Chapter 12
Designing with Risk: Balancing Global Risk and Project Risks

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Abstract The World Economic Forum, in their yearly global risk report which highlights the most significant long-term risks worldwide, consistently indicates that the 'failure of climate change mitigation and adaptation', as well the interconnected 'water crises', 'greater incidence of extreme weather events' and 'food crises', are among the top 10 global risks of highest concern. It is evident that the built environment will play a central role in fostering resilience towards such risks. Within the production of the built environment, at the same time, there is a concern with an altogether different set of risks, those related to the feasibility of a project. 'Project resilience', the capacity of a project to cope with shocks and stresses that are related to its feasibility, is often in conflict with 'global' resilience goals. Successful implementation of resilience projects in the built environment, such as 'The Big U' (of which the author is a co-design- lead), depends on designing the right balance between the two. In this paper, based on the author's work on 'The Big U' and its successor projects, as well as on two interdisciplinary seminars at PennDesign, 'Designing with Risk', the author presents the research into this question, and propose that designers can have agency in balancing the two risk types in resilience projects.

Keywords Climate-adaptive design · Urban resilience · Community engagement · Risk management · Adaptation pathways · Big U · Rebuild by design · New York City

Introduction

After Hurricane Sandy, New York City (NYC) has started implementing numerous projects that address the increased climate change risks the city is facing. These projects are part of a larger strategic approach based on the notion of 'flexible

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adaptation pathways' (Rosenzweig and Solecki 2014). This approach acknowledges the uncertainties relating to climate change and the need for a multi-layered and iterative response in a complex adaptive system such as a city. Each project, from that perspective, is itself a mechanism of action in a long term process.

Based on the author's experiences as co-lead of the design team for the Big U in Rebuild by Design (and subsequent follow-up projects), as well as through his research at PennDesign, this paper describes how climate adaptation projects need to navigate between addressing 'global risks', such as those resulting from long-term climate change, and 'project risks', that are the result of the complex political, financial, cultural and technical environment of the project, resulting in risks to its feasibility. Project Risks are considered in the shorter term. There is a tension between these two goals that can be both productive and unproductive.

The success of the Big U concept in triggering responses to climate change that fit in with NYC's 'flexible adaptation pathways' (FAP) approach is path dependent (Boschma 2015; Sjöstedt 2015) on a number of crucial initial design decisions. These decisions continue to influence the planning and implementation process of the project. The paper explores the agency that design can have in balancing the management of Global Risks and Project Risks as proxies for divergent time horizons, geographies and political interests. The paper suggests that one should not design for a static set of risks but should be designing the adaptive capacity itself, such that future iterations or designs can be accommodated at a point of time when different sets of risks may manifest.

Global Risks and Project Risks

The World Economic Global Risk Report 2016, based on a survey of more than 750 experts and decision makers from the WEF community, lists the failure of climate change mitigation and adaptation as the most impactful risk for the years to come (WEF 2016). In the report, the writers explore what they call Global Risks, "uncertain event[s] or condition[s] that, if it occur[s], can cause significant negative impact for several countries or industries within the next 10 years" (WEF 2016, p. 8). The failure of climate change mitigation and adaptation is linked to societal risks such as water crises, food crises, profound social instability and large scale involuntary migration as well as to environmental risks such as extreme weather events, natural catastrophes and biodiversity loss and ecosystem collapse, each in themselves high on the list of Global Risks.

Many of these risks will increase. Climate change is resulting in sea-level rise and increased storm intensity, the extent of which is still uncertain. Projections of sea level rise on the East Coast of the United States vary from 0.3 to 2 m (the latter under a scenario in which the polar icecaps collapse) by 2100 (Hauer et al. 2016; Vermeer and Rahmstorf 2009). The extent of the sea level rise depends on many factors, such as the success of the Paris climate mitigation agreements and planetary feedback mechanisms.

While the magnitude of the effects of climate change is uncertain, it is clear that urban environments have a great impact on climate change itself, and will play a great role in climate change mitigation and adaptation. Urban areas, home to more than 50% of the world's population, account for more than 70% of CO_2 emissions (Seto et al. 2014, p. 927). Improvements in building design, land-use and transportation planning, as well as the transition of urban energy systems, should all contribute greatly to the reduction of CO_2 emissions (Seto et al. 2014).

At the same time, it is in the urban environments that most measures need to be taken to reduce the impact of the risks, through mitigation of (potential) damages or through building resilience. Resilience can be defined in different ways. In a more limited definition, from the domain of engineering, resilience refers to the ability to return to its original form after being impacted by a stressor, such as those induced by climate change. In the field of complexity science, the concept of resilience is defined more broadly including the adaptability or transformational capacity of a complex system under stress (Martin-Breen and Anderies 2011). Resilience, in this latter definition, has the potential to not only play a role in risk mitigation, but also, through the ability of a complex adaptive system to transform, to mitigate and adapt its stressor.

The different definitions of resilience have made the term somewhat of a catch-all name for many strategies and projects that result from the need to mitigate and adapt from climate change and other risks, especially in the professional environment. There is an inherent messiness to the use of the term as it is used for such resilience strategies and—projects, a messiness that is holding back the development of climate change response initiatives (Keenan et al. 2015). To a large extent this is because these strategies and projects themselves become agents in a complex adaptive system, and reduce, or even increase, the uncertainty. The strategies and projects become part of the feedback mechanisms. This makes planning and building resilience projects highly complex, and is, in part, the reason that resilience projects have been reduced in dimension.

The Dutch Approach

The Netherlands' Delta Works is a case in point. After a major flood in 1953 that inundated much of the Southwestern Rhine/Meuse/Scheldt delta and killed approximately 2000 people, the Netherlands set forth a massive flood measure to reduce the risk of inundation to 1:10,000, meaning one flood event per 10,000 years. Devised by the engineers of Rijkswaterstaat, the Dutch Department of Waterways and Public Works, the Delta Works were originally envisioned as a series of dams which would close off all the estuaries with the exception of the Nieuwe Maas, and the Oosterscheldt, such that the ports of Rotterdam and Antwerp would remain accessible. Complemented by heightened dikes, this massive plan, at a cost of more than 15 billion US$ (in current terms) would protect the Rhine/Meuse/Scheldt delta against future floods and reduce the risk of inundation.

After most of the dams were constructed, it became clear that the original plans needed to be ameliorated. The closed-off estuaries suffered from ecological degradation (Ysebaerta et al. 2016). At the same time, the ecology of the delta was increasingly valued by scientists and the public. As a response, the final dam, at the Oosterscheldt, was built as only partly closed, with operable panels that could be opened to let the tidal flows do their work. The Delta Works is an example how large scale projects in which one set of goals (flood protection) executed by one type of experts (civil engineers) can have adverse large scale effects in other realms.

It is in part the awareness that flood protection measures are part of a complex adaptive systems that have inspired later generations of Dutch flood protection protects, in which the focus has shifted from a singular one, protection, or damage mitigation, to multiple goals, which include ecological value and spatial quality. Additionally, programs such as ‘Ruimte voor de Rivier’ (Room for the River) also allow for a more flexible approach to flood protection standards, ultimately resulting in a series of smaller, more adaptive solutions (Wesselink et al. 2007).

Another reason resilience projects have been reduced in dimension is the management of the associated project related risks. Adverse environmental impacts, such as seen in the Delta Works but also in the Oresund and Great Belt links in Scandinavia (in themselves not resilience projects but built within a similar environment), have led to significant adjustments in projects, with large cost overruns as a result of poor project risk management. In general, many large projects in the past decades have had sizeable cost overruns. This, in return, has reduced the ability of the body politic to propose such large scale projects (Flyvbjerg et al. 2003). Even after a catastrophic event, which might create the necessary political momentum, it is difficult to sustain (politically and financially) the big interventions a large scale resilience project might warrant.

New York City’s Approach

New York City is a good example where resilience projects have been re-thought from the large scale to the smaller scale. In the late 1990s, it became clear that New York was extremely vulnerable to coastal flooding (Hill 1996; Rosenzweig and Solecki 2001). Since then, various proposals have been produced for storm surge barrier systems, similar to the Oosterscheldt barrier. One such example was Arcadis’s 2006 proposal for a storm surge barrier in the Verrazano Narrows, which would connect Staten Island with Brooklyn. Combined with barriers in Arthur Kill and on the East River, such a system would protect much of New York City against coastal flooding. The cost of the Verrazano barrier was estimated to be approximately $6.5 billion (Arcadis 2009). After Hurricane Sandy, in October 2012, such proposals, sometimes with different locations of the barriers (such as one between Sandy Hook and Breezy Point in the Rockaways), were re-iterated by various engineers, and were given prominent attention in the media (Lynch 2012).

In 2008, New York City Mayor Bloomberg convened a panel the First New York City Panel on Climate (NPCC). Rather than focusing on a few large projects, such as the storm surge barriers proposed earlier, the NPCC proposed a risk-management approach called 'Flexible Adaptation Pathways' (FAP) (NPCC 2010). In this approach, climate change responses evolve over time as understanding about impacts and effectiveness of mitigation, resilience and adaptation measures develops ("learn, act, then learn some more"). Given this thinking, the NPCC noted that proposed storm surge barriers might be a relevant solution in the long term, but given the high economic, environmental, and social cost, they would require extensive study before being regarded as appropriate for implementation (Rosenzweig et al. 2011).

The subsequent Special Initiative for Rebuilding and Resiliency (SIRR) has proposed a similar iterative and multi-layered approach to climate change (City of New York 2013). In response to Hurricane Sandy, which made landfall on October 29 2012 and which caused extensive losses to the city including 43 deaths and more than 19 billion in damages, the SIRR-report outlined a large number of small-to-medium scale flood protection initiatives. Many of these were green infrastructure projects, such as expanded dune systems, wetlands and off-shore breakwaters. Locally, the hardening of critical infrastructure, floodwalls and the raising of bulkheads were proposed. Building codes and standards were to be adapted to the new condition. Further, the report explicitly debunked the idea of the flood barriers: "For some observers, the idea of constructing a single piece of engineering offers the appeal of seeming simplicity, as compared to a suite of more targeted, localized protections. However, the construction of such harborwide storm surge barriers actually presents many complications." (City of New York 2013, p. 49). It then lists the high costs, the long time it takes to plan, design and permit and the possible environmental and urban impacts. Of the many smaller initiatives, one physical coastal protection project stands out in its scale; an Integrated Flood Protection System for Lower Manhattan, encompassing some 10 miles of low-lying coastline, and including a multi-purpose levee in the Financial District. The first phase of this project alone, on the Lower East Side, was estimated to cost more than $300 million.

The damages from Hurricane Sandy on Lower Manhattan were extensive. The coast below West 57th street down to the Battery, the southern tip, and up to East 42nd historically consists of landfill on former marshland that has been used for port activity and, later, housing. The FEMA Flood zone, which wraps around the island, extends up to 5 blocks inland on the Lower East Side. With a storm tide at the Battery, on Manhattan's southern tip, of 4.3 m above mean low water, Sandy resulted in extensive flooding in this zone. The water levels were such that the subway and tunnels also flooded, and that the ConEd electricity plant at East 14th street was knocked out, causing a blackout in much of Lower Manhattan that lasted up to two weeks (SIRR 2013). On the Lower East Side, much of the New York City Housing Authority (NYCHA) public housing was flooded, causing extensive damages to the electrical systems and boilers, and greatly increasing the amount of apartments suffering from mold, with the associated health risks. Hurricane Sandy substantially increased the challenges for NYCHA to preserve the housing on the Lower East Side, home to 32,000 residents, which was already suffering from disrepair because of a financially strained housing authority (ALIGN 2014).

The Big U

The recommendation of the SIRR report to develop an integrated flood protection system for Lower Manhattan became the starting point for the BIG Team in Rebuild by Design (2014), a planning and design competition launched by the Hurricane Sandy Task Force "to promote resilience in the Sandy-affected region" and to "promote innovation by developing regionally-scalable but locally-contextual solutions that increase resilience in the region." The competition set aside HUD (U.S. Department of Housing and Urban development) Community Development Block Grant Disaster Recovery (CDBG-DR) funding specifically to incentivize the implementation of winning projects and proposals (HUD 2016).

During the BIG Team's design process, it became clear to the team that in order to design an implementable and effective project for an integrated flood protection system for Lower Manhattan (the Big U), the team had to understand the project itself as part of the complex adaptive system of New York, adjust and reduce the dimension of the project such that the City can 'digest' it, and, as such, to frame the project within FAP approach that NYC has embraced based on the NPCC recommendations (Fig. 12.1).

Multi-dimensionality

Climate change adaptation measures, according to the NPCC, need to be considered within the cultural, political, economic, environmental and developmental contexts in which climate change occurs. In 2006, Mayor Bloomberg established the Office of Long Term Planning and Sustainability (OLTPS), part of the Mayor's Office, with the goal of developing and implementing a comprehensive plan to create a 'greener', more sustainable city by 2030. The resulting plan, PlaNYC, recognized the importance of promoting both climate change mitigation and adaptation. In the 2011 update to the plan, the City described adaptation strategies in a wide variety of dimensions, including public health, green buildings, natural systems, the waterfront and public engagement, with a practical focus on the resilience of critical infrastructure (Rosenzweig and Solecki 2014, p. 401). In Bloomberg's successor De Blasio's follow-up plan, One New York; the Plan for a Strong and Just City

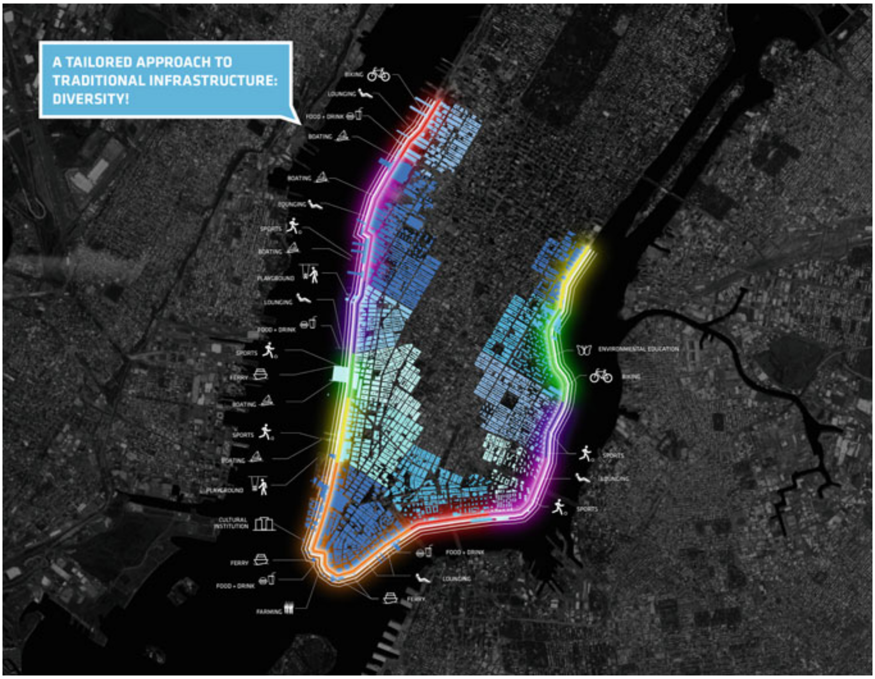

Fig. 12.1 The Big U, concept diagram (own figure)

(OneNYC), this multidimensional aspect was broadened to include the four interrelated dimensions of resilience, growth, sustainability and equity (City of New York 2015).

In the Big U proposal, this multi-dimensionality is best expressed through the BIG Team's introduction of the idea that the project should also be 'social infrastructure'. Taking a cue from the High Line, where a decommissioned piece of infrastructure is given a social function, the team asked itself if it is possible to "conceive of our public infrastructures to come with intended social side-effects from day one" (Ingels 2012). In the Big U proposal, this idea is translated in many different ways, linked to the different geographies of the project, such as an improved waterfront park with better access from the public housing, sports facilities, a new public school with flood protection built in, stormwater flooding protection measures that improved public space in the nearby housing, and community centers. Many of these ideas for social infrastructures were developed in an intensive public engagement process with the local communities. A second idea within the Big U's proposal for this multidimensional approach to adaptation was the development of 'resilient community districts', in which resilience measures (and the associated social infrastructures) were not only designed from the local perspective, but also, when possible, linked to, and in part financed by, future urban development (Rebuild by Design 2014) (Figs. 12.2 and 12.3).

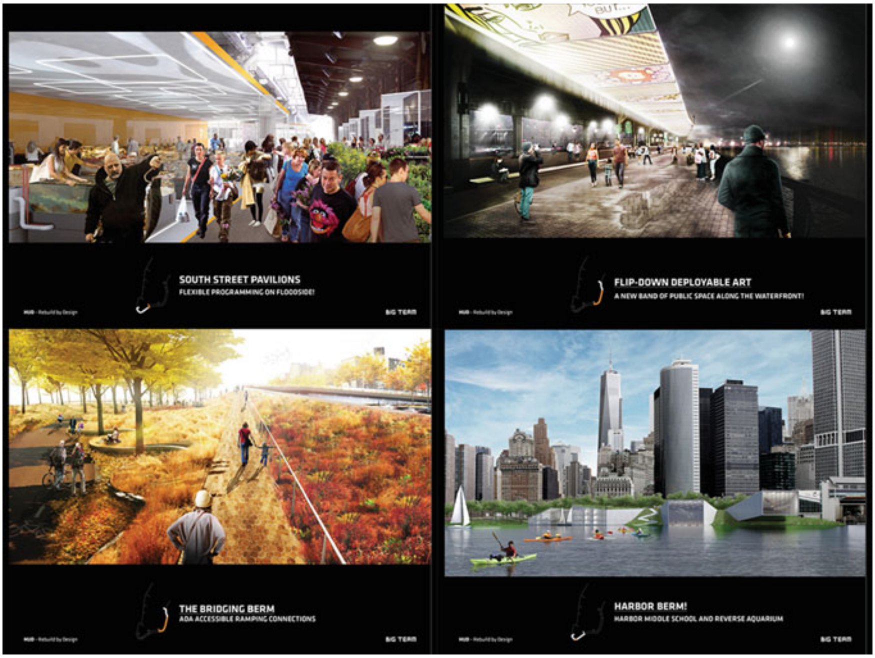

Fig. 12.2 Examples of 'social infrastructure' in the Big U proposal (own figure)

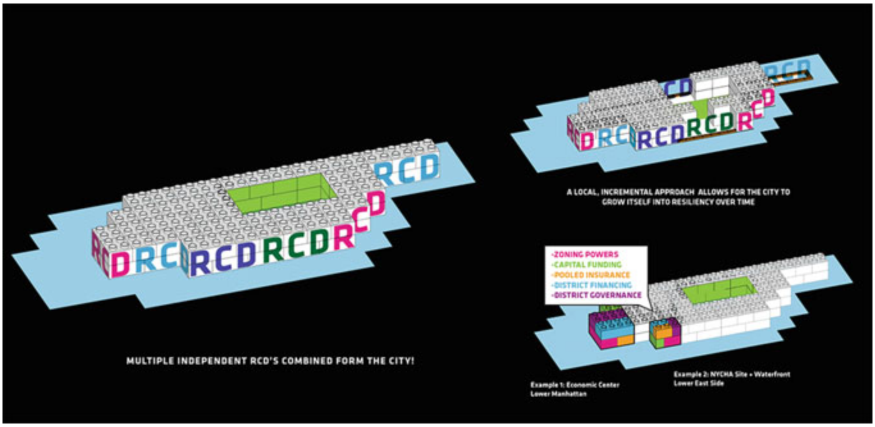

Fig. 12.3 Illustration of the idea of resilient community districts in the Big U proposal (own figure)

Intertemporality

Another important component of NYC's approach to climate change adaptation is the notion that adaptation will evolve through time. A locked-in and too rigid set of measures brings risks similar to those of large projects as described above. New climate science, actual sea-level rise, political and societal changes, adverse side-effects and technological developments all influence decisions about future climate adaptation projects. One way in which New York City has instituted means to monitor path dependency and to avoid lock-ins is the establishment of the NPCC and the Climate Change Adaptation Task force as ongoing bodies, required to regularly update the comprehensive resiliency plan (Rosenzweig and Solecki 2014, p. 402).

In order to accommodate this need for future adaptation, the Big U proposal, rather than conceiving of the flood protection system as one 10-mile long infrastructure, approaches the system as a series of self-contained compartments, 'little U's', with upland connections to higher ground at regular pinch-points. As such, the 'little U's' can each be planned and built independently from each other. When only part of the system is built, or when one of the compartments is breached, the system still provides safety for the (other) finished compartments. This compartmentation also allows the system to be easier adapted incrementally, and to respond better to local issues in building a social infrastructure (Fig. 12.4).

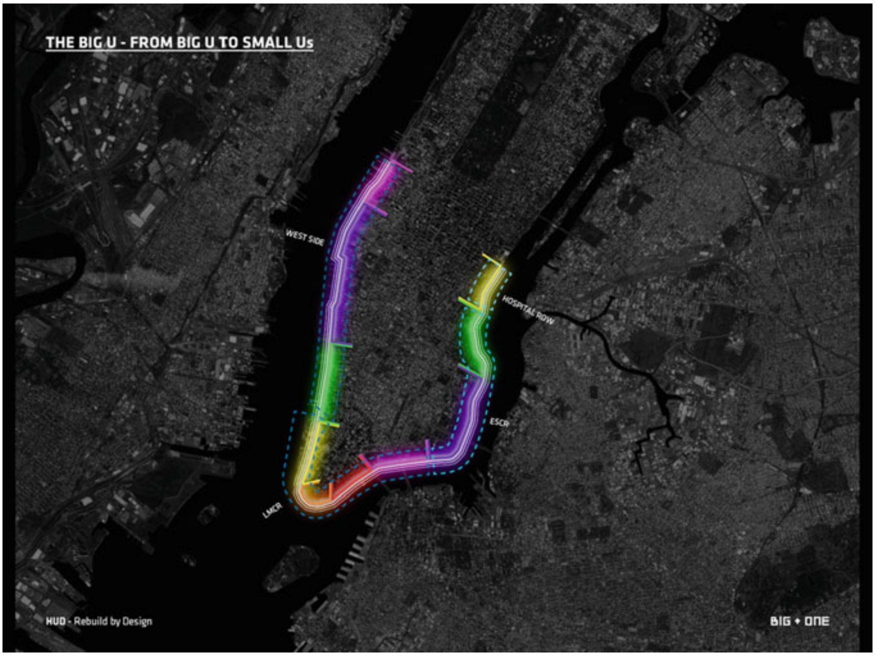

Fig. 12.4 Diagram illustrating 'Little U's', the distinct compartments in the Big U proposal (own figure)

From Design Concept to Implementation

In the case of the Big U, the Rebuild by Design competition's focus on implementable projects, backed by $1 billion of CDBG-DR funding, resulted in a proposal that was as much driven by considerations about the Project Risks that might affect implementation, such as funding requirements, community buy-in, the City's climate change approach and its capacity to handle big projects, as it was about global climate risk mitigation. And in the process of balancing the two types of risks in the proposal and its further elaboration, it is discovered that Project Risk reduction makes it easier to add more dimensions and make the project more responsive to new insights.

The funding requirements had a strong impact on the location, size and nature of the initial Big U proposal. The HUD administered CDBR-DR funding that the U.S. Congress authorized (U.S. Congress 2013) for what became the Rebuild by Design competition consisted of flexible grants to help cities, counties, and States recover from Presidentially declared disasters, especially in low-income areas. Since CDBG-DR funding had to focus on vulnerable populations, the team decided to focus first on New York's Lower East Side, where much of Manhattan's public- and low-income housing was located in the floodplain. Funding also influenced the team in determining the project's individual compartments. With the assumption that the 1 billion US dollars shall be roughly divided equally between New Jersey, New York State, and the City of New York, the team reasoned that any specific funding request should not exceed $400 million. In this context, the strategy of the 'little Us' was not only a condition for eventual success, it also neatly coincided with the size of a first compartment to be implemented at the Lower East Side. A third result of the funding requirements that the team considered was the timetable of the funding: with all possible waivers and extensions, the funding needed to be spent within approximately 5 years (Office of the Federal Register 2014). This requirement was translated by the BIG Team in a proposal that carefully avoided any lengthy regulatory processes, such as those induced by building in the water, or complex planning processes, such as those resulting from building on private land.

In the BIG Team's reasoning, the combination of a conceptual vision for the entire waterfront of Lower Manhattan (the Big U) with a readily implementable plan (one 'little U' between 23rd street and Montgomery street) based on the momentum and funding availability after Hurricane Sandy, would make it possible to make a start with building resilience such that it would trigger the implementation of additional 'little U's' and would allow for further adaptation of the initial 'little U' along the lines of the Flexible Adaptation Pathways strategy in the future. The first implemented project would, as such, become a powerful agent for change and resilience building in the complex adaptive system that is New York City.

In order to demonstrate and explore possibilities for future adaptation of the project, specifically those related to the dimensions of (housing) equity, health, accessibility and sea level rise, the BIG Team included a series of studies and 'toolboxes' that showed future iterations and expansions of the project. These were

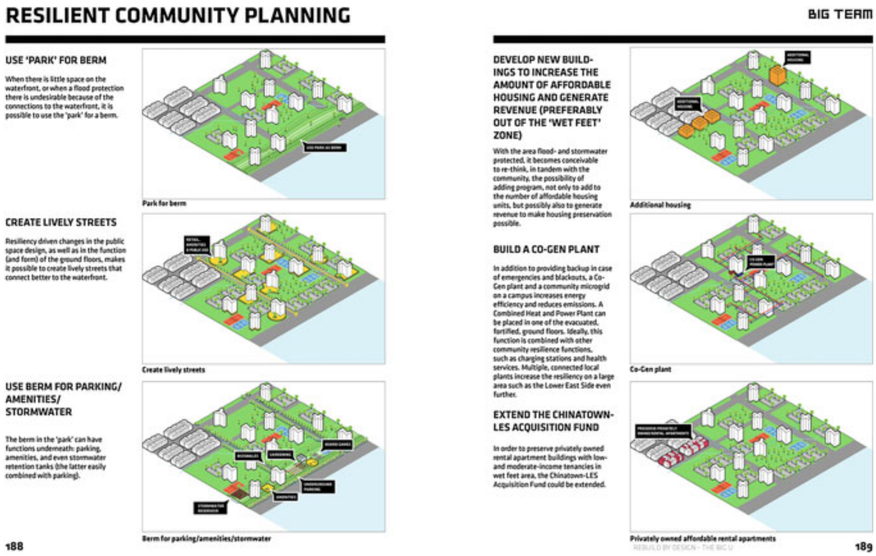

Fig. 12.5 Examples of 'toolboxes' in the Big U proposal (own figure)

explicitly not conditional at this stage, and were drawn without any geographic specifics, such as not to become an obstacle to implementation of the core project (Figs. 12.5 and 12.6).

East Side Coastal Resiliency

Quicker than expected, the Big Team's first strategic goal, to design the project such that it would trigger additional investment in the Big U concept, seemed achieved. After being awarded $335 Million in CDBG-DR funding as a result of the Rebuild by Design competition, New York City launched the East Side Coastal Resiliency project (ESCR) to implement the Big U compartment between East 23rd street and Montgomery street, with a scheduled construction start in late 2017. Shortly after the announcement, residents from the neighboring Two Bridges area, south of Montgomery street, expressed their displeasure about not being included in the first compartment. Also Community Board 1, which covers Manhattan's Financial District, said they hoped to be included in the Big U (Malesevic 2014). These reactions from the community have helped the City expedite their search for funding for future compartments, and have now resulted in the Lower Manhattan Coastal Resilience Project, which is run by the New York City Economic Development Corporations, with an additional $300 million secured for the implementation of future compartments.

The success of the second strategic goal, to make the project itself so digestible by city officials and the community that it can easier integrate other dimensions than

Fig. 12.6 Examples of studies for long term adaptation in the Big U proposal (own figure)

flood protection, is more difficult to assess. At the City's presentation of the initial concept for ESCR in late 2015, it became clear that many of the original features of the design, such as an improved park experience for the local community and improved access from the public housing, both designed in close collaboration with the local community, were still part of the design, although there were concerns about the eventual feasibility. Similarly, the integration of Solar 2, a self-sustaining, solar-powered center for green energy, arts and education, in the project strengthens its climate mitigation credentials (The Lo-Down 2015). At the same time, a high-level integration with resilience efforts by other actors in the area, such as the resilience measures in the NYCHA housing and the protection of the Con-Ed substation, seems to be pursued only in a very limited way at this time. A reason behind that can be that the strict HUD timetable does not allow for time to be expended on coordination efforts.

Conclusions

In tackling the Global Risks related to climate change, New York City, acutely aware of the Project Risks associated especially with large projects, has developed an approach to climate change adaptation that favors multiple smaller initiatives.

These initiatives, so is the City's thinking, can easier address the multiple dimensions of climate change in the city, be adaptive over time, and be more responsive to local issues and local actors. NYC's approach of FAP is based on an understanding of the city as a complex adaptive system in which each initiative generates feedback loops that can be assessed and result in new initiatives, or in the adaptation of existing ones.

The Big U proposal for the flood protection of Lower Manhattan demonstrates the role that design can play in this process. First it does so by integrating multiple dimensions through the notion of 'social infrastructure' in a public design process. And secondly it does so by dimensioning and placing the proposal such that the Project Risks are reduced and as such more manageable by the city. In the Big U, this project risk reduction has made the implementation of a signature project in the near term foreseeable, which has subsequently triggered other climate adaptation projects in the area.

Within the FAP approach, however, the big question is how the initial momentum can be preserved and how future initiatives can slowly transition from hazard mitigation to resilience to adaptation. It can be argued that working at a local scale simultaneously prevents issues from being addressed at a larger scale. At the same time, the strong (visual) image of the Big U as a concept for the flood protection of Lower Manhattan is already generating momentum for similar solutions elsewhere. However, NYC is also very much driven by Project Risks. This has led to a project that might not reach its full potential for the integration of the different dimensions, which can be considered a warning sign. But as the FAP approach is also very much the approach of learning systems, this worry might be premature. In any case, designing the adaptive capacity itself, such that future iterations or designs can be accommodated at a point of time when different sets of risks may manifest, should remain central to New York City's climate adaptation approach and to the projects therein.

Methodology

The BIG-Team (2014), which entered the Rebuild by Design (Rebuild by Design 2014) competition in July 2013, was initiated by the author and co-led by the office of which the author is its founding principal, One Architecture, and BIG (Bjarke Ingels Group). It further consisted of Starr-Whitehouse, James Lima P+D, Arcadis, Buro Happold, Level Engineering, Green Shield Ecology, AEU Consultancy, Project Projects and Parsons School of the Constructed Environments. The author fulfills the role of principal in the team.

Rebuild by Design was a four phased design competition. In the second phase of the competition, the analytical phase, the BIG-team focused its attention on New York City, and Lower Manhattan in particular. In this phase, the team explored

New York City's climate change policy mostly through site visits, desk top and design research, as well as through site visits. At the end of this phase, the concept of the Big U was developed and presented as one of three 'design opportunities'. The Big U was subsequently selected by the Rebuild by Design jury for further development. In the third phase of the competition, the design phase, the team collaborated with the Mayor's Office of Recovery and Resilience (ORR) on the design project, and had a total of 49 meetings with stakeholders, such as City agencies and local community groups. The design project had its primary focus on three sections, or compartments, of the Big U concept, running from East 23rd street to The Battery. The resulting design was presented to the Jury in April 2014 and announced a winner of the competition in June 2014. It was also announced that New York City was awarded $ 335 million to implement the proposed first phase of the project, the compartment between East 23rd street and Montgomery Street. The funding agency, HUD, specified the requirements for implementation in a federal notice in October 2014 (Office of the Federal Register 2014).

New York City designated the Department of Design and Construction (DDC) as the implementing agency, with ORR and the Department of Parks and Recreation (DPR) as initial partners, for the first phase of the project in the Fall of 2014, in and called this first phase the East Side Coastal Resiliency project (ESCR). Five members of the original BIG-Team (BIG, One Architecture, Starr-Whitehouse, James Lima Planning + Development and Arcadis U.S.) are part of the consultant team DDC procured to develop the design for ESCR. In this consultant team, the author continues to fulfill the role of principal. The team has weekly meetings with City Agencies, and frequent meetings with stakeholders and the community. In addition to ESCR, the City is also working on the Lower Manhattan Coastal Resiliency project (LMCR). This planning study, led by New York City's Economic Development Corporation (EDC) in partnership with ORR, started in June 2016. In the consultant team for LMCR, three of the original BIG-Team members (BIG, One Architecture and James Lima Planning + Development) are represented. In both the ESCR and LMCR project, the author is the principal designer of One Architecture. While the author has attempted to base this paper strictly on publicly available material about the three projects, in part because of the non-disclosure agreements that are part of his ongoing consultancy contracts with NYC, his intimate knowledge of, and role in, the decision making processes within the BIG-Team and the City is reflected in this paper.

Concurrent to the design work on ESCR, the author has developed and twice taught a graduate seminar 'Designing with Risk' at PennDesign (the first year together with Ellen Neises). A central element of this seminar was the possible tension between Global Risks and Project Risks. Much of the general thinking about this tension has been developed in conversations with guest lecturers in the seminar, in particular Michael Berkowitz, Andrew Salkin, Marilyn Jordan Taylor, Richard Weller and Peter Hendee Brown, and with students.

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