



Capacities for urban transformations governance and the case of New York City



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ABSTRACT

The narrative of urban sustainability transformations epitomises the hope that urban governance can create the conditions to plan and govern cities in a way that they contribute to local and global sustainability and resilience. So far, urban governance is not delivering: novel governance approaches are emerging in cities worldwide, yet are unable to transform conventional policymaking and planning to allow for innovative, co-beneficial and long-term solutions and actions to emerge and institutionalise. We present a capacities framework for urban transformations governance, starting from the need to fulfil distinct output functions ('what needs to happen') for mobilising and influencing urban transformation dynamics. The framework helps to diagnose and inform urban governance for responding to disturbances (stewarding capacity), phasing-out drivers of path-dependency (unlocking capacity), creating and embedding novelties (transformative capacity) and coordinating multi-actor processes (orchestrating capacity). Our case study of climate governance in New York City exemplifies the framework's applicability and explanatory power to identify conditions and activities facilitating transformation (governance), and to reveal gaps and barriers of these vis-à-vis the existing governance regime. Our framework thereby functions as a tool to explore what new forms of urban transformation governance are emerging, how effective these are, and how to strengthen capacities.

1. Introduction

A new narrative of sustainable and resilient urban transformations has been gaining ground in scientific and policy discourses, for example being enshrined in the New Urban Agenda (UN-Habitat, 2016) and the Sustainable Development Goals (SDGs, UN, 2016). Cities increasingly have to grapple with a variety of interrelated challenges, including pollution, poverty and inequality, ageing infrastructure and climate change (Haase et al., 2018; UN-Habitat, 2016; Seto et al., 2017). The new narrative epitomises the hope that cities concentrate the conditions and resources for delivering the fundamental changes in urban energy, transportation, water use, land use, consumption patterns and lifestyles

that are needed to ensure wellbeing in cities and beyond (Elmqvist et al., 2018; Koch, Krellenberg, & Kabisch, 2016; Romero-Lankao et al., 2018; Winnington, Fahrenkamp-Uppenbrink, & Malakoff, 2016). For example, it regards cities as ideally placed for delivering effective climate change action while also decreasing air pollution, strengthening local communities and polishing recreation spaces (Castán Broto, 2017; Chu, Anguelovski, & Roberts, 2017; McPhearson, Haase, Kabisch, & Gren, 2016; McPhearson, Pickett, Grimm, et al., 2016).

The zealous narrative of urban opportunities for navigating urban transformations towards desirable directions contrasts with how these opportunities are mobilised in practice. Local governments worldwide have already demonstrated how more open-ended, experimental and

Abbreviations: 100RC, 100 Resilient Cities; DCAS, NYC Department of Citywide Administrative Services; DEP, NYC Department of Environmental Protection; DOB, NYC Department of Buildings; DOT, NYC Department of Transport; DPR, NYC Parks and Recreation Department; EDC, NYC Economic Development Corporation; EMD, NYC Emergency Management Department; FEMA, US Federal Emergency Management Agency; GGBP, Greener Greater Buildings Plan; HPD, NYC Housing Preservation Department; HUD, US Federal Department of Housing and Urban Development; MOS, Mayor's Office of Sustainability; NPCC, NYC Panel on Climate Change; NYSERDA, New York State Energy Research and Development Authority; OneNYC, One New York: The Plan for a Strong and Just City; ORR, Mayor's Office of Recovery and Resiliency; SIRR, Special Initiative for Rebuilding and Resiliency (SIRR); SRI@JB, Science and Resilience Institute at Jamaica Bay

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collaborative approaches enable to harness opportunities for developing innovative and integrated policies, goals and solutions (Castán Broto, 2017; Frantzeskaki, Castán Broto, Coenen, & Loorbach, 2017; Huang-Lachmann & Lovett, 2016; Raven et al., 2017). A plethora of actors from local communities, regional and national governments, businesses and research institutes contribute to knowledge generation, experimentation with social, economic and technological innovations and self-organisation of service provisions (Burch et al., 2016; Frantzeskaki, Kabisch, & McPhearson, 2016; Hughes, Chu, & Mason, 2017). However, even when these efforts manifest in new solutions, narratives, practices and institutions, so far they are countered by the negative impacts of urbanisation, unsustainable production and consumption, pollution and inequality and thus unable to create stepping stones for transforming urban systems (Rink, Kabisch, Koch, & Krellenberg, 2018; Ürges-Vorsatz et al., 2018). For example, continued investments in maladaptive infrastructures such as building area development in flood-prone areas are at odds with the implementation of climate-resilient building codes and flood zones (Rosenzweig et al., 2015; Torabi, Dedekorkut-Howes, & Howes, 2018).

In our view, this disconnect between narrated opportunities and on-the-ground practice signifies a mismatch of existing urban governance regimes and characteristics of urban transformations. Urban transformations are complex, long-term, uncertain and contested processes of radical change in urban systems, which result from the interaction and feedback of diverse driving forces across sectors, scales and time (Wolfram et al., 2017; Rink et al., 2018). Therefore, urban transformations cannot be managed or brought about by traditional urban policymaking and planning approaches that merely aim at sustaining and optimising existing urban regimes (Frantzeskaki, Hölscher, Wittmayer, Avelino, & Bach, 2018; Loorbach, Frantzeskaki, & Huffenreuter, 2015; Rink et al., 2018). The majority of urban governance systems is still characterised by administrative and jurisdictional divisions across sectors and scales and short-sighted political cycles, resulting in policies, plans and solutions that prioritise ‘pressing’ and rather isolated urban needs over long-term sustainability and resilience goals (Friend et al., 2014; Torabi et al., 2018; Wamsler, 2015). This type of decision-making and planning exacerbates existing path-dependencies and mal-adaptation, for example when infrastructure developments do not account for long-term and multiple benefits and societal needs (Torabi et al., 2018; Ürges-Vorsatz et al., 2018). While the emerging learning-based and collaborative approaches open-up new avenues for organising urban governance for transformations, their mechanisms and effectiveness are still under-examined and they have not yet become an alternative to existing urban governance regimes (Elmqvist et al., 2019; Romero-Lankao et al., 2018).

In this paper, we take a step back to first conceptualise what type of urban governance contributes to sustainability and resilience transformations. We premise that significant changes of urban governance have to accompany, or, even precede a radical re-direction of urban development pathways towards sustainability and resilience (McCormick, Anderberg, & Neij, 2013; Rink et al., 2018; Romero-Lankao et al., 2018). Steering and achieving desirable urban transformations requires new collaborations across domains, long-term planning horizons beyond electoral cycles, and learning-based approaches that allow for innovation and synergies to emerge and flourish (Burch, Hughes, Romero-Lankao, & Schroeder, 2018; Koch et al., 2016; Loorbach et al., 2015). Our aim is to employ this understanding of urban transformation governance to facilitate a better explain whether the emerging, learning-based and collaborative urban governance approaches contribute to transformative change, and how they can be strengthened vis-à-vis existing urban governance regimes to mainstream and scale sustainable innovations.

We present and illustrate a conceptual framework of governance capacities that enables exploration and explanation of the development of urban transformation governance vis-à-vis existing urban governance regimes. We first present the capacities framework for steering

sustainability and resilience transformations in cities, starting from a comprehensive understanding of urban transformation governance that mobilises the driving forces of urban transformations to influence the direction and speed of emerging urban transformations (Section 2). The agency-centred perspective of the framework allows explaining how, and by whom, new conditions for urban transformation governance are developing, to evaluate whether these conditions manifest in capacities for urban transformation governance, and to derive recommendations for how to strengthen the capacities. We illustrate in Section 3 how the framework helps studying empirical attempts at urban transformation governance. Our case study of climate governance in New York City (NYC) exemplifies the framework's explanatory power in explaining by which activities diverse actors have created conditions for long-term, ambitious and integrated climate, sustainability and resilience agendas, cross-cutting collaboration and experimentation with innovative solutions. In the discussion Section 4, we reflect on the contributions of the framework, limitations and future research. In Section 5 we conclude with an outlook on how to strengthen urban transformation governance.

2. Capacities for urban transformation governance

The call for radical change towards sustainable and resilient urban systems has prompted diverse work on urban transformation governance (Elmqvist et al., 2018; Wolfram & Frantzeskaki, 2016). The common departure point is the shared assumptions that urban systems are in permanent non-equilibrium state and that change in urban systems is complex, uncertain and contested (Wolfram et al., 2017; Loorbach et al., 2015; Rink et al., 2018; Romero-Lankao et al., 2018). Highlighting the inherent tension between the self-organisation properties of complex urban systems and the idea of planning towards a desirable societal goal, transformative approaches to urban governance advocate a ‘transformation of urban governance’ that shifts away from steady-state approaches which control urban systems through singular policies and solutions. Rather, urban transformation governance creates conditions for mobilising and navigating the driving forces and dynamics of urban transformations in alignment with long-term sustainability and resilience goals (Loorbach et al., 2015; Meerow, Newell, & Stults, 2016; Pickett et al., 2013). Sustainability and resilience thus serve as complementary goals for orienting urban transformations in terms of normative parameters (sustainability) and ability to respond to dynamics, disturbances and uncertainty (resilience) (Elmqvist et al., 2019).

We developed a capacities framework to enable explaining, evaluating and supporting urban transformation governance (see also Hölscher, Frantzeskaki, & Loorbach, 2018). The framework provides an agency-oriented perspective to bridge how activities of actors create conditions for governing urban transformations. Our capacities notion recognises that urban governance manifests in the interactive decision-making processes by which public and private actors collaborate and the outputs they produce to address collective problems at this scale (Jabareen, 2013; Kooiman & Jentoft, 2009; Hodson et al., 2018). While institutional and organisational conditions (e.g. institutional settings, rules and regulations, networks), knowledge resources and discourses are important components of governance capacity, building-up capacities for urban transformation governance ultimately depends on the abilities of actors to mobilise, create and remove governance conditions (Koop et al., 2017; Bettini, 2013). Governance capacities are thus manifest in the emergent processes and patterns resulting from the activities by which actors mobilise and put in use structural governance conditions and in the conditions themselves that together determine how urban transformation governance is accomplished (Hölscher et al., 2018; cf. Koop et al., 2017).

Our framework conceptualises urban transformation governance as an ideal-type and normative approach that enables to mobilise and influence the driving forces and dynamics characterising urban

Table 1
 Functions, capacities and sub-functions for urban transformation governance and related governance concepts.
 (Adapted from Hölscher et al., 2018).

Function and capacity	Sub-functions	Transformation dynamics addressed	Sustainability transitions	Resilience	Meta-governance
Stewarding Ability to anticipate, protect and recover from uncertainty and risk while exploiting opportunities beneficial for sustainability	<ul style="list-style-type: none"> • Generating knowledge about system dynamics • Strengthening self-organisation • Monitoring and continuous learning • Revealing drivers of unsustainable path-dependency and mal-adaptation • Undermining vested interests and incentive structures • Breaking open resistance to change • Enabling novelty creation • Increasing visibility of novelty • Anchoring novelty in context 	Emergent instabilities, uncertainty and surprise affecting urban systems and creating vulnerabilities	–	Adaptive governance and adaptive capacity (Plummer, 2013; Berkes, 2017); resilience (Jabareen, 2013; Matyas & Pelling, 2014; Meerow et al., 2016)	–
Unlocking Ability to recognise and dismantle structural drivers of unsustainable path-dependencies and mal-adaptation	<ul style="list-style-type: none"> • Revealing drivers of unsustainable path-dependency and mal-adaptation • Undermining vested interests and incentive structures • Breaking open resistance to change • Enabling novelty creation • Increasing visibility of novelty • Anchoring novelty in context 	Institutional, technological and behavioural path-dependencies and lock-ins, which perpetuate high-emission trajectories and mal-adaptation	Regime destabilisation (Geels, 2014; Turnheim and Geels, 2013; Kivimaa & Kern, 2016; David, 2017; Bosman, Loorbach, Rotmans, & van Raak, 2018); phase-out (Loorbach, 2014)	–	–
Transforming Ability to create and diffuse novelties that contribute to sustainability and resilience and to embed these novelties in structures, practices and discourses	<ul style="list-style-type: none"> • Enabling novelty creation • Increasing visibility of novelty • Anchoring novelty in context 	Build-up of new and sustainable alternatives	Niche experimentation and leadership (Brown, Farrelly, & Loorbach, 2013; Raven, van den Bosch, & Weterings, 2010); embedding, scaling and replicating (Ehnert et al., 2018); transition arenas to create guiding visions and agendas (Loorbach et al., 2015)	Experimentation and leadership (Westley et al., 2013; Moore & Westley, 2011; Biggs et al., 2010)	–
Orchestrating Ability to coordinate multi-actor governance processes and foster synergies and minimise trade-offs and conflicts across scales, sectors and time contexts	<ul style="list-style-type: none"> • Strategic alignment • Mediating across scales and sectors • Creating opportunity contexts 	Contested and diffuse interactions across scales, sector and time causing synergies and trade-offs	Intermediation, boundary spanning and brokering (Prantzeskaki, Wittmayer, & Loorbach, 2014; Hodson & Marvin, 2010; Kivimaa, 2014)	Polycentric governance (Pahl-Wostl & Knieper, 2014; Galaz et al., 2011; Anderies et al., 2013)	Meta-governance (Sørensen, 2006; Kooiman & Jentoft, 2009; Capano, Howlett, & Ramesh, 2015; Doberstein, 2013)

transformations towards achieving sustainability and resilience in the long-term. We posit that different types of conditions and processes (e.g. experimentation, partnerships) are needed to mobilise and play into the diverse driving forces and dynamics characterising urban transformations. Different research strands concerned with urban transformation governance offer complementary concepts and insights for conceptualising and operationalising capacities for urban transformation governance in relation to different driving forces and dynamics of urban transformations. Urban sustainability transitions scholarship focuses on overcoming persistent institutional, technological and socio-cultural path-dependencies in urban (sub-)systems like mobility, food or energy by experimenting with and diffusing innovations and challenging vested interests, existing institutions and behaviours (Caprotti & Cowley, 2017; Castán Broto, 2017; Frantzeskaki et al., 2018; Raven et al., 2017). Urban resilience and adaptive governance literatures highlight the need for flexible and decentralised institutions that enable learning, self-organisation and fit-to-context management approaches (Chu et al., 2017; Torabi et al., 2018; Wamsler, 2015). We also turned to meta-governance literature, which helps to further conceptualise and operationalise the capacity for coordination of multiple and fragmented but purpose-oriented governance networks to facilitate goal alignment and concerted actions across sectors and scales (Jessop, 1997, 2011; Sørensen, 2006; Doberstein, 2013; Engberg & Norvig Larsen, 2010).

From the integration of sustainability transitions, resilience and meta-governance approaches, we inductively identified four capacities for urban transformation governance that enable fulfilling distinct output functions by addressing different types of transformation dynamics (Table 1). Based on these functions we can derive the governance conditions, processes and actions that make up effective urban transformation governance: We reviewed the literatures in terms of the activities they identify in relation to delivering the distinct functions and inductively clustered these into different types of sub-functions that enable delivering the capacity functions. While the functions are output-oriented, i.e. they help to address different types of transformation dynamics to build and maintain sustainability and resilience, the activities create the conditions for delivering the governance functions. Supplementary Material A presents a detailed overview of the agency-based operationalisation of capacities (in terms of how to deliver the sub-functions) and supporting sources.

2.1. Stewarding capacity: anticipating and responding to uncertainty and risk

Urban transformation processes are driven by system-level changes including climate change, economic deterioration and urbanisation that create short-term and long-term instabilities, uncertainty and surprise (Johnson, Toly, & Schroeder, 2015; Carter et al., 2015; Rosenzweig et al., 2015). Resilience and adaptive capacity are key concepts to identify critical institutional, social and physical conditions enabling urban systems to anticipate, react to and recover from risks and surprises (Bettini, Brown, & de Haan, 2015; Chelleri, Water, Olazabal, & Minucci, 2015; Chu et al., 2017; Pickett, McGrath, Cadenasso, & Felson, 2014). Urban resilience demands attentiveness to the structural drivers of vulnerability and mal-adaptation (Pelling & Manuel-Navarrete, 2011; Tanner, Mitchell, Polack, & Guenther, 2009) as well as teleconnections and far-stretched impacts (Chelleri et al., 2015; Pickett et al., 2014).

We define stewarding capacity as the abilities of actors to anticipate, protect and recover from risks while exploiting opportunities beneficial for sustainability. It is manifest in conditions that enable learning and flexible responses to (uncertain) change and disturbance. Generation and integration of knowledge about complex and long-term social-ecological system dynamics across scales enable the anticipation of emergent risks and uncertainties (Chelleri et al., 2015; Koop et al., 2017; McPhearson, Andersson, Elmqvist, & Frantzeskaki, 2015). Decentralised, fit-for-context and flexible institutions and networks that incorporate long-term risks facilitate dynamic responses to changes and

disturbances (Torabi et al., 2018; Boyd et al., 2014; Tanner et al., 2009). Monitoring and participatory learning are key ingredients to reconsider and adapt management objectives and practices to changing situations in line with new information (Koop et al., 2017; Tanner et al., 2009).

2.2. Unlocking capacity: recognising and dismantling unsustainable path-dependencies

Dominant urban land-use, design and living patterns propel excessive air pollution, land and water consumption and CO₂-emissions (Boyd et al., 2014; Seto et al., 2014) as well as high levels of inequality among urban inhabitants (Koch et al., 2016; Pickett et al., 2013). Infrastructural, institutional and behavioural lock-ins create path-dependencies and mal-adaptation (Brown et al., 2013; Malekpour, Brown, & de Haan, 2015; Ürge-Vorsatz et al., 2018). Sustainability transitions approaches analyse how the co-evolution of dominant technologies, social interests, expectations and institutional structures in urban systems drives path-dependency and mal-adaptation (Adil & Ko, 2016; Moloney & Horne, 2015; Moss, 2014; Shaw, Burch, Kristensen, Robinson, & Dale, 2014). These regime structures, cultures and practices need to be unveiled and dismantled to overcome the resulting path-dependencies and lock-ins, for example by providing disincentives and raising awareness (Geels, 2014; Kivimaa & Kern, 2016; Bosman et al., 2018).

Unlocking capacity is manifest in the abilities of actors to recognise and dismantle structural drivers of unsustainable path-dependencies and mal-adaptation. Knowledge generation mechanisms like baseline measurements and system analyses create the condition for recognising institutions, technologies and behaviours that perpetuate mal-adaptation and need to be strategically phased out (Jhagroe & Frantzeskaki, 2015; Loorbach et al., 2015; Sperling & Ramaswami, 2017). Excavating vested interests and existing (financial, regulatory) incentive structures serves to reduce the comparative advantage of business-as-usual (Bettini et al., 2015; Sperling & Ramaswami, 2017; Van der Heijden, 2014). Breaking open resistance to change diminishes support for business-as-usual and creates opportunities and awareness for alternatives (Kivimaa & Kern, 2016; Sperling & Ramaswami, 2017; Moloney & Horne, 2015).

2.3. Transformative capacity: creating and embedding novelties

Escaping current unsustainable and mal-adaptive urban development trajectories requires the development and diffusion of radical alternatives that provide new ways of doing, thinking and organising (Loorbach et al., 2015). Urban experimentation has become an important mode of urban governance as a way to test innovations (Caprotti & Cowley, 2017; Castán Broto, 2017; Bulkeley et al., 2017; Raven et al., 2017). Increasing attention is paid to processes of learning from, replicating and upscaling of experiments (Luederitz, Abson, Audet, & Lang, 2017; Ehnert et al., 2018; Raven et al., 2017) as well as to the institutionalisation of (new) sustainability and climate change agendas into urban planning (Den Exter, Lenhart, & Kern, 2014; Wamsler, 2015).

We define transformative capacity as the abilities of actors to create novelties (for doing, thinking, organising) that contribute to sustainability and resilience and to embed them in structures, practices and discourses. Creating the condition for novelty creation ensures space, resources and networks for developing and testing innovations (Loorbach et al., 2015; Nevens, Frantzeskaki, Gorissen, & Loorbach, 2013; Raven et al., 2010, 2017). To challenge dominant regimes and motivate acceptance and update, the innovation needs to gain visibility, traction and support (Brown et al., 2013; Frantzeskaki et al., 2017; Nevens et al., 2013). Anchoring the novelty in context ensures its replication and scaling by making the implications and lessons from an innovation more generalisable and fitting them into existing or new

structures, cultures and practices (Den Exter et al., 2014; Ehnert et al., 2018; Frantzeskaki et al., 2017; Wamsler, 2015).

2.4. Orchestrating capacity: coordinating multi-actor processes

Urban sustainability and resilience transformations touch upon a diverse bundle of socially negotiated, mobile and partially competing, goals, affect different actors in different ways and their dynamics extend across sectors and geographical scales (Chelleri et al., 2015; Koch et al., 2016). Key questions are how co-beneficial strategies and solutions can be encouraged, coordinated and assisted aligning to shared long-term goals (Gordon & Johnson, 2017; Hodson & Marvin, 2010; Moloney & Horne, 2015; Ürge-Vorsatz et al., 2018). Research found that local governments are re-inventing their roles from planners and regulators to facilitators of strategic, vision-oriented networks and partnerships that integrate and mediate different social interests and resources (Frantzeskaki et al., 2014, 2017; Hedensted Lund, Sehested, Hellesen, & Nellemann, 2012). In this context, intermediation and meta-governance have gained increasing attention as ways to streamline the dispersed activities at multiple scales, to facilitate synergies and enable ‘small wins’ in multiple areas while creating momentum for larger-scale changes (Frantzeskaki et al., 2014; Fuhr, Hickmann, & Kern, 2018; Hodson & Marvin, 2010).

Orchestrating capacity refers to the abilities of actors to coordinate multi-actor governance processes and foster synergies and minimise trade-offs and conflicts across scales, sectors and time. Strategic alignment orients the activities of diverse actors towards shared, integrated and long-term goals (Chu et al., 2017; Hodson & Marvin, 2010; McPhearson, Iwaniec, & Bai, 2017; Moloney & Horne, 2015). Conditions to mediate and share knowledge, conflicts and resources across sectors and scales are manifest in formal and informal structures, spaces and communication channels (Hedensted Lund et al., 2012; Kivimaa, 2014). Opportunity contexts to incentivise and assist actions towards long-term goals are established by framework conditions that clarify costs, benefits and responsibilities (Hölscher, 2018; Koop et al., 2017). This requires support from national and regional actors that set legislative standards and provide financial support (Castán Broto, 2017; Johnson et al., 2015).

3. Illustrating case study: capacities for urban transformation governance in New York City

We illustrate the capacities framework by tracing the climate governance activities by which actors in NYC have created new types of governance conditions that manifest in new capacities for urban transformation governance. This section presents our case study methodology and the analysis of whether and how climate governance activities created the conditions for accomplishing stewarding, un-locking, transforming and orchestrating functions in NYC.

We approach climate governance in NYC as suitable example to show how urban transformation governance activities and conditions evolve and change existing governance regimes. Climate change is a key persistent problem that due to its systemic and long-term nature cannot be addressed through short-term responses and in isolation from other urban (governance) processes (Runhaar, Wilk, Persson, Uittenbroek, & Wamsler, 2018; Wamsler, 2015). In cities worldwide, the topic of climate change on the policy agenda has driven changes in existing urban governance regimes to enable experimentation, collaboration, learning and long-term planning (Aylett, 2015; Den Exter et al., 2014; Castán Broto, 2017). NYC is a city that pro-actively experiments with addressing climate change while achieving long-term sustainability and resilience goals. This is visible in the ambitious and cross-cutting climate change, sustainability and resilience agendas published by the city government and the portfolio of innovative solutions for climate mitigation and adaptation (Depietri & McPhearson, 2018; Forgione, Pregitzer, Charlop-Powers, & Gunther, 2016;

McPhearson, Hamstead, & Kremer, 2014; McPhearson & Wijsman, 2017; Solecki et al., 2016). The experimentation with these new types of systemic, long-term goals has opened up opportunities for setting up new governance mechanisms and networks for managing long-term climate risks while encouraging equity and prosperity. The case study of climate governance in NYC thus enables to study how actors experiment with and develop new types of capacities for urban transformation governance.

3.1. Case study methodology

The case study provides a snapshot of transformative climate governance capacities in NYC today, while accounting for the activities that contributed to the emergence of the capacities starting from 2007, when the city's first climate mitigation and sustainability plan was released.

3.1.1. Climate governance in NYC

NYC is a delta and port city and an important global economic centre accommodating over 8.55 million people (US Census Bureau, 2015). Expected climate impacts in NYC include rising sea levels, increasing severity of heavy downpours and storms, flooding, heat waves, droughts and extreme wind events (NPCC, 2015). The city has already experienced climate extremes, most notably hurricane Sandy's landfall in October 2012. Sandy caused an estimated \$19 billion in damage and 43 deaths, flooded sewer systems, roads and subway stations, disrupted vital transport networks and power and water supply (NYC, 2013). It underscored the vulnerability of low-income, coastal communities, which have been severely affected while struggling with rising rents, increasing depth and delays in repairs (Cowan & Hogan, 2014). NYC faces social stratification, population growth, air and noise pollution, economic downturn and escalating housing prices (McPhearson et al., 2014; Solecki, 2012).

The city government's approach to climate governance started with integrated climate mitigation and sustainability goals in 2007. This focus was successively expanded towards climate adaptation and broader resilience pursuits. Mayor Bloomberg (2002–2014) commissioned the cross-cutting sustainability and climate mitigation plan PlaNYC, which was released in 2007 and tied goals such as emissions reductions, improving air quality, managing population growth, modernising infrastructure to the city's long-term quality and global competitiveness (NYC, 2007). In response to extreme weather events, the 2011 update of PlaNYC included goals and initiatives on heat stress reduction, storm water management and infrastructure protection (NYC, 2011). After hurricane Sandy, the public-private Special Initiative for Rebuilding and Resiliency (SIRR) was convened to develop a programme for reducing the city's vulnerability to coastal flooding and storm surge and for rebuilding communities affected by Sandy (NYC, 2013). When Mayor de Blasio took office in 2014, he introduced affordable housing and social equity as top priorities in the next PlaNYC update, called OneNYC (NYC, 2015a).

The cross-cutting Mayor's Offices of Sustainability (MOS) and Recovery and Resiliency (ORR) spearhead the city government's efforts on climate change, resilience and sustainability. They are charged with knowledge and strategy development, fostering partnerships and enlisting in and overseeing projects' implementation. Multiple city departments contribute to the city's overarching strategies and goals and put in place departmental sustainability and resilience offices and strategies. The city government works closely together with business networks (e.g. the NYC Waterfront Alliance, Urban Green Council), sets up, oversees and collaborates in cross-sectoral and cross-scale knowledge platforms and partnerships, and participates in international city networks (e.g. C40, 100 Resilient Cities (100RC)). NGOs and community organisations are mostly informally involved, engaging in knowledge development, community organising, advocacy and project implementation.

Table 2
Analytical steps to apply the capacities framework.

Step	Questions addressed	Results
(1) Assessment of capacity output functions	What strategies, programmes, actions, regulations etc. exist to accomplish stewarding, unlocking, transforming and orchestrating?	<i>Evaluation of urban transformation governance:</i> to what extent are the output functions accomplished in terms of what system-level changes?
(2) Identification of urban climate governance activities and actors	What activities are being undertaken in both cities to develop and implement strategies, networks, programmes, actions, knowledge etc. for stewarding, unlocking, transforming and orchestrating? Which actors engage in these activities?	<i>Explanation of urban transformation governance activities:</i> what activities and actors develop new conditions manifest in capacities?
(3) Identification of governance conditions	What conditions (e.g. knowledge, networks, partnerships, resources) were created to accomplish stewarding, unlocking, transforming and orchestrating?	<i>Explanation of urban transformation governance conditions:</i> what institutional, knowledge, network and social conditions support fulfilment of capacity functions and manifest in capacities?
(4) Identification of capacity gaps and challenges	What are challenges, shortcomings, conflicts, gaps etc. for stewarding, unlocking, transforming and orchestrating?	<i>Identification and explanation of capacity gaps:</i> what are shortcomings in fulfilling output functions and how do they come about (e.g. challenges in developing conditions)?

3.1.2. Data collection and analysis

Different data were collected for the study. We performed desk research to review policy documents (strategies, visions and programmes from 2007 to 2017, including e.g. NYC 2007, 2010, 2015), media articles and scientific papers about climate and sustainability governance in NYC. Between October 2015 and January 2016, we conducted 38 semi-structured interviews in person with climate governance actors in NYC. The interviewees included policy officers from the city government ($n = 12$), regional ($n = 4$) and national ($n = 2$) governmental bodies, as well as representatives from knowledge institutes and partnerships ($n = 7$), local businesses, architects and stakeholder platforms ($n = 6$), NGOs and community-based organisations ($n = 7$). We covered different sectors: water, transport, energy, health, buildings, parks and recreation, environmental protection, emergency management and housing.

The collected data was analysed in reference to the conceptual capacities framework. We applied the capacities framework by following a step-wise analytical coding process to make connections between the activities, conditions and capacity functions – i.e. to connect actors ('who'), activities and conditions ('how') and output functions ('what') (Table 2; Strauss & Corbin, 1998; Saldana, 2009). The steps were iterative because insights gained from further analysis could add or differentiate insights gained from earlier steps. Supplementary Material B illustrates how the empirical material was systematically analysed by applying the governance capacities framework.

3.2. Transformative climate governance capacities in New York City

In the following we show how the capacities framework helps to understand whether and how new conditions for delivering different functions of urban transformation governance are developing. In NYC, a long-term, systemic, collaborative and experimental approach to climate governance is emerging that crosses multiple policy sectors and domains (e.g. transport, energy, health, justice), involves multiple actors and facilitates innovative solutions. This has helped to move beyond single climate innovation programmes or solutions and to address climate mitigation and adaptation in the context of broader urban transformation processes. We call this a starting approach for transformative climate governance, which itself acts transformative, because it challenges existing governance regimes in NYC that tend to make decisions in sectoral siloes (Hölscher, Frantzeskaki, McPhearson, & Loorbach, 2019).

Our analysis of the development of transformative climate governance in NYC illustrates how the capacities framework helps explaining and evaluating emerging activities and conditions for urban transformation governance. We outline how each of the capacity functions – stewarding, unlocking, transforming and orchestrating – are addressed and delivered in NYC and identify the key conditions that deliver the respective function, the activities by which these have been created and

capacity gaps and challenges. The analysis of the different types of governance capacities shows that diverse institutional, knowledge, network and social conditions were created to systemically address mitigation and adaptation in policy and planning (Table 3). A detailed overview of results, including how activities were related to sub-functions and conditions, is given in Supplementary Material B.

3.2.1. Stewarding capacity in NYC

The main stewarding objectives of climate governance policies, plans and actions in NYC are the protection and recovery of the population and infrastructure from climate impacts like flooding, storms and heat waves while contributing to liveability, economic development and social equity. The practical approach combines long-term infrastructure protection with community resilience and short-term emergency relief. The NYC government revised hurricane evacuation zones, placing a greater focus on the varying angles of approach for different storms, and employs regulatory instruments, including building codes and zoning, to ensure that building and area developments take future climate impacts into account, and establishes community-planning processes. Conditions for developing and implementing stewarding interventions have been developed through the creation of a vast amount of knowledge on systemic risks and uncertainties relating to flooding, storms, ecosystem services and health, the set-up of integrated, long-term and multi-level planning approaches and the support of diverse social networks.

Stewarding capacity is manifest in the vast amount of knowledge about climate risks and socio-economic vulnerabilities for different issue areas (e.g. emergency planning, coastal resilience, buildings). This includes projections on long-term sea-level rise and flood safety risks, heat and health stresses and infrastructure risks (Fig. 1). The Hazard Mitigation Plan considers how climate change may change the physical, social and economic vulnerabilities from natural and non-natural hazards including coastal storms, disease outbreak, drought, flooding and cyber threats (NYC, 2014a). Diverse partnerships between actors from academia, local, regional and national governments and local communities support the generation of knowledge. The NYC Panel on Climate Change (NPCC) regularly reports on climate impacts and adaptation needs in NYC (NPCC, 2015). NYC city departments contribute to creating knowledge on emergency planning, coastal resilience and ecosystem services. The Department of Parks and Recreation (DPR) collaborates with knowledge institutes such as the Urban Field Station and Natural Areas Conservancy and local communities to monitor the social-ecological values of nature in the city (Forgione et al., 2016).

The NYC government adapted the systemic, long-term and context-specific perspective on risks, vulnerabilities and uncertainty in planning and management approaches to facilitate adaptive management and self-organisation. ORR coordinates and oversees the implementation of the multi-layered strategy for strengthening resilient communities and infrastructures including legislative, community support and

Table 3
Transformative climate governance capacities (conditions and activities) in NYC.

Capacity	Institutional conditions	Knowledge conditions	Network conditions	Social conditions
Stewarding capacity	Fit-to-context, flexible and knowledge-based institutions for dealing with different needs	Co-production and integration of knowledge about systemic and long-term risks and uncertainty	Polycentric and multi-actor networks across scales and sectors to implement projects in line with context needs	Social capital and empowerment for local self-organisation
<i>Activities:</i>	Integrating long-term, systemic risks and uncertainties Adopting problem-based, fit-to-context and no-regret approaches Providing flexible regulation and incentives to facilitate fit-to-context risk protection Assigning and communicating responsibilities	Long-term forecasting of systemic risks and uncertainties Generating problem-based and context-specific knowledge Continuously updating plans and resilience and sustainability indicators Mandating knowledge generation to ensure access to data	Creating issue-specific, multi-level and multi-stakeholder programmes and partnerships Involving communities in joint and context-specific visioning, planning and implementation processes	Raising awareness about risks and response options Strengthening social networks to enable self-organised response and social resilience
Unlocking capacity	Dismantling of institutional path-dependency and competitive advantage of business-as-usual Setting standards and providing incentives for sustainable investments Integrating sustainability into public tendering Implementing regulation to control unsustainable practices	Establishing science-policy-community interface Linking past, present and future to identify path-dependencies and mal-adaptation Road mapping and scenario analyses to explore phase-out options Conducting regular emissions inventories Mandating knowledge generation to ensure access to data	Support networks with an explicit mission for change Setting up public-private partnerships for issue-specific action Setting up support networks with key stakeholders (groups) Identifying key stakeholders and groups to know whom to reach out to	Social and political awareness and support for departing from business-as-usual Raising awareness and providing assistance for sustainable investments and behaviour change Lobbying for political support
Transformative capacity	Space for experimentation as governance approach to learn about new solutions Temporary lifting or avoiding existing regulations Creating open mind-set for taking up innovations in tactical agendas and daily practices Allocating budget to developing and maintaining innovation, upscaling and replicating Leadership for creating and using opportunities for change	Learning institutions for harvesting knowledge from experimentation Identifying proof-of-concept lessons from innovations to facilitate replicating and embedding Identifying opportunities from innovation for upscaling Identifying bricolage of solution elements to mainstream innovations into urban planning processes and decisions	Multi-actor and inclusive innovation and advocacy networks Forming informal and formal 'coalitions of the willing' for strategic and operational innovation Involving communities in design and implementation of experiments Creating advocacy coalitions to carry the innovation story Setting up cross-sectoral networks and partnerships tasked with (embedding of) innovation Participating in regional, national and international networking, best practice and knowledge exchange Formal and informal connection channels, network brokering and intermediary spaces	(Trans-)local support for the innovation story Mobilising political leadership to put new and ambitious goals on the agenda Piggy-backing and quickly expressing potential of a new solution Creating and advocating an inspiring innovation story Showcasing innovations as market potential for the city Co-ownership over shared and long-term visions
<i>Activities:</i>	Long-term nexus approach when drafting, implementing and financing (sectoral) policies and solutions Developing long-term climate mitigation and adaptation, sustainability and resilience goals Redefining responsibilities for carrying costs Creating competitions to leverage innovative, long-term and co-beneficial solutions	Co-creation of social-technological-ecological systems knowledge Employing a systems perspective to aggregate knowledge about drivers, risks, opportunities and challenges Identifying opportunities, synergies and trade-offs between different goals Pooling and integrating knowledge and resources across scales and sectors	Establishing central and cross-cutting connection nodes for pooling knowledge, actions and resources Designating theme-leads and contact persons Identifying private and community-based initiatives Creating neutral co-creation spaces and knowledge partnerships to build trust for knowledge sharing	Involving multiple actors from different city departments and private organisations in strategy formulation Public outreaching and participation
Orchestrating capacity	Long-term nexus approach when drafting, implementing and financing (sectoral) policies and solutions	Co-creation of social-technological-ecological systems knowledge	Establishing central and cross-cutting connection nodes for pooling knowledge, actions and resources Designating theme-leads and contact persons Identifying private and community-based initiatives Creating neutral co-creation spaces and knowledge partnerships to build trust for knowledge sharing	Involving multiple actors from different city departments and private organisations in strategy formulation Public outreaching and participation

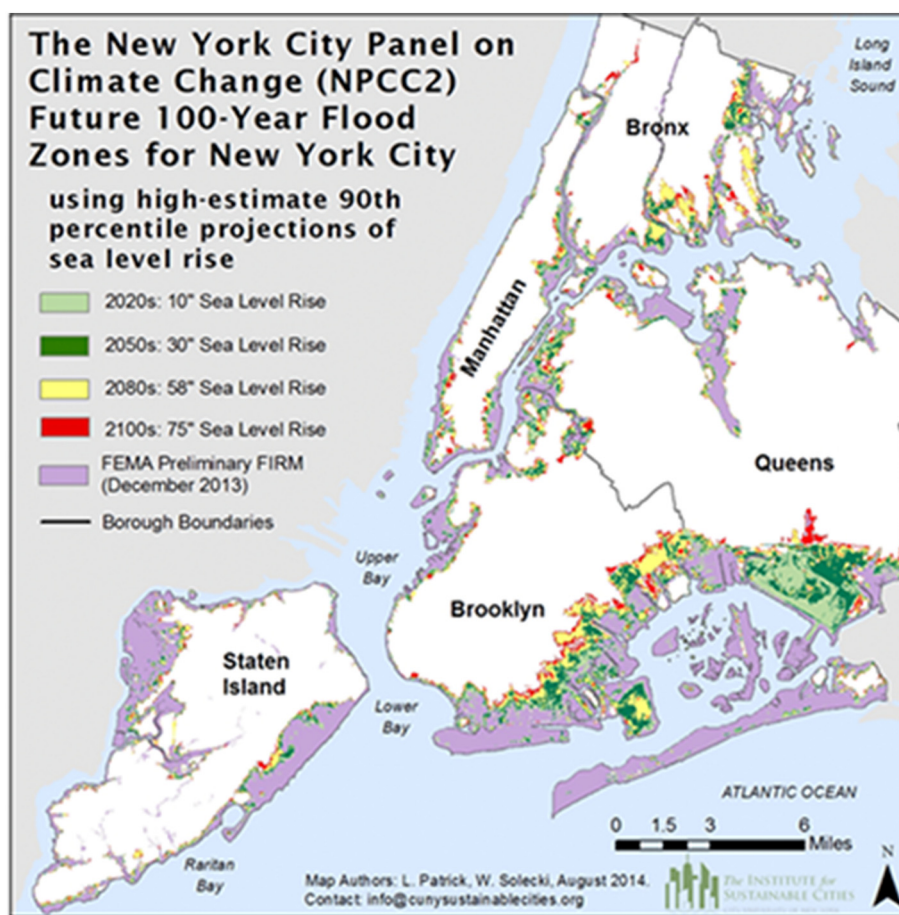


Fig. 1. NPCC projections on potential areas that could be impacted by the 100-year flood in the 2020s, 2050s, 2080s and 2100. (Source: NPCC 2015: 12).

investment actions. Different departments take the lead in implementing initiatives touching their responsibility in a decentralised way. The Department of Environmental Protection (DEP) leads green infrastructure developments as a cost-effective tool to manage storm-water while contributing social-ecological value. Infrastructure systems (e.g. transport, energy) are adapted through multi-level governance networks that develop fit-to-context approaches at multiple scales (e.g. buildings, neighbourhoods, coast). For example, effective flood-zoning policies and building codes require cooperation among the Federal Emergency Management Agency (FEMA), DOB and the Planning Department.

Community-specific strategies and community engagement gain increasing momentum to develop place-based interventions, access local knowledge and foster social resilience. The Economic Development Corporation (EDC) facilitates neighbourhood-based visioning processes to integrate climate adaptation with community concerns. DRP engages communities in maintaining the city's green, for example through the GreenThumb programme (Campbell, Svendsen, Sonti, & Johnson, 2016; NYC Parks, 2016).

An unclear distribution of responsibilities across multiple jurisdictions and a lack of mainstreaming adaptive and long-term risk strategies constrain stewarding capacity. The former became visible in the aftermath of hurricane Sandy, when local, state and federal agencies struggled with providing relief. In neighbourhoods with strong community organisations, such as in Redhook, these could fill this void (Cowan & Hogan, 2014). The lack of mainstreaming and multi-scale integration results in contradictory rules and investments especially in flood-prone waterfronts where developments continue to be allowed. Effective flood-zoning policies and building codes require cooperation

among the Federal Emergency Management Agency (FEMA), the Department of Buildings and the Planning Department.

3.2.2. Unlocking capacity in NYC

Unlocking climate governance efforts in NYC focus on reducing emissions from buildings, which are responsible for over 70% of the city's total emissions (NYC, 2015b), and from transport while improving health, wellbeing and economic prosperity (NYC, 2014b; NYC, 2015a). Unlocking outputs include changes in regulation and physical structures and awareness raising to facilitate renewable energy production, energy efficiency in buildings and sustainable and safe transport. Conditions for unlocking manifest in the identification of and awareness raising on drivers of emissions in connection with drivers of air and noise pollution, waste and inequality, support networks with an explicit mission for change and social and political awareness and support for departing from business-as-usual.

Various knowledge input mechanisms, including emissions inventories and information disclosure mandates, help to reveal structural drivers of emissions (e.g. energy use in buildings) and relationships with other risks (e.g. health). This was critical to identify target areas for action and synergies between different issue areas and to generate political and societal support. The new building plan outlines a roadmap for making NYC's buildings low-carbon and reducing emissions by 80% by 2050 (NYC, 2015b). Reporting mechanisms and partnerships facilitate reporting and data analysis. The Greener Greater Buildings Plan (GGBP) (NYC, 2009) mandates owners of buildings over 50,000 ft² to annually disclose their energy and water consumption and identify target areas for policies and cost-effective upgrades.

The creation of social and political support is a critical condition for

legislative changes and incentives for behavioural changes and investments in sustainable and low-carbon physical structures. Critical for the buy-in to the GGBP was the involvement of key actor groups (e.g. large homeowner associations) in the NYC Green Codes Task Force that gave recommendations for building code changes. A key challenge is still to facilitate energy retrofitting in buildings under 50,000 ft², which are more heterogeneous in their ownership and energy structure. Other types of awareness raising activities by MOS to achieve a wider outreach include the Retrofit Accelerator, which offers free advisory services on energy efficiency improvements. Additionally, training is provided to build the skills for using new energy technologies.

Securing political support is critical for changing incentive structures. The high-level political support for climate mitigation and sustainability legitimised the integration of sustainability standards into public procurement. Political lobbying and the fact that MOS directly reports to the Mayor supported the building code changes. Communicating the benefits and the availability of cost-effective alternatives help to make strong cases for changing regulation. The NYC Health Department's data on the health benefits of reducing air pollution substantiated the DEP's push to regulate the phase-out of high sulphur heating oil, which also reduced emissions.

A central challenge for unlocking capacity in NYC is the implementation of decisive measures that challenge existing economic structures and vested interests. Existing regulations hamper more decisive action to change energy use and transport patterns. This is exacerbated by political disputes between city and state agencies that have overlapping jurisdictions. For example, the Department of Transportation's (DOT) plan to impose congestion charges for entering the core of Manhattan was blocked by the New York State government for political reasons.

3.2.3. Transformative capacity in NYC

Transformative capacity in NYC is evident in the continuous innovation of how climate change is addressed on strategic, operational, institutional and organisational levels. Strategic goals and agendas were redefined to position climate mitigation and adaptation as opportunity for sustainable and resilience and innovative, multifunctional solutions were implemented. The integrated goals were institutionalised through new governance structures for more open-ended and hybrid decision-making and planning. Conditions for creating and embedding these novelties are include the creation of spaces for (learning from) experimentation and heterogeneous networks and partnerships.

The initiative and high-level political support from the Mayors and individual departments' Commissioners created space for formulating new strategies and testing new solution-approaches like green infrastructure. Hurricane Sandy demonstrated urgency for resilience and resulted in the establishment of SIRR as a heterogeneous network to develop a resilience plan (NYC, 2013). This created informal space for diverse actors to come together and share ideas and resources in open and collaborative innovation learning processes. The Rebuild-by-Design (RbD) competition that was initiated by the Federal Department of Housing and Urban Development (HUD) after Hurricane Sandy pioneered a novel process design to co-develop innovative, fit-to-context and integrative resilience solutions. The competition asked for innovative projects to support long-term rebuilding, community resilience and sustainability in the Sandy-affected region. It demanded far-reaching expert and community engagement. Three of the winning designs are in NYC: The BIG U foresees the instalment of a 10-mile system of berms and other protections around Lower Manhattan (Big, 2016), the Living Breakwaters project envisions living reefs along Staten Island's south shore to accommodate flooding (Fig. 2), and the Hunts Point Lifelines project in the Bronx integrates flood protection, recreation, health, local livelihood development and emergency management (RbD, 2016).

The integrated goals were anchored in institutional and organisational practices. Action programmes on specific topics were developed

to lay out new solution options in alignment with long-term strategic approaches (e.g. NYC, 2010, 2015b; NYC Planning, 2011). In an effort to embed the integrated thinking into organisational processes MOS and ORR and dedicated sustainability and resilience offices within city departments were established. To ensure optimal implementation of new energy reporting technologies and standards, the Department of Citywide Administrative Services (DCAS) trains building operators on energy reporting. DEP continuously explores further options for implementing and upscaling the implementation of green infrastructure, also by engaging in international knowledge exchange processes.

The strategic goals and innovative solution approaches do not yet permeate city-wide planning and policy activities. Mainstream implementation is constrained by existing institutions that still dominate funding decisions and the legitimacy of service provisions. In moving towards the implementation phase, the RbD-projects were confronted with complex regulatory barriers and conflicting interests of local, regional and federal public agencies and private stakeholders. This could partially be eased by strategically selecting sites with less regulatory constraints (e.g. avoiding imminent domains) and fewer jurisdictions and by intensive multi-stakeholder communication.

3.2.4. Orchestrating capacity in NYC

Orchestrating capacity is evident in the city-wide long-term and integrated climate, sustainability and resilience goals and the formal and informal conditions and processes that were established to mediate priorities, knowledge and resources of multiple actors across sectors and scales in line with these overarching goals. These conditions support the alignment, oversight and collaboration of diverse actors and networks in line with shared, strategic and long-term goals and the development of co-beneficial climate solutions that make use of multiple synergies.

A key condition for orchestrating capacity is the strategic and integrated climate, sustainability and resilience policy agenda, which facilitates strategic alignment across city-wide and departmental policy documents and ways solutions. This goal integration is achieved by co-creative agenda setting processes at multiple governance levels. MOS and ORR coordinate issue-specific cross-departmental, public-private task forces (e.g. climate adaptation, built environment) to align priorities, foster trust and spark new relationships for synergistic project implementation. Through these heterogeneous collaborations, synergies and trade-offs could be identified. For example, green infrastructures could be put forth as a cost-effective way to manage stormwater while contributing to social-ecological value (McPhearson et al., 2014). The collaboration of DPR and DOB in the Urban Heat Island group resulted in the requirement to plant street trees as part of building development. An identified trade-off is between restricting air conditioning to reduce emissions and the vulnerability of low-income populations having neither access to air conditioning nor green space to protect them from heat waves.

Diverse formal and informal networks, nodes and communication channels were established to integrate and mediate priorities and pool resources for implementation. MOS and ORR are central nodes with multiple tasks: facilitate strategy development, oversee and streamline implementation processes, channel information and knowledge, connect to other on-going processes, assign responsibilities, search funding and lobby for support. They participate in cross-scale partnerships to align goals and mediate knowledge and resources across local, regional and federal levels. The Chief Resilience Officer is a key position and contact point for pooling all resilience efforts in the city by working across departments and with local communities. Similar positions have been created within individual departments to bring the agenda into the departments. An informal cross-departmental group of sustainability and resilience 'peers' informally exchanges experiences.

Diverse actors and partnerships support mediation efforts by acting as intermediary to facilitate knowledge exchange and trust building. The Harbor Estuary Program is a federally authorised programme that

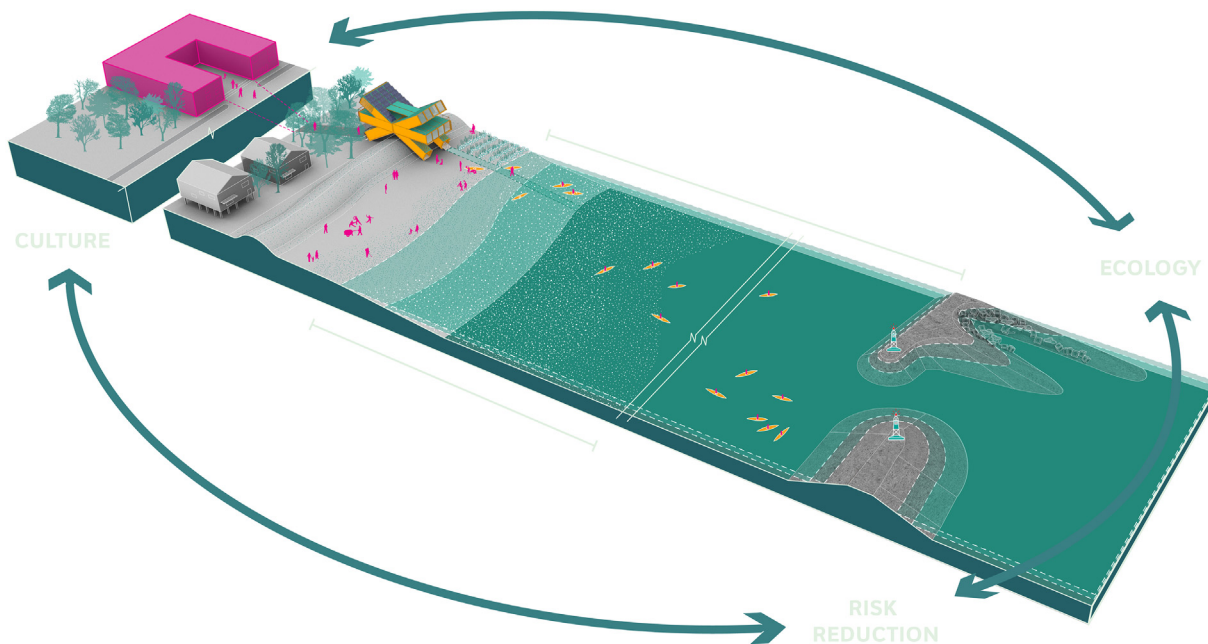


Fig. 2. The Living Breakwater Project envisions living reefs along Staten Island's south shore to accommodate flooding, protect ecology and strengthen local communities. This is a concept image that was developed for the Rebuild by Design competition. (Source: SCAPE Team for the Rebuild by Design Competition 2015).

brings together federal, state and local agencies and citizen groups to define common goals and priorities for the management of the harbour estuary. Private partnerships such as the Waterfront Alliance integrate and represent the interests of business actors to the city government. Non-governmental organisations and knowledge institutes take up roles as facilitators of knowledge sharing, trust building and community engagement. The Science and Resilience Institute @ Jamaica Bay (SRI@JB) mediates scientific and community knowledge between universities, local communities and public agencies by creating an informal space that is not politicised to share ideas and concerns, doing trans-disciplinary research and introducing research results into the discussion.

Delivering the orchestrating function is time demanding. Due to time, staff and resource limitations, the ability to align and reach out to the public and to mainstream the strategic perspective are hindered. Community-based organisations such as the NYC Environmental Justice Alliance generate knowledge on climate risks and lobby for more support of vulnerable communities, but feel insufficiently engaged by the city government. Additionally, while processes like RbD experimented with new funding options, the strategic orientation is not translated into consistent long-term and multi-beneficial financing mechanisms. Establishing such mechanisms requires support from federal and state governments. For example, FEMA's funds for post-disaster relief are still tied to rebuilding what was there before rather than ensuring protection from future risks.

4. Discussion

We developed a framework of four capacities for urban transformation governance in response to the growing calls for a 'transformation of urban governance' for effectively steering urban transformations towards sustainability and resilience (Frantzeskaki et al., 2016; Frantzeskaki, Kabisch, & McPhearson, 2016; McCormick et al., 2013; Rink et al., 2018; Romero-Lankao et al., 2018). Our capacities framework can be used to analyse and assess the extent to which these capacities are developing and to support governance actors (e.g. city officers, strategists) in developing these more systematically vis-à-vis existing urban governance regimes. We posit that by strengthening the

capacities for urban transformation governance it is possible to close the current disconnect between narrated urban opportunities and lagging on-the-ground practice.

4.1. Towards a systematic and agency-based understanding of urban transformation governance

The transformative perspective on urban governance underscores the need for governance approaches that allow flexible, innovative and systemic strategies and solutions to respond to and mobilise complex, contested and uncertain urban transformation dynamics. Research on urban transformation governance has so far failed to deliver detailed and systemic explanations and evaluations of the roles of actors, interactions, mechanisms and processes in bringing urban transformative governance to realisation (Rink et al., 2018; Koop et al., 2017; Bettini et al., 2015). This limits the understanding about how, and by whom, urban transformation governance is developed and delivered, and how it can be strengthened vis-à-vis existing governance regimes.

Our capacities framework provides a comprehensive and agency-centred perspective that bridges different research approaches to explain, evaluate and support the development of urban transformation governance vis-à-vis existing governance regimes. The distinction in output functions for mobilising and influencing the driving forces and dynamics characterising urban transformations is implicitly done by urban transformation researchers. For example, processes and conditions for innovation and experimentation are identified to create novelties that disrupt existing ways of thinking, doing and organising (Castán Broto & Bulkeley, 2013; Nevens et al., 2013; Raven et al., 2017). Other examples are governance processes and conditions that facilitate flexible and adaptive responses to emergent risks, surprises and uncertainties (Torabi et al., 2018; Boyd et al., 2014; Tanner et al., 2009). The distinction in different output functions and corresponding capacities allows to integrate the insights of different approaches in terms of 'what needs to happen' for urban transformations to unfold, as well as 'how to make it happen'.

Our case study illustrates the explanatory power of the framework to explain and qualitatively assess whether and how new types of capacities for transformation governance are developing in NYC, and to

identify capacity gaps that restrain the full potential of this type of governance. As shown in Table 3 and Supplementary Material B, capacities for transformation governance in NYC are visible in diverse institutional, knowledge, network and social conditions that have been created to address mitigation and adaptation in a more innovative, systemic and collaborative policy and planning. For example, the long-term and integrated perspective on climate mitigation, adaptation, sustainability and resilience provides a shared narrative and mobilises actors to pool their efforts and seek synergies (e.g. between emissions reductions in buildings, health and justice) when drafting, implementing and financing (sectoral) policies and solutions, such as green infrastructure innovations that touch on multiple responsibilities and jurisdictions. The establishment of formal and informal connection channels and spaces support alignment, knowledge exchange and collaboration across city departments and between the city government and private actors. Similarly, we found that the creation of (e.g., regulatory, institutional) space for experimentation contributes to strategic, operational and institutional innovations in how climate change is addressed in NYC.

While new conditions are developing – and the insights into what and how conditions are developing inform also other cities in how to move forward – these need to be strengthened vis-à-vis the existing governance regime in NYC. Despite some experimentation with innovative and multi-functional solutions, these often remain isolated and stand-alone initiatives, which indicates gaps in transformative capacity to embed the innovative strategies and solution approaches within mainstream governance processes. Overall, the majority of existing incentive structures and regulations in NYC still favour short-term economic interests and investments, which pre-empts systematic and synergistic protection from long-term risks and decisive unlocking and phase-out of the root causes of emissions and unsustainability. There is thus a clear need for strengthening the created conditions, for example by making more decisive legal and regulatory changes that facilitate experimentation, collaboration and prioritisation of long-term co-benefits over short-term and largely isolated and powerful economic interests. This also demands from the local government in NYC to take up more formalised roles and collaborate with governments at regional and federal levels to streamline and align regulations and rules.

4.2. Advancing and applying the capacities framework

Table 2 summarises the different types of questions the framework enables to address for studying and learning from ongoing efforts to develop urban transformation governance. While we understand the framework itself as open for further advancement and application, we highlight several avenues for future research.

We suggest the capacities framework as a tool to derive more generalisable results on how and what new forms of urban transformation governance are emerging and how effective these are for steering sustainability and resilience transformations. We understand capacity as an enabler of change, not the change itself. Derived from this, we recognise that multiple parallel processes and context dependencies (e.g. social dynamics, political elections, cultures, values) determine how a function is fulfilled (Castán Broto, 2017; Koop et al., 2017). The lens of capacity therefore aids a deeper, integrated and empirically-based understanding of the most important enabling and limiting conditions that determine governance capacity as well as how conditions are created and changed (Koop et al., 2017). The application of the framework to different contexts and scales can yield generalisable results on activities, opportunities and challenges for building capacities for urban transformation governance and thus reveal pathways for increasing governance capacities in relation to different contextual needs, institutional conditions and resources.

As a high-level structuring approach of functions and capacities for transformation governance, the framework can also be applied to conceptually advance and explore specific questions related to the

individual capacities. Existing shortcomings of urban transformation governance and the challenges of mainstreaming, which are also visible in experimenting cities like NYC, indicate a need for improving understanding about how the diffuse urban governance landscape can be coordinated. Relatedly, this will improve our understanding on how climate, sustainability and resilience goals and agendas can be more mainstreamed (Aylett, 2015; Den Exter et al., 2014; Hölscher et al., 2019). For example, while there are many insights on activities enabling innovation and experimentation, whether the generated novelties contribute to a common vision and how they can be mainstreamed, replicated and scaled has received little attention (Caprotti & Cowley, 2017; Ehnert et al., 2018; Raven et al., 2017). Likewise, the question of how to overcome technological, institutional and behavioural lock-in by unveiling vested interests, disrupting institutional procedures and disincentivising unsustainable practices and lifestyles demands more scrutiny (Bai et al., 2018; Brown et al., 2013; Ürgé-Vorsatz et al., 2018). Such research would help to strengthen the conceptualisation of the capacities, because it feeds back to literature that is just starting to emerge.

Thirdly, the framework provides a prism to approach questions about ‘who’ is involved in transformation governance. Like in NYC also in other cities worldwide rather than there being one sole authoritative position, actor or institution, heterogeneous groups of individual actors, organisations and actor networks across sectors and jurisdictions, both in and outside of government, have important roles in urban governance with implications on how climate change, sustainability and resilience are addressed (Castán Broto, 2017; Hodson et al., 2018). While our case study shows that the framework helps to identify the types of actors taking up responsibilities and action, we see room for linking the framework with a more consistent theory and approach about who is taking up actions, why and by using which strategies – as well as about what are existing urban governance regime networks that need to be dismantled. For example, despite the integration of social equity values into resilience planning, large investments are still made in economically important areas like Lower Manhattan while more socio-economically vulnerable neighbourhoods remain with infrastructures vulnerable to flooding. We acknowledge that these questions about the political struggles of urban transformation (governance) cannot be understood by merely looking at the activities, arrangements and structural conditions, but also requires critical scrutiny of the (construction of) narratives that provide a rationale for intervention (Castán Broto, 2017).

Finally, we suggest the capacities framework as a practical and action-oriented tool to support reflection on and co-creation of governance capacities. The dynamic perspective on how governance capacity is developing makes capacity an empowering concept (Wolfram et al., 2017). It draws attention to the on-going learning processes and based on an understanding of the capacities' conditions and activities makes it possible to derive recommendations about how to address capacity gaps. For example, the framework can support action-oriented research to facilitate the co-creation of governance capacities in specific contexts when it is integrated in practice-based governance frameworks such as transition management (Hölscher, 2018; Pedde et al., 2019). In this sense, the capacities framework provides a basic frame for questioning existing governance structures and practices and for developing conditions that enable urban transformation governance in line with Table 2.

5. Conclusions

The disconnect between the zealous narrative of urban opportunities and how these are harnessed in practice demands closer attention to what types of conditions facilitate urban transformation governance and how they are developed, and by whom, vis-à-vis existing urban governance regimes. Our capacities framework responds to this need for better understanding and supporting urban transformation

governance. We suggest the framework as a tool to derive more generalisable results on what new forms of urban transformation governance are emerging, how effective these are for contributing to urban sustainability and resilience transformations and for deriving pathways for effectively strengthening the capacities.

The capacities framework allows studying and learning from ongoing efforts to develop urban transformation governance. We could identify critical conditions and activities facilitating more transformative approaches to addressing sustainability and resilience in NYC, which can inform urban governance practice (in other cities). These mark an important shift from traditional urban governance approaches that tend to make decisions in siloes and based on short-term (economic) interests. In addition, we can reveal barriers and gaps relating to how urban transformation governance is developing vis-à-vis existing governance regimes – most notably relating to the persistence of mainstream structures and siloes across departments, scales and time.

As such, the framework provides a frame for deeper research about how to strengthen the ‘transformation of governance’ for ‘governance for transformation’. Given the complexity of the challenge, as also illustrated in NYC, this is critical for actually delivering on the hopes invested in cities as key loci for achieving sustainability and resilience locally and globally.

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