoods sharing communal resources, like cars and tools, to reduce residents' need to own things; to utilities service providers sharing data and physical infrastructure to facilitate integrated planning and management of services.

Collaborating as an approach to work. To tackle complex urban and global problems and even as a social value, the capacity to collaborate needs to be viewed as more valuable than individualism. At the neighbourhood level, NGOs and markets cooperate to improve work and catalyse local improvements. At the city scale, there are more possibilities for the co-production of places and policies. Even at a regional or global scale, cities can collaborate, instead of competing against one another, to work together towards common goals.

Closely linked to the concepts of sharing is *the cyclical or circular economy*, which is an alternative to the traditional linear economy and builds on the idea of zero waste, cradle-to-cradle and bio-mimicry.[3] The concept of not throwing away used material requires the best use of materials at all stages, which requires less use of raw materials and resources, including energy. Concepts such as re-use, re-cycle, restore and regenerate emerged at the different scales of the city as a different way of producing, consuming goods, services and spaces in the future.

Linked to the concept of re-use and re-cycle is *the idea of flexibility, adaptability, multi-functionality or multipurpose and optimal use of existing building, facilities or materials.* In this context, empty places, like old factories, can be turned into markets or museums; empty plots or spaces can become urban gardens or pop-up stores; and the area around water tanks can be turned into pocket parks. Moreover, elements of the natural environment, such as rivers, lakes, the ocean, parks, and not roads, traditionally helped to define the structure for the city. This means that these ecosystem elements, which can also be called green and blue infrastructure, provide several services for the city, including biological functions, places for culture and leisure, and transport.

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[3]   For more information about the circular economy and related concepts, please read *The Little Book of Circular Economy in Cities* in this series.

3.1.3 Analysis and recommendations for practice and processes

In the following section, we will describe the issues raised in discussions from the workshops and suggest possible processes or principle-based actions that we felt were important in applying the principles to a future city.

3.1.3.1 Goals and aspirations

Inequality was one of the challenges mentioned by participants when thinking about people or cities' goals. Specifically, participants talked about social inequality and unequal access to resources as a result of some persons gaining more power than others. Social exclusion and social unrest, and its impact on life expectancy, were also mentioned as challenges. Other challenges included environmental issues, like pollution or climate change affecting overall health and life expectancy and, at the level of personal aspirations, cars or material things continuing to be a symbol of status.

When discussing characteristics of populations, participants described an ageing population and cities not being a true demographic mix as challenges. And in terms of urban population growth, overcrowding leading to the deterioration of city experience was seen as another challenge.

These challenges give rise to a number of principle-based actions or processes that should be prioritised in the development of a future city:

1. Promote social inclusion and equality of access to resources;

2. Prevent environmental conditions that can affect health and life expectancy;

3. Promote conditions for people to be able to hope for a change of circumstances and a better future, and that these are believable;

4. Allow cities to continue to be a true and cohesive demographic mix (different ages, different cultures);

5. Promote empathy, compassion and sense of community;

6. Prepare the city to cope with population growth so that the city experience does not deteriorated and appropriate action can be taken in good time to avoid potential overcrowding.

In terms of behaviour, the main issues we highlighted related to fear of change and

inefficient and materialistic consumption that leads to excessive waste. This leads to principle-based actions or processes, which:

7. Provide the conditions that will facilitate people being unafraid of needed changes;

8. Create conditions to prevent materialistic consumption that contribute to symbols of status;

9. Create conditions to prevent the inefficient use of resources and materialistic consumption that leads to excessive waste.

3.1.3.2 Soft infrastructure - economy

In terms of the economy, a global recession was one of the challenges mentioned. Unsurprisingly, this was specifically raised by the retail sector, but it affects the other sectors as well. Affordability issues related to rising property costs, rents and land values putting people out of business were also identified, as was unaffordable housing creating slums all across the city and unaffordable utilities increasing poverty and poor health.

Unemployment issues with humans being replaced by technology was a recurrent theme and the idea that people's ability to make choices could no longer exist if everything is chosen for them by digital technology. Another concern was about inequality related to the digital divide and increased transport poverty. On the topic of growth, an exploding economy could make the urban built form disposable, and rates of growth could strain the city systems and bring the city to a halt in its effort to respond. Thinking about the system of cities within a country or in the world, the idea of unbalanced growth with some cities growing and others declining and losing their purpose was identified as a challenge. Similarly, for resources related to cultural capital and heritage, participants mentioned that funding allocated to the most touristic cities makes it difficult to advance cultural capital in smaller cities. Finally, policies that focus on relentless economic growth agenda was mentioned by participants as a great challenge because they were seen as unsustainable.

In relation to investment, the main challenges identified were financial constraints, lack of foreign investment and underinvestment, all of which could lead to a reduction in safety and the unreliability of systems. Similarly, diverting budgets from everyday, on-street problems to Information and Communications Technologies (ICT) presented a challenge for maintaining everyday, face-to-face activity in

the community. At the local level, the lack of funding to preserve public spaces, community hubs and public buildings, such as libraries, was seen as particularly challenging.

So principle-based actions or processes that could be developed to resolve these issues include:

10. Ensure affordability for commercial properties – rents, land and property values – so that independent and small and medium enterprises have more favourable environments to prosper;

11. Ensure affordability of services – housing, transport, health and education – and utilities to provide living and working environments that prevent or reduce urban poverty;

12. Promote adequate employment or entreprenurial opportunies for everyone and so that human labour can work with technology and not be replaced by it;

13. Prevent people or regions being left behind because of lack of connectivity or accessibility to digital technologies and mobility services;

14. Manage economic, population etc. growth so that it does not negatively affect the functional systems, infrastructure networks and built environments ability to deliver quality of life in the city;

15. Consider the different areas in a city as components of a system that need to be in-balance, prevent excessive growth of certain areas and the decline of others;

16. De-couple prosperity and growth from practices that are socially and environmentally unsustainable;

17. Ensure adequate investment levels to deliver good quality and reliable functioning of city systems;

18. Ensure adequate funding of public spaces to facilitate alternative spaces for social interactions, leisure and amusement for everyone;

19. Ensure investments are not channeled mainly to one sector or system and disconnected from reality and people's everyday needs

3.1.3.3 Soft infrastructure - knowledge and ingenuity

According to the participants, one of the worst things that could happen in relation to Knowledge and Ingenuity is the loss of imagination for problem-solving and the loss of creativity and lack of individuality, especially in children. In terms of innovation, both extreme innovation that overtakes and rules people, and lack of innovation progress, were described as undesirable. In terms of skills, the identified challenges were around the loss of diversity in professional interests. Similarly, a mismatch between available and required skills was mentioned as a challenge, for example, in a situation in which everyone decides to go to universities and, in consequence, the skills for professions that do not require graduate-level credentials are lost. Finally, participants suggested that an overemphasis on the preservation of physical versus personal heritage and learning from human experience when we fail were key challenges that cities of the future faced.

These challenges suggest principle-based actions or processes such as:

20. Promote creativity and imagination for problems solving;

21. Promote progress through innovation while preventing extreme innovation, which might have negative impacts on people and the ecosystem;

22. Foster mechanisms to value different skills, promote diversity of professional interests and ensure there is a match between required and available skills;

23. Preserve both physical and personal heritage and find ways to learn from human experience.

3.1.3.4 Soft infrastructure - mobilities and interactions

Regarding mobilities and interactions, participants defined loss of connectivity, integration and vastly-reduced mobility as main challenges. Participants also made comments about the challenge of having less physical interaction because of technology. These challenges were bound up in larger issues around where things are physically located and how accessible, as they raise concerns about building up a sense of community and defining the types of transport needed. So an important, principle-based action or process for achieving this is:

24. Enable connectivity, integration, mobility and accessibility.

3.1.3.5 Soft infrastructure - planning

In relation to Planning, some challenges connected to designing the city. There was some mention of having cities in which design is only about survival or designed less creatively. Similarly, some participants felt that if engineers were in charge of decaying cities, they could worsen quality of life because they are simply trying to make the city work at the expense of locals' desires and aspirations.

Finally, there was a challenge described around having cities designed as machines in which people are considered just bolts in the process.

In addition, there was a concern around the idea of a manufactered city, which is designed from scratch, denying the wider cultural, social, economic and environmental context, or discarding chaotic and surprising elements that contribute to cities being exciting places. This concern was also expressed in relation to regulation: cities might become overly managed and regulated 'non-places'. However, at the other regulatory extreme, complete elimination of a planning system or government disengagement was mentioned as a challenge. Uncontrolled development could result in everything being idiosyncratically designed by, or for, the private sector; the free market expanding; and extreme projects being built that rapidly change urban environments with detrimental impacts for people and the city fabric. Important, principle-based actions or processes to tackle this include:

25. Enable the involvement of different disciplines in city planning and design;

26. Prevent cities from being 'manufactured' and constructed in a way that is not good for people or the sense of place;

27. Promote city design that is congruent within the wider context that preserves the city's identity and allows for chaos and surprise elements;

28. Planning and development regulation should allow for a balanced perspective, not over-regulated non-places or places completely devoid of planning and governance that permit development to be led exclusively by local individuals, the private sector or the free market.

Participants' comments emphasised the issues related to the temporal dimension of planning, underscoring that short-term thinking can lead to inaction in planning and the building of physical infrastructure without clarity of its long-term purpose. Another challenge related to short-term thinking was present-mindedness, which believes that current technologies and solutions are the best at the expense of the

past. In terms of long-term planning, foresight that is too narrow in scope and too deterministic was also mentioned as a challenge. Finally, lack of democratic debate for a shared future vision, lack of a societal vision and lack of interest in the dynamics of society or knowledge of the reality of people's lives were seen as challenges for planning.

Principle-based actions or processes associated with this include:

29. Cities need to consider the temporal dimension of planning, addressing today's problems but moving beyond a present-mindedness, considering valuable elements from the past and future implications at the same time;

30. Foresight exercises need to be broader in scope and not deterministic;

31. Cities need to have democratic debates to define a shared future vision that considers the dynamics of society and the reality of all communities, not just a section.

3.1.3.6 Soft infrastructure - policy and governance

In terms of policy and governance, participants raised issues, such as a lack of capabilities, to respond to people's needs. For example, a local authority wanting to improve neighbourhood streets, but lacking the technology skills to do so. Another challenge was the failure to make strategic, regulatory changes in relation to climate change and urbanisation, such as critically examining physical infrastructure provision for an increasing population. Finally, a lack of reaction and resilience in response to climate-related disasters, which can lead to further marginalisation of various communities, was seen as a challenge.

Principle-based actions or processes associated with this include:

32. Develop capabilities at the city government level to manage systems to respond to people's needs;

33. Build capacity at the city government level in key areas to enable knowledge transfer;

34. Make strategic, regulatory changes to facilitate adaptation, response and resilience to the challenges of increasing urbanisation and climate change.

Participants also raised a lack of effective decision-making to respond to climate change, political indecision preventing changes, a lack of mechanisms to accept

needed changes and enforcement approaches increasingly based on penalties and not incentives. They felt that heavy regulation limited the free flow of information, perhaps even creating a need for national control of the world wide web, which could result in loss of benefits of global connectivity. Regulatory uncertainty was mentioned as a challenge due to its implications for investment. Lack of long-term regulation in general and the common situation of having no, agreed regulation frameworks were also mentioned as challenges. As a result, citizens would losing their trust in systems.

Principle-based actions or processes suggested for resolving these issues include:

35. Define effective decision-making strategies to reduce political indecision, and flesh out communication and engagement mechanisms to increase acceptance of changes;

36. Promote enforcement approaches that are based on understanding behaviours and defining incentives and not solely on penalties;

37. Regulation frameworks need to promote a sense of trust and certainty that allow people and cities to benefit from systems whilst preventing potential threats;

38. Regulation frameworks should be long-term and agreed with citizens.

Finally, participants discussed how increased 'silo thinking' for planning and delivering utilities leads to fragmentation of government at the local scale and can jeopardise service provision and quality. Political destruction, geopolitical issues, costly international relationships and Europe losing global influence and power[4] were also mentioned as challenges. The action or process that is needed to respond to these challenges could be described as follows:

39. Regulation, planning and delivering of utilities should be integrated, not siloed, to prevent government fragmentation and improve service provision and quality.

3.1.3.7 Hard infrastructure

In terms of the hard or physical infrastructure, scarcity of resources to build imagined cities was mentioned as a challenge. Also discussed were challenges around poor build quality of buildings and use of materials that are not resilient to weather

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[4] These workshops took place before Brexit was in consideration.

challenges if they have to be built swiftly in response to increasing urbanisation. Similarly, poor street quality with roads that did not respond to all users' needs such as cyclists and pedestrians, was mentioned as a challenge. A worst-case scenario for housing provision was the over-reliance on mass production, which would result in 'one size fits all' or 'cookie cutter' type of housing. Regarding urban form, densification with excessive heights overtaking all green spaces and resulting in over-crowding, or segregation and zoning that can lead to urban sprawl, were defined as challenges. Another key issue mentioned in relation to urban form was the loss of importance of public spaces, coupled with extreme privatisation, for example, everything gets fenced off.

In relation to utilities networks, risk of failure, damage or loss of infrastructure due to events, such as natural disasters, was mentioned. In addition there could be an inability to expand the capacity of old networks, for example, the national grid, if demand outstrips supply. To make matters worse, there is a problem that different stakeholders and actors involved in the building process do not speak to each other, preventing necessary investment.

Principle-based actions or processes to embrace the requirements of society for hard infrastructure include:

40. Ensure good quality of buildings and built environment, resilient to weather changes and natural disasters, that can respond to all users' needs;

41. Prevent housing provision from being disconnected from reality and peoples' needs, and over-reliant on mass production;

42. Promote balanced urban form and prevent over-densification or segregation and zoning;

43. Preserve the importance of public spaces and prevent extreme privatisation;

44. Identify strategies for increasing the capacity of old networks;

45. Ensure that infrastructure accords with people's aspirations and meets their need for a good quality of life;

46. Align the incentives and interests of everyone involved in the building process and prevent the competition for space above ground and underground.

3.1.3.8 Functional systems - business and culture

The retail sector identified as possible challenges a lack of retail diversity, the loss of service qualities and lack of perceived safety on streets due to changes in demographics leading to fewer retail high streets. For culture, the heritage sector mentioned a lack of cultural diversity, which could come from excessive philanthropy, for example, funding projects that only speak to the priorities or extremist perspectives of the funder. Similarly, increasing privatisation, or a purely utilitarian view, of heritage can result in a loss of public spaces that are considered to be 'public', like museums. Loss of community open space was also seen as a great difficulty.

Principle-based actions or processes associated with this include:

47. Improve safety and perception of safety on streets;

48. Promote cultural diversity;

49. Prevent loss of community spaces and loss of culture and heritage spaces that are also public spaces.

3.1.3.9 Functional systems - education

The education sector mentioned challenges about creating a culture that does not allow failure to be part of the learning process. The use of international standards that disregard culture and context, which can be reliable but are basically meaningless, was another pressure they felt. Exclusion in education was also described as a challenge that could create or reinforce marginalisation. Also the problem of children who have trouble engaging in school was mentioned.

On a more general scope, inequality could occur due to the disenfranchisement of those who are not highly literate or not able to cope with technology and who could be seen as an underclass. Another problem arises if education is being disconnected from the real context of world needs, industry or knowledge. Less funding for university-based teacher education was raised as a problem for maintaining the diversity and quality of educational resources, including, but not only, teachers. Finally, participants discussed the prevalence of a siloed approach to education in which disciplines are further separated and professionals from different disciplines do not communicate with each other.

Associated, principle-based actions or processes include:

50. Promote education strategies to prevent exclusion, marginalisation and

disenfranchisement;

51. Promote connectedness of education with the real context of people's needs, the industry and knowledge;

52. Ensure adequate funding levels for quality in education and provide affordable access to education;

53. Prevent a silo approach to education and further separation of disciplines to facilitate the communication of professionals from different disciplines.

3.1.3.10 Functional systems - energy, transport, water and sewerage and ICT

For the main utilities, participants worried that energy was being politicised, there weren't enough public debates around energy choices, there was limited energy capacity and cities were becoming excessively reliant on the national grid. Other issues mentioned were transport services failing to reduce CO_2 emissions, resulting in climate change; no airfreight; public transport relying on old technologies, like combustion engines; and an over-reliance on cars in cities, creating excessive traffic. Excessive pollution, including noise; too much travel, especially by air, car and rail; and the dependence on cars means that nobody is walking in cities. Challenges for the food and agriculture system are around lack of crops adaptation.

Principle-based actions or processes associated with this include:

54. Prevent energy from being politicised and promote public debates around energy choices;

55. Prevent systems, such as energy or transport, reaching their supply capacity limit, and promote resilience to respond to climate change;

56. Promote changes in the transport sector to reduce CO_2 emissions and noise pollution;

57. Prevent over-reliance on cars in cities and promote walking and affordable public transport;

58. Promote adaptation strategies for food and agriculture systems.

For Information and Communications Technology (ICT), worst case scenarios were related to failure, such as a breakdown of computers and satellites, and cities being over-reliant on technology without a way to cope with its failure. Related to

data, having too much data without criteria or tools to prioritise it was also defined as a challenge. Problems with information related to not sharing best practices for preserving information and the safeguarding of people's personal information without risks of information misuse also arose. Many other issues about security related to ICT were mentioned; for example, data overuse and extreme privacy invasion, cyberattacks, cyberespionage, technology warfare. Terrorism was also described as a potential worst-case scenario, with terrorists accessing data or using other weapons, such as dirty bombs.

Associated, principle-based actions or processes include:

59. Design city systems to prevent ICT failure, but which include coping, adapting and learning mechanisms in case failure occurs;

60. Define ways to draw meaningful information from large amounts of data and criteria to prioritise it;

61. Share best practices for preserving information and using data whilst preventing misuse of data and problems with security and privacy.

3.1.3.11 Functional systems - ecosystem

Participants described the worst-case scenarios for the ecological system as all-natural environments being irreversibly lost, there being a scarcity of resources due to overconsumption and no access to foreign resources that could potentially result in warfare. An ecological environment increasingly polluted which could increase death and bad health was another challenge.

Another big challenge for the Ecosystem was related to green infrastructure, such as parks, and governments not understanding, or lacking ways to value, the benefits that parks deliver to ecosystems; health, social and cultural services; and the wider economy, especially in the context of small living spaces and higher densities. Similarly, there is challenge of a lack of adequate regulation to preserve green spaces or guidelines on how they can be used or maintained in the face of new developments and increasing urban densification.

Actions or processes to respond to or prevent these include:

62. Prevent the irreversible loss of natural environments;

63. Prevent overconsumption that can lead to resource scarcity;

64. Prevent the pollution of natural environments and the consequent negative impacts on health of people and other urban life;

65. Define mechanisms to assess and value the services or benefits that the ecosystem delivers in cities.

4. Summary

In this Little Book, we have discussed how the ways in which we look at cities need to change, from one of seeing them as large collections of buildings and infrastructure to understanding them as made up of people, their aspirations and their desire for a better quality of life. We need to see cities as embracing people and to ensure that future generations have options available to them for how to meet their own desires. To do this, we needed to recast the vision of a city away from the incremental and legacy-driven arrangement of today, with its emphasis on economic growth, to a vision of future wellbeing for the population in the future. To activate the vision, we then discussed a set of guiding principles, that, if applied to every decision made within or about the city, would improve the chances of creating a city that is fit for the purpose of acting as the home for society in the future.

This vision-based approach to principles development was used as the start for a series of workshops with various sectors involved in cities and their futures. We discussed those workshops and how they were run and the analyses derived from combining these discussions to obtain a generic model for a city. We then described the analysis of the outputs of the workshops and created a suggestion for a number of actions and processes that could be set in motion to improve the way in which cities can see themselves in relation to the future of the societies that will live within them.

The list of 65 actions and processes is not intended to be exhaustive or complete. It is a list derived from the analysis of what was said in the workshops. Nevertheless, it does indicate things and ways of thinking that could be invoked as a starting point by people who wish to transform their city, whether they are professionals, inhabitants or people who use facilities and activities in the city, but live elsewhere.

This book shows the route from a vision and principles, to the practice of designing and operating a city in which people can live and obtain a sustainable improvement in their quality of life. A key message is that bringing the urban principles to practice will require several processes and actions, most of which are related to governance, with city planning having a fundamental role in the process. However, in this context city planning needs to be perceived differently. Planning in cities that allows us to take urban principles into practice requires a shift from a relatively static activity

that revolves around a specific plan or project to a continuous process that steers the course of a city based on the understanding of its people and management of its systems and interactions. As defined by the UN HABITAT 2016 World Cities Report, cities need to rethink planning to move from being 'planned cities' to be 'cities that plan'. Remembering the point that it is people who make decisions, not cities, this means recognizing that city planning is a complex multi-actor, socio-technical and political process that needs to integrate several sectors and services.

There is much to be said about the process of planning and how that might be made more person-oriented, but that discussion is not for this book. Moreover, in a city that plans, the planning process is permanently on-going. This means that the planning process enables a continuous interaction between different actors: residents, leaders, researchers, investors and decision makers – at different scales, which in turn enables the fundamental principles to permeate into plans and projects. Planning as an on-going process can be guided by government institutions or by civil society or communities. For large scale projects, which are commonly led from the top-down, the continuous interactions create the window of opportunity that allows the principles to go into the political agenda and into plans and projects in a way that people can understand and accept. At the small scale, the continuous interactions can be led from the bottom up, which will allow the principles to go into projects that can be developed quickly and can demonstrate results sufficiently quickly to show that change is possible and that the transformations enabled the principles can be a reality. In both cases, the processes need to be directed towards attainment of the vision in a way that is shaped by the principles.

Finally, we have found that transforming the engineering of cities requires deep thought about what we mean by 'engineering', so that it embraces the need to include people as its central core. Capturing the aspirations of people and embodying these in the design, implementation and operation of infrastructure is central to this approach. We need to shift engineering from being the application of physical and virtual infrastructure to 'physical' activities such as moving around, communicating with people, treating water etc., to the application of systems as an embodiment of the mind. Thinking much more about process than product, adaptation rather than stasis, and understanding people, not just physical systems, will deliver a future city that will be fit for future generations. This is a great challenge – for politicians and citizens as well as engineers – but the great positive outcome from this tranche of work is that we have seen that not only is it possible, but it is feasible. Transforming engineering means embracing the challenge of creating the high-level vision and

principles as an integral part of the engineering process and then putting these principles into practice.

Resources

This is a small section containing relevant websites and further readings. As with any of these digital resources, they grow and change rapidly, but we thought we'd give you some websites and readings we liked.

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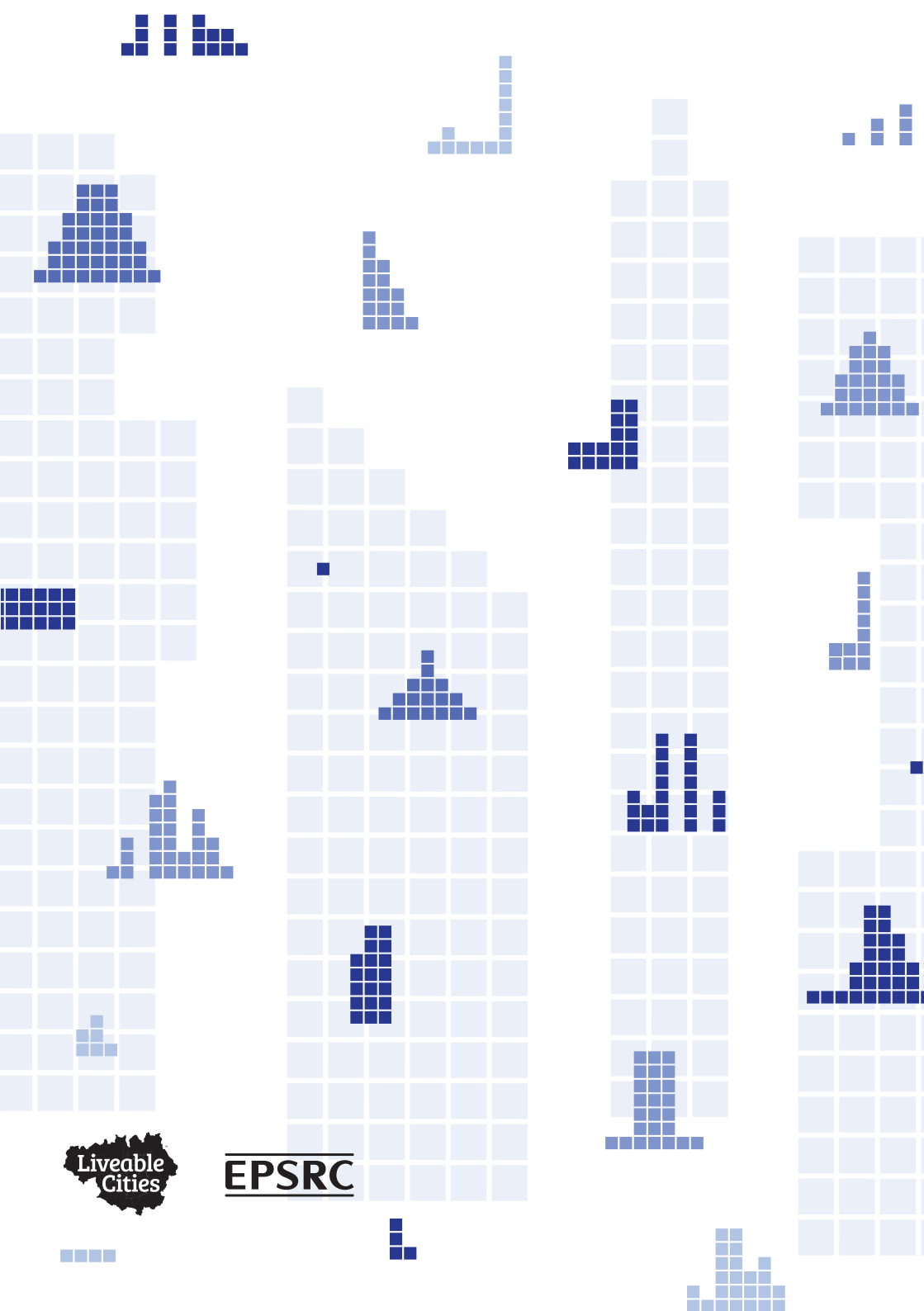UN-Habitat (2012) State of the World Cities. World Urban Forum Edition.

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Sarah Willliams-Goldhagen . (2017) *Welcome to your World: How the Built Environment Shapes Our Lives*, Harper Collins, New York, USA