# Building Resilience in African Cities: A Think Piece

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FUTURE RESILIENCE FOR AFRICAN CITIES AND LANDS

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# About FRACTAL think pieces

*This series is funded by the UK's Department For International Development (DFID) and the Natural Environment Research Council (NERC) through the Future Resilience for African CiTies and Lands (FRACTAL) project, within the Future Climate For Africa (FCFA) multi-consortia programme. The overarching objective of FCFA is to generate fundamentally new climate science focused on Africa, and to ensure that this science has an impact on human development across the continent. FRACTAL's main aim is to advance scientific knowledge on regional climate responses to global change and enhance knowledge on how to integrate this information into decision making at the city-region scale in Southern Africa. These products have been developed to share initial findings from research in the hope of fostering dialogue and eliciting feedback to strengthen the research. The opinions expressed are therefore the author(s) and are not necessarily shared by DFID, NERC or other programme partners.*

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## WHY THIS THINK PIECE?

*Resilience* has become a powerful term, used in multiple contexts, at multiple scales. A mutually understood definition, that all who use it adhere to, is lacking, particularly in relation to the future development of cities, and in the developing world. The motivation behind writing this think piece was that when engaging with city stakeholders during the Future Resilience for African CiTies And Lands (FRACTAL) project and others, we would often get asked: but what does this term resilience really mean, what does it mean within the context of cities, and more specifically, what does it mean for African cities? The think piece that follows is based on reflections from a group of FRACTAL project members. It is largely based on our experiences, as well as additional research. We do not consider this think piece authoritative, but rather a conversation starter, and encourage you the reader to contact us with your inputs/ experiences/ comments. We recognise that there are multiple other resources on resilience and encourage you to seek them out (see for example: United Nations[1], 2012; UNISDR[2], 2012; ULI[3], 2014; City Resilience Framework[4], 2015; ResilientCity.org[5], 2016; The Resilience Alliance[6], 2016; Stockholm Resilience Centre[7], 2015). In light of this, this think piece forms part of a series, it is the first of many, and we look forward to your inputs for shaping future instalments. Finally, we must acknowledge at the outset that resilience as an approach and/ or outcome should not be imposed on cities. Furthermore, we recognise, that the desired outcomes of resilience are not uniformly held, hence the need for interrogation of questions such as: Resilience for whom/ what? City residents and decision makers need to decide themselves on how to tailor the resilience concept to be best applied in their specific context, related to the outcomes they seek.

## WHY RESILIENCE?

Over the past decade, resilience has gained prominence in both research and practice (see: United Nations, 2012[1]; UNISDR, 2012[2]; ULI[3], 2014; City Resilience Framework[4], 2015; ResilientCity.org[5], 2016; The Resilience Alliance[6], 2016; Stockholm Resilience Centre[7], 2015). Definitions of resilience vary, but most relate to the ability of a system to recover while maintaining its functions during and post shocks and stresses (see **Box 1**). In the context of cities, resilience has been defined as *"the degree to which cities are able to tolerate alteration before reorganising around a new set of structures and processes [which] can be measured by how well a city can simultaneously balance ecosystem and human functions"* (Barnett and Bai[8], 2007, p. 8). A resilient society is one that is able to adjust under uncertainty and surprise, and is also in a better position to take advantage of the opportunities that change may bring (Barnett and Bai[8], 2007; Da Silva et al[9]., 2012), partly because it acknowledges that change is constant and that future predictions are difficult in a world that is dynamic and complex (Ward[10], 2007). Resilience can be applied as both a desired state to strive for, and thus a guiding principle for city practitioners, as well as a means to address city needs. In

[1] United Nations, 2012. *How To Make Cities More Resilient: A Handbook For Local Government Leaders - A contribution to the global campaign 2010-2015*. Available http://www.unisdr.org/files/26462_handbookfinalonlineversion.pdf [2016, August 15].
[2] UNISDR Global Assessment Report . 2012. Available: https://www.unisdr.org/we/inform/publications/19846 [2016, August 18].
[3] Urban Land Institute (ULI). 2014. *Resilience Strategies for Communities at Risk. Urban Resilience Program, White Paper Series, Washington, D.C. 2014*. Available: http://uli.org/wp-content/uploads/ULI-Documents/Resilience-Strategies-for-Communities-at-Risk.pdf [2016, August 18].
[4] City Resilience Framework, 2015. Available https://www.rockefellerfoundation.org/report/city-resilience-framework/ [2016, August 08].
[5] ResilientCity.Org. 2016. Available: http://www.resilientcity.org/ [2016, August 08].
[6] The Resilience Alliance. 2016. Available: http://www.resalliance.org/ [2016, August 08].
[7] Stockholm Resilience Centre. 2015. *Applying Resilience Thinking: Seven Principles for Building Resilience in Social – ecological Systems*. Available: http://www.stockholmresilience.org/research/research-news/2015-02-19-applying-resilience-thinking.html [2016, August 08].
[8] Barnett, G. & Bai, X. 2007. Urban resilience research prospectus. Resilience alliance. Stockholm (Sweden): Stockholm University.
[9] Da Silva, J., Kernaghan, S. & Luque, A. 2012. A systems approach to meeting the challenges of urban climate change. International Journal of Urban Sustainable Development. DOI:10.1080/19463138.2012.718279.
[10] Ward, C. 2007. *Diesel-Driven Bee Slums and Impotent Turkeys: The Case for Resilience*. Available: http://www.tomdispatch.com/post/174826/chip_ward_how_efficiency_maximizes_catastrophe [2016, August 25].

essence, there are three uses of the term: (a) a characteristic of a system, (b) an output/ outcome, and (c) an approach. Not all individuals and organisations understand the concept in the same way. In order to take strategic actions that build resilience, it is important that decision makers understand what resilience is, and have engaged with the associated assumptions and differing understandings attached to the concept (UNISDR[2], 2012). **Of vital importance, is for decision makers to then apply the concept within the specific context in which they are operating, in a sensitive and flexible fashion, with a tailored understanding of resilience and the outcomes sought.**

**Box 1: Resilience definitions**

- "The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganising in ways that maintain their essential function, identity and structure, while also maintaining the capacity for adaptation, learning and transformation" (IPCC[11], 2014, p. 127).

- "The capacity of a system to maintain or recover functionality in the event of disruption or disturbance" (Gunderson[12], 2000, p. 426).

- "Resilience is the capacity of a system to absorb disturbance and reorganise while undergoing change, so as to still remain essentially the same function, structure, identity, and feedbacks" (Walker et al[13], 2004, pg. 5).

Resilience is built and developed through a progressive process where the cumulative impact of multiple, diverse and interrelated interventions in a city over time results in increased capacity for future adaptation, learning and change (Pelling[14], 2011). Increasing a city's resilience involves robust planning, sustainable economic growth, improved design and development decisions that in combination contribute towards increased resilience (Satterthwaite and Dodman[15], 2013).

Whilst some evidence shows that "hard" (human-made) infrastructure solutions have the most tangible impact on a city's resilience, interventions across other components of city landscapes (e.g. institutions, formal and informal networks, knowledge flows and ecosystems), are also required to build resilience (ARUP[16], 2014). The Infrastructure Consortium for Africa (ICA) identifies the need for quality infrastructure to build resilience for Africa which it defines in terms of building climate resilience, embracing ecological infrastructure, and being appropriate for the unique challenges in Africa. System designs that benefit the well-being and diversity of the surrounding ecosystem (could be called "ecological infrastructure") reduce the severity and likelihood of disasters (Bornstein[17], 2013), thus increasing resilience. This solution also contributes significantly to the "**resilience dividend**" by providing additional services within the urban environment, such as: (a) reducing the urban heat island effect; (b) providing opportunities for recreation, urban food

[11] IPCC, 2014: Annex II: Glossary [Mach, K.J., S. Planton and C. von Stechow (eds.)]. In: Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland, pp. 117-130.
[12] Gunderson, L. H. 2000. Ecological Resilience in Theory and Practice. Annual Review of Ecology and Systematics. 31: 425 – 439.
[13] Walker, B., Holling, C. S., Carpenter, S. R. & Kinzig, A. 2004. Resilience, Adaptability and Transformability in Social-ecological Systems'. Ecology and Society. 9 (2): 5.
[14] Pelling, M. 2011. *Adaptation to Climate Change: From Resilience to Transformation*. New York and London: Routledge Taylor and Francis Group, pp. 1 – 274.
[15] Sattherwaite, D. & Dodman, D. 2013. *Towards Resilience and Transformation for Cities within a Finite Planet. Environment & Urbanisation Brief*. Available http://pubs.iied.org/pdfs/10648IIED.pdf [2016, August 12].
[16] ARUP. 2014. *Vision for a resilient city*. Available publications.arup.com/~/media/Publications/.../Resilient_Cities_Scoping_Study.ashx [2016, August 25].
[17] Bornstein, J. 2013. The Dynamics of Social Resilience. Minding Nature. 6 (2): 33 – 43.

gardens, and new access corridors supportive of non-motorised transport; and (c) providing areas for reflection and community gatherings, increasing the well-being of city residents. New commercial opportunities also result from an improved living environment, for offices, restaurants and other businesses.

Rodin[18] (2014) indicates that investing in resilience yields results during both stable and crisis periods, calling this the "resilience dividend". In periods of no crisis, resilience can increase a city's competitiveness (Rodin[19], 2015), as resilient cities are well-serviced cities where there is effective coordination and collaboration between the public and private sectors (Rodin[14], 2014). In many African cities (see quote alongside) there is an opportunity to "leap-frog" into a low-carbon, more climate resilient development trajectory with new competitiveness in emerging green economy sectors (The Economist[20], 2014).

> *"Prosperous, socially-inclusive, compact cities, serviced by public transport, potable water and clean energy are not the norm or default in Africa. Ironically, however, the relative lack of infrastructure and services create the opportunity to avoid lock-in to fossil fuels, and to create from scratch the infrastructure and institutional capacity to respond effectively and systematically to climate change risks"*
>
> (Cartwright[21], 2015, p. 3).

## WHY CITIES?

Cities play a key role as centres of economic activity, opportunity and innovation, but they are also places where stresses accumulate or sudden shocks occur (City Resilience Framework[4], 2015), due in part to concentrated resource use and human populations in cities, exacerbated by issues such as urbanisation and the tragedy of the commons[22]. These stresses and shocks can potentially result in social breakdown, physical collapse and/ or economic deprivation, unless a city is resilient (City Resilience Framework[4], 2015). Human wellbeing in cities depends on a complex web of interconnected institutions, infrastructure and information. As regulators of local development and providers of local services, city governments play a key role in ensuring human wellbeing and increasing resilience. As we move into an increasingly urban future, city governments in particular, play an increasingly vital role in achieving developmental and environmental goals established at the global, national and regional level. Governance issues are thus of vital importance for resilience building. How a city is governed, for example, what participatory processes are utilised, how equitably power is dispersed in the city, how learning is captured and built upon, is essential in either building or undermining resilience.

Service delivery is a priority for cities, and building resilience can assist in achieving this objective.

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[18] Rodin, J. 2014. *New Orleans Should Nickname Itself the Resilient City*. Available http://www.nola.com/opinions/index.ssf/2014/11/new_orleans_should_nickname_it.html [2016, August 25].

[19] Rodin, J. 2015. The Resilience Dividend: Being Strong in a World Where Things Go Wrong. [Online]. PublicAffairs. [Accessed 06 March 2017]. Available from: https://ssir.org/articles/entry/the_resilience_dividend

[20] The Economist. 2015. *A Brightening Continent*. Available http://www.economist.com/news/special-report/21639018-solar-giving-hundreds-millions-africans-access-electricity-first [2017, March 06].

[21] Cartwright, A. 2016. Better Growth, Better Cities: Rethinking and Redirecting Urbanisation in Africa. The New Climate Economy. Avaliable http://www.cisl.cam.ac.uk/about/where-we-work/cape-town/pdfs/NCE-APP-final.pdf [2017, March 06]

[22] "The tragedy of the commons is an economic problem in which every individual tries to reap the greatest benefit from a given resource. As the demand for the resource overwhelms the supply, every individual who consumes an additional unit directly harms others who can no longer enjoy the benefits. Generally, the resource of interest is easily available to all individuals; the tragedy of the commons occurs when individuals neglect the well-being of society in the pursuit of personal gain" (Source: http://www.investopedia.com/terms/t/tragedy-of-the-commons.asp)

There are a number of interventions that a resilient city may implement. Some of these interventions are housed in **Figure 1** (based on ICLEI Africa's experience) and others (based on Stockholm Environment Institute experience), are listed below:

- well planned drainage systems that help alleviate floods utilising ecological infrastructure;
- early warning systems that facilitate timeous citizen evacuations;
- energy systems utilising diverse sources, reducing the occurrence of power outages;
- health care services that are equipped to respond to public health emergencies, while continuously improving resident's health;
- an efficient sewerage system that reduces the outbreak of diseases; and
- effective solid waste disposal facilities that prevent blocked drains.

In a resilient city, fewer buildings should collapse, less power outages should occur, deaths and injuries should be minimised during disaster events, and fewer communications and coordination breakdowns should take place (Godschalk[23], 2003).

## WHY AFRICAN CITIES?

Africa is considered to be one of the continents most vulnerable to the impacts of climate change (IPCC[11], 2014). African cities are amongst the fastest growing in the world and despite efforts by engineers and city planners, the majority of growth in African cities continues to be in informal settlements. This is partly because infrastructure maintenance and development cannot keep up with urban population growth in African cities, but is primarily an issue of affordability in that many of those moving into the city and/or forming new independent households within the city (i.e. internal growth) cannot afford land, property and rental prices in the formal economy. There is therefore a great need for increased resilience in African cities that connects the formal and informal parts of these cities.

Many resilience champions operating in African cities face challenges (see Satterthwaite[24], 2011; Satterthwaite[25], 2013) related to:

- public fiscal constraints (including a lack of public funding), conservative financial management regulations and/ or high levels of corruption, which suppress innovative and new practices;
- highly centralised systems that do not encourage the garnering and application of multiple knowledge systems and implementation methods;
- major infrastructure maintenance and new building backlogs, which erode existing resilience to extreme events; and
- in some cases antiquated and in other cases new (untested, unfamiliar, unimplemented) legal and policy frameworks that cannot be easily harnessed for resilience building.

## CONSIDERATIONS FOR TAKING RESILIENCE FORWARD AT THE CITY SCALE:

Based on our experience of interacting with cities and key decision makers across Africa, we have compiled a list of considerations that have emerged as being critical with regards to building resilience in African cities. These considerations are further demonstrated in **Figure 1**.

[23] Godschalk, D.R. 2003. Urban hazard mitigation: Creating resilient cities. Natural Hazards Review. 4(3): 136–143.
[24] Satterthwaite, D. 2011. How can urban centers adapt to climate change with ineffective or unrepresentative local governments?. Wiley Interdisciplinary Reviews: Climate Change. 2: 767–776.
[25] Satterthwaite, D. 2013. The political underpinnings of cities' accumulated resilience to climate change. Environment and Urbanization. 956247813500902.

**Consideration 1**: Use systems thinking

> *"Systems thinking focuses on how the thing being studied interacts with the other constituents of the system - a set of elements that interact to produce behaviour – of which it is a part"* (Aronson[26], 1996, pg. 1).

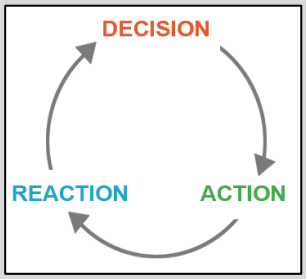
As cities are interacting systems (Kilcullen[27], 2012), a systems thinking approach assists in building resilience at the local level (Stockholm Resilience Centre[7], 2015). The faster a city system can detect and respond to changes, the greater it's potential for effectively coping with these changes. Given that cities are highly complex, dynamic and non-linear systems, social, economic, and technical components of cities, designed with both tight and multiple feedback loops (see **Box 2**) are likely to increase resilience (Stockholm Resilience Centre[7], 2015). Therefore a traditional analytical approach to addressing individual challenges independently (e.g. only focusing on infrastructure design /or/ economic systems /or/ policy development) will unlikely result in sustainable and resilient solutions. As Orr[28] (2014) notes, resilient governance requires the calibration of two kinds of non-linear systems: social systems (e.g. laws, regulations, taxation, policies, elections and markets), and ecological systems (e.g. biological, hydrology, geology, wildlife, climatology and land use). A systems approach is therefore critical for resilient urban development and provides a "*lens by which we might see more clearly through the fog of change, and potentially better manage the complex cause and effect relationships between social and ecological phenomena*" (Orr[28], 2014). The circles within circles depicted in **Figure 1** illustrates the non-linearity of city environments and the need to use a systems approach, in order to build resilience at the local level.

**Plate 1** City scape in Addis Ababa, illustrating the multiple land uses that need to be considered when building resilience in African cities

[26] Aronson, D. 1996. *Overview of systems thinking*. Available: http://resources21.org/cl/files/project264_5674/OverviewSTarticle.pdf [2016, August 31].
[27] Kilcullen, D.J. 2012. The City as a System: Future Conflict and Urban Resilience. The Fletcher Forum of World Affairs. 36 (2): 19 – 39.
[28] Orr, D. 2014. Systems Thinking and the Future of Cities. Available http://www.resilience.org/stories/2014-05-30/systems-thinking-and-the-future-of-cities [2017, February 14]

**Box 2: The importance of feedback loops for resilient systems**

When the outputs of a system are routed back to become inputs, influencing the same system that created them, the system forms a series of 'loops' or 'feedbacks' (Aronson[22], 1996). For example, in cities, a decision (e.g. low cost homes should be built with solar water heaters) taken usually results in an action (the 'output') (e.g. low cost homes are built with solar water heaters), this action will then lead to a reaction (the 'input') (e.g. household members spend less time heating water), which ultimately may result in another decision (e.g. household members can decide to utilise the freed up time to engage in other important activities). A 'tight' feedback loop refers to shortening the delay between all components of a system, resulting in feedback more quickly and hence the system is more responsive to change, thus potentially building resilience more effectively.




**SOURCE:** https://ceblog.s3.amazonaws.com/wp-content/uploads/2015/06/feedback-loop-decision-action-reaction.png

**Consideration 2:** Get knowledge flowing

A city's ability to gather and distribute applicable information is key to resilience building (Bornstein[26], 2013; The Stockholm Resilience Centre[7], 2015). A resilient city is one that has a solid, experience based knowledge system, where innovative approaches for resilience have been tested to build an evidence base, and can be implemented when necessary. Cities that practice learning by doing, reflection, recording of lessons learned, and effectively integrating them back into the planning process are often more resilient. Improving the link between science/ research and municipal decision making is likely to improve the available knowledge base, enhancing research informed policy. Institutionalising multi-stakeholder groups also helps with the ability to gather, preserve and distribute different knowledge sets that can build resilience and help deal with change. Utilising technology, such as mobile phones is an essential opportunity for garnering and distributing information, even in the most informal of settlements. Furthermore, improved monitoring is critical to building resilience and being able to adapt quickly in an increasingly uncertain future for African cities.

**Consideration 3:** Develop more responsive governance structures

The ability to garner, filter, utilise and distribute relevant information can also be limited by the organisational structure of the responsible authorities (UNISDR[2], 2012). As cities work to build resilience, procedures that enable city officials to carry out their daily mission while building no regret options for the future, are useful. One such no regret intervention, is developing a coordination platform for gathering innovative ideas for resilience building within the specific context of a city or community. Essential to this platform functioning effectively will be how accessible it is to different stakeholders and whether incentives exist for its use. An exciting

example of such a platform is WeFarm[29], a SMS-based social network for smallholder farmers. WeFarm has facilitated 15 million exchanges, on agricultural issues and solutions, connecting more than 105 000 farmers across Uganda, Kenya and Peru (Bharwani[30], 2016).

Resilience is a cross-cutting issue, applicable to multiple sectors. Some of the ways the concept can be mainstreamed within city governments, is to: (a) build the capacity of city officials to be able to use the resources available to them to combat vulnerability; (b) appoint a resilience officer placed at a high level within the local authority; (c) establish a resilience office/ department or resilience officers in each department; and/ or (c) develop a resilience plan with city-wide departments responsible for input and implementation (ICLEI ACCCRN Process[31], 2015; UNISDR[2], 2012; TERI[32], 2016). Another important resilience building intervention is to regularly update the city's understanding of hazards and vulnerabilities, with risk assessments forming the basis for urban design plans and decisions (ICLEI ACCCRN Process[31], 2015; City Resilience Framework[4], 2015).. Similarly, urban residents need to understand the risks at play in their locale, and then be empowered to participate in city decision making, increasing the diversity of solutions and resources for implementation of these solutions (UNISDR[2], 2012). The process of transferring powers, functions, resources and responsibilities from central government to multiple governing bodies that interact within a specific policy arena is considered to be a useful way to achieve collective action in the face of disturbance and change (Stockholm Resilience Centre[7], 2015). Collaboration across institutions and scales improves connectivity and learning; well-connected governance structures can swiftly deal with change and disturbance by events being addressed by the right people at the right time (ResilientCity.org[5], 2016; Stockholm Resilience Centre[7], 2015).

**Consideration 4:** Co-ordinate, cooperate and collaborate

Resilience involves cooperative action and setting priorities that are endorsed by multiple stakeholders working across different sectors, scales and perspectives (ARUP[25], 2014; ULI[3], 2014). It is thus crucial that city governments prioritise and strengthen community engagement processes (including with the research community) and private sector engagement (Bornstein[26], 2013). Improved private-public collaboration allows for the development of new technologies, economic models and continuous innovation and refinement, needed for positive change. Community engagement allows for improved participation in decision making (ULI[3], 2014; The Stockholm Resilience Centre[7], 2015), increasing the diversity of knowledge garnered and thus the chances of finding innovative solutions that work within the local context.

**Consideration 5:** Creating diversity

Creating diversity in systems is important (ResilientCity.org[5], 2016; The Resilience Alliance[6], 2016; Stockholm Resilience Centre[7], 2015), as evidence from several studies suggests that systems with many different components are generally more resilient than systems with few components. The presence of many elements often compensates for the loss or failure of others (Stockholm Resilience Centre[7], 2015). For example, city transportation that includes multiple modes, such as trains, buses, bicycles, walking and cars will be better off in periods of damage to transport infrastructure that supports one mode of transport. An additional benefit being that having these alternatives, alleviates congestion outside crisis periods. Diverse social systems also assist in

[29] WeFarm. 2017. 2016. Available: http://www.wefarm.org [2017, February 08].
[30] Bharwani, S. 2016. *What makes a good climate service? Learning from practice.* Available https://www.sei-international.org/climate-services/news-and-opinion/3601-what-makes-a-good-climate-service-learning-from-practice [2017, February 03]
[31] ICLEI ACCCRN Process, 2015. Available http://acccrn.net/resources/iclei-acccrn-process [2016, August 25].
[32] Energy and Resources Institute (TERI), 2016, 'Decoding Urban Climate Change Resilience', presented to Enabling Policy Frameworks for Climate Resilient Cities', New Delhi, 8 July 2016, http://www.teriin.org/index.php?option=com_events&view=details&sid=885&Itemid=110 and https://www.youtube.com/watch?v=skL8xb-vvCA

spreading risk, as a resilient community ultimately depends on the resilience of its individual members (Andrews[33], 2015). Another example, relates to water supply in cities. Studies have shown the benefits of having a highly integrated bulk distribution system, which derives water from multiple sources, mitigates some of the impacts of increased variability in precipitation and streamflow, as well as some of the potential economic risks of climate change in Africa (Cullis et al, 2015[34]).

[33] Andrews, J. 2015. *What Makes a Resilient City?* Available: http://citiestoday.com/what-makes-a-resilient-city/ [2016, August 18].
[34] Cullis, J., Alton, T., Arndt, C., Cartwright, A., Chang, A., Gabriel, S., Gebretsadik, Y., Hartley, F, De Jager, G., Makrelov, K., Robertson, G., Schlosser, A., Strzepek, K. & Thurlow, J. (2015). An uncertainty approach to modelling climate change risk in South Africa. United Nations University World Institute for Development Economics Research. WIDER Working Paper 2015/045. Avaliable: https://www.wider.unu.edu/publication/uncertainty-approach-modelling-climate-change-risk-south-africa [2016, March 03].

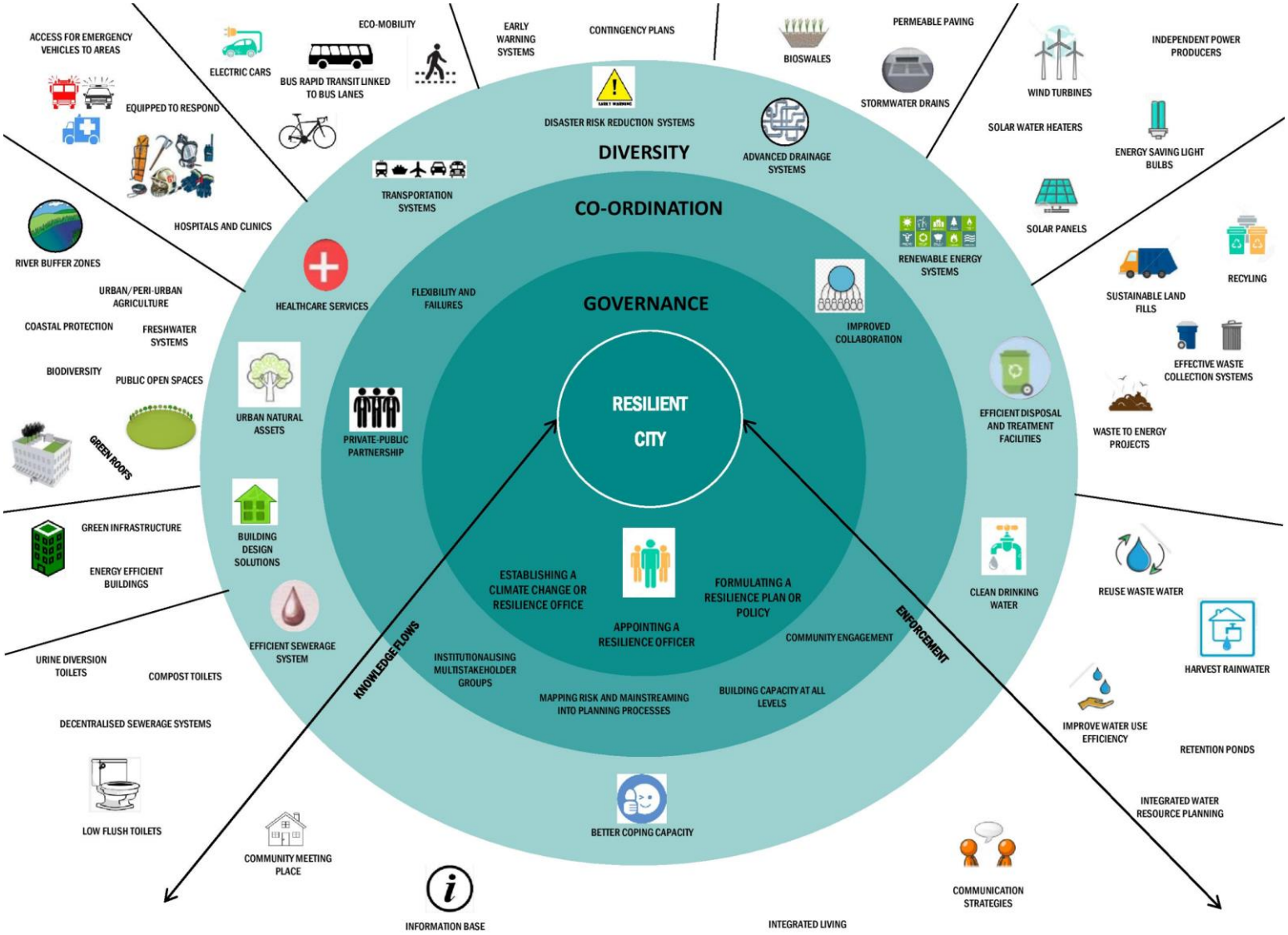



**Figure 1: CONSIDERATIONS FOR TAKING RESILIENCE FORWARD AT THE CITY SCALE**