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Article

An Assessment Framework for Cities Coping with Climate Change: The Case of New York City and its PlaNYC 2030

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Abstract: Climate change and its resulting uncertainties challenge the concepts, procedures, and scope of conventional approaches to planning, creating a need to rethink and revise current planning methods. This paper proposes a new conceptual framework for assessing city plans based on the idea of sustainability and planning countering climate change. It applies this framework to assess the recent master plan for the city of New York City: PlaNYC *2030*. The framework consists of eight concepts that were identified through conceptual analyses of the planning and interdisciplinary literature on sustainability and climate change. Using the proposed conceptual framework to evaluate PlaNYC *2030* reveals some of the merits of the Plan. PlaNYC promotes greater compactness and density, enhanced mixed land use, sustainable transportation, greening, and renewal and utilization of underused land. With regard to the concept of uncertainty, it addresses future uncertainties related to climate change with institutional measures only. From the perspective of ecological economics, the Plan creates a number of mechanisms to promote its climate change goals and to create a cleaner environment for economic investment. It offers an ambitious vision of reducing emissions by 30% and creating a "greener, greater New York," and links this vision with the international agenda for climate change. On the other hand, the assessment reveals that PlaNYC did not make a radical shift toward planning for climate change and adaptation. It inadequately addresses social planning issues that are crucial to New York City. NYC is "socially differentiated" in terms of the capacity of communities to meet climate change uncertainties, and the Plan fails to address the issues facing vulnerable communities due to climate change. The Plan calls for an integrative approach to climate change on the institutional level, but it fails to effectively integrate civil society, communities, and grassroots organizations into the process. The lack of a systematic procedure for public participation throughout the city's neighborhoods and among different social groupings and other stakeholders is a critical shortcoming, particularly during the

current age of climate change uncertainty. Practically, the proposed conceptual framework of evaluate appears to be an effective and constructive means of illuminating the Plan's strengths and weaknesses, and appears to be an easy-to-grasp evaluation method, and should be easily understood and applied by scholars, practitioners and policy makers.

Keywords: New York City; PlaNYC 2030; planning; plans; climate change; sustainability; adaptation; mitigation; risk

1. Introduction

Climate change poses new risks and uncertainties that often lie outside our range of experience and that have the potential to affect the social, economic, ecological, and physical systems of any given city [1]. In this way, climate change and its resulting uncertainties challenge the concepts, procedures, and scope of conventional approaches to planning, creating a need to rethink and revise current planning methods [2,3]. This paper examines how planning today addresses the challenges of global climate change in urban contexts using the city of New York, and its recent PlaNYC *2030: A Greener, Greater New York*, as a case study.

PlaNYC "is the sustainability and resiliency blueprint for New York City" [4]. It is a long-term plan for the city [5]. A fundamental assumption of PlaNYC, which was launched on Earth Day 2007, is that "climate change poses real and significant risks to New York City" [6]. Rosenzweig, Solecki, Hammer, and Mehrotra [7] suggest that "New York has won considerable recognition for its long-term growth and sustainability plan, PlaNYC 2030". PlaNYC, which was first implemented in 2007 and updated in 2011, set an ambitious goal of a 30 per cent reduction of GHG emissions from 2005 levels by 2030 [8].

My aim here is to explore the manner in which city planners propose to deal with the issue. To this end, I offer a new multifaceted framework to evaluate PlaNYC. In developing this framework, I was motivated by the need for an easy to grasp assessment method that allows planners, practitioners, policymakers, and the interested members of the public to critically evaluate plans as they relate to the pressing issue of climate change. Moreover, a review of the planning literature reflects that, although current scholarship offers a number of criteria for assessing issues related to sustainability and climate change, it lacks a multifaceted evaluation framework for assessing plans' specific contributions to climate change mitigation. As climate change is a subject of multidisciplinary interest, the proposed framework draws on various bodies of knowledge.

2. Methods

In the field of urban planning, "planning assessment," or "evaluation," is an established field of research, the evolution of which has been closely tied to changes in planning theory and practice [9]. The field of evaluation of planning scenarios, policies and programs, "has become a principle means of informing and supporting decision making" [10]. In addition, the increase in environmental concerns and the rise of sustainability and climate change discourse have been concurrent with a growing

interest in environmental policy evaluation among academics and policymakers, and in civil society as a whole. In recent years, various theoretical approaches and methods have been employed for policy evaluation in general, and in the climate change and sustainability related fields such as risk assessment, environmental assessment, and resilience [2,3,11].

A review for the main approaches used in the field of environment and planning is found in Crabbě and Leroy [12], Khakee, Hull, Miller, and Woltjer [13], Levent and Nijkamp [14], and Alexander [15]. Yet, a review of the planning literature reflects that, although current scholarship offers a number of criteria for assessing issues related to sustainability and climate change, it lacks a multifaceted evaluation framework for assessing plans' specific contributions to climate change mitigation. From this perspective, a more comprehensive assessment framework would be crucial for efforts to counter climate change.

Therefore, the proposed conceptual framework was developed through qualitative process analysis based on the *grounded theory* method [16–19]. As Jabareen writes [3] (p. 222), "the methodology delineates the following stages in the building of a conceptual framework: (a) mapping multidisciplinary data sources; (b) reviewing the literature and categorizing the selected data; (c) identifying and naming the concepts; (d) deconstructing and categorizing the concepts; (e) integrating the concepts; (f) synthesizing, re-synthesizing, and making it all make sense; and (g) validating the conceptual framework. The process of constructing the conceptual framework involves extensive review and classification of the literature that addresses environmental, social, cultural, and urban aspects of resilience".

The evaluation framework employed here to analyze PlaNYC consists of eight concepts of assessment that were identified through conceptual analyses of the planning and interdisciplinary literature on sustainability and climate change. Together, these concepts—each of which represents a distinctive aspect of climate change mitigation and adaptation themes—form the conceptual framework of the method. Each concept has several measures of evaluation (criteria and questions). It should be noted that this evaluation framework is qualitative and employs no complicated models, and is therefore easy to grasp by practitioners, policy makers and members of the public. The evaluation procedure involves applying each concept of assessment, with its measures of evaluation, to the plan under consideration. For example, when applying the concept of *equity*, we ask whether the plan addresses issues of environmental justice; whether it facilitates systematic public participation; and whether it addresses the needs of different communities in the face of climate change.

3. The Concepts of Assessment

The *evaluation conceptual framework* is composed of eight concepts, where each is directed towards climate change adaptation and GHG reduction. These concepts are:

3.1. Utopian Vision

This concept is concerned with a plan's future vision. This concept evaluates a plan's visionary and utopian aspects regarding future urban life and the city's potential role in climate change mitigation. Usually, urban planning seeks to bring about a different and more desirable future. Theoretically, the power of utopian thinking lies in its inherent ability to envision the future in terms of radically new

forms and values [20]. An urban vision incorporating climate change as a central theme is of the utmost importance to practitioners, decision makers, and the public. Visionary frames are important in climate change, as they serve to identify problematic conditions and the need for change, to propose future alternatives, and to urge all stakeholders to act in concert to affect change. Climate change planning visions must provide people with an interpretive framework that enables them to understand how the issue is related to their own lives in the present and future, and to the world at large [21,22].

3.2. Equity

Equity is a key concept in evaluating climate change policies [23]. The concept of equity is used to evaluate a plan's social aspects, including: environmental justice; public participation; and methods of addressing each community's vulnerability to climate change (urban vulnerability matrix). The impacts of climate change and climate change mitigation policies are "socially differentiated," and are therefore matters of local and international distributional equity and justice [24–26]. A society's vulnerability is influenced by its development path, physical exposure, resource distribution, social networks, government institutions, and technological development [1] (pp. 719–720).

3.3. Uncertainty Management

This concept evaluates a plan's adaptation strategies (*ex-post* and *ex-ante*) and policies and the planning strategies for addressing future uncertainties stemming from climate change. Uncertainty "is a perceived lack of knowledge, by an individual or group, which is relevant to the purpose or action being undertaken and its outcomes" [27] (p. 503). To address these risks, planners have two types of uncertainty or adaptation management at their disposal: (1) Ex-ante management, or actions taken to reduce and/or prevent risky events; and (2) Ex-post management, or actions taken to recover losses after a risky event [28].

3.4. Natural Capital

This concept evaluates the consumption and-equally as important-the renewal of natural assets that are used for development, such as land, water, air, and open spaces. Natural capital refers to "the stock of all environmental and natural resource assets" [29] (p. 1). Maintaining constant natural capital is an important criterion for sustainability [30] (p. 44), [31–33].

3.5. Integrative Approach

Planning for climate change is more complex than the conventional approach to planning as it is undertaken in a context of great uncertainty. This concept evaluates the integrative framework for city planning and adaptive management under conditions of uncertainty, and the spectrum of collaboration that a plan proposes. This context poses new challenges for collaboration among public, private, and civil institutions and organizations on all levels. Integrating the many different stakeholders and agents into planning is essential for achieving climate change objectives. The "ability of a governance system to adapt to uncertain and unpredicted conditions is a new notion" [34] (p. 152). Therefore, adaptive management requires new planning strategies and procedures that transcend conventional planning

approaches by integrating uncertainties into the planning process and prioritizing stakeholders' expectations in an uncertain environment. Plans should also be "flexible enough to quickly adapt to our rapidly changing environment" [34].

3.6. Ecological Energy

The clean, renewable, and efficient use of energy is a central theme in planning for the achievement of climate change objectives. This concept evaluates how a plan addresses the energy sector and whether it proposes strategies to reduce energy consumption and to use new, alternative, and clean energy sources.

3.7. Ecological Economics

This concept is based on the assumption that environmentally sound economics can play a decisive role in achieving climate change objectives in a capitalist world. Cities that are committed to climate change mitigation and sustainability should stimulate markets for "green" products and services, promote environmentally friendly consumption, and contribute to urban economic development by creating a cleaner environment [35] (p. 11), [36]. In this spirit, the American Recovery and Reinvestment Plan, proposed by President Barack Obama, calls for spurring "job creation while making long-term investments in energy, and infrastructure," and increasing "production of alternative energy" [37]. This concept evaluates a plan's ecological economic aspects, including the economic engines it puts in place to meet climate change objectives.

3.8. Eco-Form

The physical form of a city affects its habitats and ecosystems, the everyday activities and spatial practices of its inhabitants, and, eventually, climate change. This concept evaluates spatial planning, architecture, design, and the ecologically-desired form of the city and its components (such as buildings and neighborhoods). Jabareen [38] suggests the following set of nine planning typologies, or criteria of evaluation, which are helpful in evaluating plans from the perspective of eco-form:

a. *Compactness* refers to urban contiguity and connectivity and suggests that future urban development should take place adjacent to existing urban structures [39].

b. *Sustainable Transport* suggests that planning should promote sustainable modes of transportation through traffic reduction; trip reduction; the encouragement of walking and cycling; transit-oriented development; safety; equitable access for all; and renewable energy sources [40,41].

c. *Density* is the ratio of people or dwelling units to land area. Density affects climate change through differences in the consumption of energy, materials, and lands [18,42,43].

d. *Mixed Land Uses* indicates the diversity of functional land uses, such as residential, commercial, industrial, institutional, and transportation. This encourages walking and cycling and reduces the need for car travel, as jobs, shops, and leisure facilities are located in close proximity of one another [44–47].

e. *Diversity* is "a multidimensional phenomenon" that promotes other desirable urban features, including a larger variety of housing types, building densities, household sizes, ages, cultures, and incomes [48] (p. 320). Diversity is vital for cities. Without it, the urban system declines as a living

place [49] and the resulting homogeneity of built forms, which often produces unattractive monotonous urban landscapes, leads to increased segregation, car travel, congestion, and air pollution [39].

f. *Passive Solar Design* aims to reduce energy demands and to provide the best use of passive energy through specific planning and design measures, such as orientation, layout, landscaping, building design, urban materials, surface finish, vegetation, and bodies of water. This facilitates optimum use of solar gain and microclimatic conditions and reduces the need for the heating and cooling of buildings by means of conventional energy sources [50,51], [52] (p. 43).

g. *Greening*, or bringing "nature into the city," makes positive contributions to many aspects of the urban environment, including: biodiversity; the lived-in urban environment; urban climate; economic attractiveness; community pride; and health and education [53–58].

h. *Renewal and Utilization* refers to the process of reclaiming the many sites that are no longer appropriate for their original intended use and can be reclaimed for a new purpose, such as brownfields. Cleaning, rezoning, and developing contaminated sites are key aspects of revitalizing cities and neighborhoods and contribute to their sustainability and to a healthier urban environment.

i. *Planning Scale* influences and is influenced by climate change. For this reason, desirable planning scale should be considered and integrated in plans for regional, municipal, district, neighborhood, street, site, and building levels. Planning that moves from macro to micro levels has a more holistic and positive impact on climate change.

4. Assessing PlaNYC 2030

PlaNYC identifies three main challenges for the plan: growth, an aging infrastructure, and an increasingly precarious environment [4] (p. 4). The present population of New York City is approximately 8,363,700 people [59], and according to the plan, the target population for 2030 will surge past nine million [4] (p. 6). The work force will grow by 750,000 jobs and the need for 60 million square feet of additional commercial space, which the Plan suggests should be filled by the "re-emergence of Lower Manhattan and new central business districts in Hudson Yards, Long Island City and Downtown Brooklyn" [4] (p. 6). "The plan predicts 65 million visitors to the city by 2030. The additional jobs, tourists, and residents could generate an additional $13 billion annually—money that can be used to help fund some of the initiatives described in the following pages and to provide the services that our residents, businesses, workers, and visitors deserve" [4] (p. 6). The plan is composed of 127 new initiatives that aim to strengthen the economy, public health, and the quality of life in the city. Collectively, they will form the broadest attack on climate change ever undertaken by an American city. In addition, "most of PlaNYC's 127 separate initiatives contribute directly to achieving the city's GHG reduction goals: to reduce citywide GHG emissions by 30 percent by 2030 and to reduce city government GHG emissions by 30 percent by 2017" [60].

We now turn to an assessment of PlaNYC based on the eight-concept evaluation method outlined above.

4.1. Uncertainty Management and Adaptation in PlaNYC

New York city is portrayed as a city at risk by both PlaNYC and the New York City Panel on Climate Change [61], a public body proposed by PlaNYC [4] (p. 139) and convened by the mayor of

New York in 2008 in order to achieve the climate change related goals outlined in the Plan. The NPCC holds that "climate change poses a range of hazards to New York City and its infrastructure" and that "these changes suggest a need for the city to rethink the way it operates and adapts to its evolving environment" [61] (p. 3). According to the NPCC [61], climate change is likely to bring warmer temperatures to New York City and the surrounding region, as mean annual temperatures, as projected by global climate models, increase by 1.5–3 F by the 2020s, 3–5 F by the 2050s, and 4–7.5 F by the 2080s [61]. In addition, the city will also see more intense rainstorms, while annual precipitation is likely to increase and droughts become more severe toward the end of 21st century. Heat waves are also likely to become more frequent, intense, and longer in duration. Furthermore, sea levels are also likely to rise in the decades to come, with rises of 2–5 inches by the 2020s, 7–12 inches by the 2050s, and 12–23 inches by the 2080s. In comparison to the period preceding the industrial revolution, when sea levels rose at rates of 0.34 to 0.43 inches per decade, current rates around New York City range between 0.86 and 1.5 inches per decade [61] (pp. 5–9), [62,63]. As a result, flooding and storm-related coastal flooding are likely to increase as well [61] (p. 4). New York City has almost 578 miles of coastline and over half a million residents living within the current flood plain, which is especially dangerous to New York. In fact, at the current sea level, NPCC suggests that New York City already faces the probability of a "hundred year flood" once every 80 years. This could increase to once every 43 years by the 2020s and to once every 19 years by the 2050s. According to one estimate, a Category 2 hurricane would inflict more damage on New York than on any other American city except Miami [61] (p. 8).

Climate change poses particular threats to the city's infrastructure, in the form of: Increased summertime strain on materials; increased peak electricity loads in summer and reduced heating in winter; voltage fluctuations, equipment damage and service interruptions; increased demands on HVAC systems; transportation service disruption; increased street, basement and sewer flooding; reduction of water quality; inundation of low-lying areas and wetlands; increased structural damage and impaired operations; and increased need for emergency management procedures [61] (pp. 4–30).

In addition to these threats, the already deteriorating physical condition of city infrastructure adds dramatically to the uncertainties surrounding climate change. According to PlaNYC [4] (p. 7), New York City's infrastructure "is the oldest in America." Not only are the subway system and highway networks heavily-used, but about 3000 miles of roads, bridges, and tunnels are in need of repair, as are many subway stations. To make matters worse, the water infrastructure has not been inspected in more than 70 years, and 52% of the city's tributaries that run adjacent to the shoreline and pass through neighborhoods are unsafe even for boating. Finally, about 7600 acres throughout the boroughs remain contaminated, and the city suffers from one of the worst asthma rates in the country [4] (p. 7).

With regard to these risks and uncertainties, PlaNYC explains that "there is no silver bullet to deal with climate change," and "as a result, our strategy to help stem climate change is the sum of all the initiatives in this plan" [4] (p. 135). The Plan's main thrust for climate change adaptation appears to lie in the creation of "an intergovernmental Task Force to protect our city's vital infrastructure" and "to work with vulnerable neighborhoods to develop site-specific strategies" [4] (p. 136). In addition, PlaNYC proposes the establishment of a New York City Climate Change Advisory Board, a citywide strategic planning process "to determine the impacts of climate change to public health and other elements of the City and begin identifying viable adaptation strategies" [6] (p. 39). Proposed

adaptation policies also include measures to fortify the city's critical infrastructure, to be implemented through close cooperation between city, state, and federal agencies and authorities; updating the flood plain maps to better protect areas that are most vulnerable to flooding; and working with at-risk neighborhoods across the city to develop site specific plans. "In addition to these targeted initiatives," the Plan reads, "we must also embrace a broader perspective, tracking the emerging data on climate change and its potential impacts on our city" [4] (p. 136).

PlaNYC addresses future uncertainties of climate change on a general level and suggests primarily institutional procedures–establishment of the NPCC and the Climate Change Advisory Board-to meet the challenge. Without a doubt, these bodies, which are charged with monitoring climate change parameters vis-à-vis the City and proposing adjustment policies, enhance the city's urban adaptive planning capacity. At the same time, however, the plan's adaptation strategy is based principally on emission reduction, an *ex-ante* strategy. In this way, PlaNYC fails to prepare the city and its infrastructure for the disasters that could stem from climate change. For example, the Plan proposes no infrastructure design or development projects along the city's vulnerable 570-miles of coastal zones. In contrast, PlaNYC proposes to intensify development wherever possible, in waterfront and other areas, without considering the risks posed by climate change. Finally, PlaNYC proposes no *ex-poste* strategy, or an emergency response to such disasters.

4.2. The Utopian Vision of PlaNYC

From the outset, PlaNYC *diagnoses* the local and global climate change crisis as problematic and critical for New York City and the world as a whole. The Plan states that New York has "already started to experience warmer, more unpredictable weather and rising sea levels" and notes scientists' projections that, as temperatures rise across the globe toward the end of the century, New York City could find itself with between 40 and 89 days that are 90 degrees or hotter each year. "As a coastal city," it concludes, "we are vulnerable to the most dramatic effects of global warming: rising sea levels and intensifying storms" [4] (p. 133). From 2000 to 2005, New York's greenhouse gas emissions increased almost 5% [4] (p. 135). This is significant, as New York City emits nearly 0.25% of the world's total greenhouse gases.

Later, PlaNYC portrays New York City as the most sustainable and "one of the most environmentally efficient cities" in the USA [4] (p. 135), producing "less than a third of the CO_2e generated by the average American." In this way, it holds, "Growing New York is, itself, a climate change strategy." According to the Plan, New York City is a globally responsible, pioneering, modern and innovative city—a city with an "unending sense of possibility" [4] (p. 135). Still, PlaNYC acknowledges, "in spite of our inherent efficiency, we can do better. In addition, we must. Instead we are doing worse" [4] (p. 135). As one of the world's most spectacular cities, planners hold, New York should seize the opportunity and "define the role of cities in the 21st century and lead the fight against global warming" [4] (p. 130). The city "cannot afford to wait until others take the lead" on slowing climate change. "New York has always pioneered answers to some of the most pressing problems of the modern age," the planners argue, and "it is incumbent on us to do so again, and rise to the definitive challenge of the 21st century" [4] (p. 9).

PlaNYC's vision generates a sense of local and global *urgency*: "unless the public…appreciate[s] the urgency…we will not meet our goal" [4] (p. 110). "Meanwhile, we will face an increasingly precarious environment and the growing danger of climate change that imperils not just our city, but the planet. We have offered a different vision… It is a vision of New York as the first sustainable 21st century city—but it is more than that. It is a plan to get there" [4] (p. 141).

The planning vision promises a *better future*: "The result, we believe, is the most sweeping plan to strengthen New York's urban environment in the city's modern history…we have developed a plan that can become a model for cities in the 21st century" [4] (p. 10).

> *"It is a vision of providing New Yorkers with the cleanest air of any big city in the nation; of maintaining the purity of our drinking water;…; of producing more energy more cleanly and more reliably, and offering more choices on how to travel quickly and efficiently across our city. It is a vision where contaminated land is reclaimed and restored to communities; where every family lives near a park or playground; where housing is sustainable and available to New Yorkers from every background, reflecting the diversity that has defined our city for centuries"* [4] (p. 141).

PlaNYC casts "climate change," or "sustainability," as a major concern and central theme of the plan. New York City Mayor Michael Bloomberg describes PlaNYC as "a long-term vision for a sustainable New York City" which "has been acknowledged around the world as one of the most ambitious–and most pragmatic–sustainability plans anywhere" [6] (p. 4). He also maintains that each of the plan's 127 initiatives "will not only strengthen our economic foundation and improve our quality of life; collectively, they will also form a frontal assault on the biggest challenge of all: global climate change" [6] (p. 4).

The vision advanced in PlaNYC includes solutions and planning strategies, calls for collective action, and promises that, "We can do better. Together, we can create a greener, greater New York" [4] (p. 3). In the words of the mayor, "Truly, PlaNYC has become a citywide effort…we are creating a better and more sustainable city–one that will rise above the current economic turmoil and show the world how it is possible to come back stronger than ever… The City is committed to these goals, and together, I know we can build a greener, greater New York" [6] (p. 4).

The vision of PlaNYC is ambitious: its practical aim is to reduce emissions by 30%, and its physical agenda is to develop New York City as a "greener, greater New York." The vision adequately addresses local and global climate change as a central concern of planning and future development. It aims to inspire and mobilize New Yorkers to collectively adhere to the planning initiatives and to build consensus and legitimacy for its implementation. For this reason, the word "*we*" appears 1708 times in the 156 pages of PlaNYC, or about 11 times per page.

Yet, the vision overlooks the social and cultural agenda of such a diverse city. Strikingly, even though New York is "more diverse than ever; today nearly 60% of New Yorkers are either foreign-born or the children of immigrants" [4] (p. 4), with 174 languages spoken by the city residents, the vision neglects the social and cultural issues related to this majority of the city's population. Truly, Angotti [64] suggests that the plan presents a growth scenario, which will appeal to the economic sectors that thrive on growth real estate, finance, construction, and some services. Yet, "by starting with this scenario and not exploring other possible scenarios, NYC2030 is silently making a

major policy decision that favors what some have called *the growth machine*." Moreovcer, critical reading of the the utopian element in the plan, suggests that it is a utopia for large scale real estate developers, who would be the beneficiaries of increased high density growth, and completely ignores the utopias of the majority of residents who live in neighborhoods facing poor housing, poverty, displacement and gentrification.

4.3. PlaNYC and the Concept of Equity-Public Participation

New York is a diverse city with 5 boroughs, 59 community districts and hundreds of neighborhoods. PlaNYC acknowledges that shifting climate patterns will have a wide range of effects on these communities, taking lives and posing "major public health dangers," and impacting the property and livelihood of many [4] (p. 138). Moreover, all five New York City boroughs "have vulnerable coastline." Moreover, the massive growth proposed by PlaNYC will certainly affect these communities, and may even "erase the character of communities across the city" [4] (p. 18). In considering the spatial impact of implementing the plan, the authors raise a crucial dilemma for the future of New York City and its communities:

> *"We cannot simply create as much capacity as possible; we must carefully consider the kind of city we want to become. We must ask which neighborhoods would suffer from the additional density and which ones would mature with an infusion of people, jobs, stores and transit. We must weigh the consequences of carbon emissions, air quality, and energy efficiency when we decide the patterns that will shape our city over the coming decades"* [4] (p. 18).

Despite the significant planning it embodies and the crucial dilemmas it raises, PlaNYC suggests no mechanism or procedure for facilitating citizen participation in the planning process, and makes no mention of public participation in the City's communities and neighborhoods. In short, careful reading of PlaNYC reveals markedly inadequate public participation in the planning process. PlaNYC asks: "What kind of city should we become?" and asserts: "We posed that question to New York" [4] (p. 9). However, instead of a systematic procedure for public participation in central planning, the planners employed participation methods that were disorganized at best:

> *"Over the past three months, we have received thousands of ideas sent by email through our website; we've heard from over a thousand citizens, community leaders and advocates who came to our meetings to express their opinions; we have met with over 100 advocates and community organizations, held 11 Town Hall meetings, and delivered presentations around the city. The input we received suggested new ideas for consideration, shaped our thinking, reordered our priorities"* [4] (p. 9).

Notwithstanding this process, it is clear that public participation in the process was inadequate and insufficient for meeting the planning challenges stemming from climate change for one of the world's most socially and culturally diverse cities. PlaNYC poses important urban dilemmas but does little to elicit real community participation. Instead, the planners appear to provide the answers themselves, in the name of New Yorkers: "By moving ahead, we will continue to ensure that the essential character of the city's communities remains intact as we seek out …opportunities for public rezonings" [4] (p. 21).

In 2010, the Mayor Office of NYC released a report, *The Process behind PlaNYC: How the City of New York Developed its Long-Term Sustainability Plan*, which describes how PlaNYC's has applied a pioneering and "comprehensive public outreach process generated broad public support and helped to educate the general public about climate change and sustainability issues" [65] (p. 6). Yet, some distinguished scholars and practitioners suggest that PlaNYC 2030 basically ignores issues of equity and diversity [4,66–69]. Persuasively, Brian Paul [67] (pp. 2–3) argues that: "PlaNYC 2030 is a top-down bureaucratic initiative with little community involvement and "buy-in" and is not well-integrated with the rest of city policy making". Moreover, he contends that "In reality, public participation in PlaNYC2030 was an afterthought that was initiated only when the Mayor's office realized it was a necessary component of selling the plan to the public". Angotti [68] argues that PlaNYC 2030 is actually a strategic real estate growth plan, and its presentation of "sustainability" is primarily a public relations effort. Dan Miner [66] (p. 1) suggests that "the public wasn't involved in creating the plan, so no grassroots constituency or broad public support ever developed around it".

Affordable housing appears to be one of the only themes that PlaNYC seeks to address. "The most pressing issue we face today is affordability," planners write. "Between 2002 and 2005 the number of apartments affordable to low-and moderate-income New Yorkers shrank by 205,000 units" [4] (p. 18). The Plan assumes that "if supply is not created as fast as people arrive, affordability could suffer further" [4] (p. 18). On this basis, it calls for expanding the housing "supply potential by 300,000 to 500,000 units to drive down the price of land" and for pairing "these actions with targeted affordability strategies like creative financing, expanding the use of inclusionary zoning, and developing homeownership programs for low-income New Yorkers." This, planners hold, will "ensure that new housing production matches our vision of New York as a city of opportunity for all" [4] (p. 12). However, what PlaNYC does in practice is to propose the provision of 500,000 housing units without proposing effective policies for ensuring affordable housing and regaining the more than 200,000 units that have already been lost. Moreover, PlaNYC's rezonings also have failed to adequately protect affordable housing [70]. Paul [70] (p. 4) proposes "that The affordable units created by the city's inclusionary zoning program (commonly known as the "80–20" because developers receive a subsidy for allocating 20 percent of units to affordable housing) are outweighed by the loss of previously existing affordable units as market rents rise and rent-regulated tenants are pushed out by aggressive new landlords".

Although PlaNYC notes the existence of environmental injustice in the city, it fails to address the issue in a serious manner and takes no practical measures to mitigate the phenomenon. For example, planners acknowledge, most brownfields are concentrated in low-income communities, resulting in a case of severe environmental injustice [4] (p. 41). The owners of such land "often find that their financial interests dictate development plans that minimize cleanup requirements" and "may choose new uses for the land" that "do not reflect community needs or desires" [4] (p. 42). Moreover, "in some communities, the impacts of exposure to local air emissions have likely contributed to higher asthma rates and other diseases" [4] (p. 119). These clear cases of environmental injustices also go unaddressed by the plan.

PlaNYC encourages community involvement in significant planning issues *in the future* and reflects little interest in community involvement during the preparation of the plan itself. In this spirit, it suggests *future engagement* in developing adaptation strategies, mainly to "work with vulnerable

neighborhoods to develop site-specific strategies," and to "create a community planning process to engage all stakeholders in community-specific climate adaptation strategies" [4] (p. 138). PlaNYC also suggests working with communities when exploring potential sites for development in their communities [4] (p. 25), and in the rezoning of brownfields [4] (p. 44).

Convincingly, Tom Angotti [5] (p. 3) argues that the city's 59 community boards are

> *"…still invisible in the 2030 plan, barely mentioned in the scores of spreadsheets, maps and colorful images that herald the coming of the green city. They can post comments but play no role in setting priorities or initiating change. They are not consulted until after the fact, yet they are often criticized for only reacting. Civic and advocacy groups, including many that started fighting for a greener and greater future decades ago, and advocated sustainability long before the term was uttered in City Hall, are similarly sidelined".*

Overall, PlaNYC focuses primarily on physical planning dimensions such as land, air, water, energy, and transportation in order to "unleash opportunity" [4] (p. 3) and less on socio-cultural issues. Virtually none of the major thrusts of the plan deal directly with issues of equity and justice, such as diversity, the future of communities and neighborhoods, poverty (which appears only once in the entire plan), and the cultural diversity of the city and its immigrants. Moreover, PlaNYC does not address the climate change vulnerability matrix, *i.e*., how climate change could affect each neighborhood, with an emphasis on the specific environmental risks that exist in each neighborhood and that each neighborhood is likely to face in the future.

4.4. PlaNYC and Natural Capital

As we have seen, PlaNYC focuses on the dimensions of natural capital (air, water and land) and proposes their efficient use in the future development of New York City. Its major strategies are to restore air quality, ensure clean water and waterfronts, collect runoff water, maximize land use and clean contaminated sites and brownfields, plant trees, and green the city. To this end, the Plan takes the following measures:

(1) *Air*: Without action, the carbon emissions of New York City will grow to almost 74 million metric tons by 2030 [4] (p. 9). PlaNYC promotes initiatives to improve air quality and reduce emission by 30% [4] (p. 116).

(2) *Water*: The Plan calls for "developing critical backup systems for our aging water network to ensure long-term reliability" [4] (p. 12). It also proposes ways to maximize urban water absorption when planting trees [4] (p. 59). Finally, it suggests creating vegetated ditches (swales) along parkways to store direct rainfall and facilitate the natural cleansing of runoff [4] (p. 60).

(3) *Waterfronts and Waterways*: New York City has 578 miles of waterfront, which the Plan regards as "one of the city's greatest opportunities for residential development," and an important site of other types of projects as well [4] (p. 22). PlaNYC also confronts the "legacy of the City's industrial past…" "…which treated New York's waterways as a delivery system" [4] (p. 51), and proposes to open 90% of the City's waterways to recreation by preserving natural areas and reducing pollution [4] (p. 53).

(4) *Trees*: "The City will expand efforts to reforest approximately 2000 acres of parkland by 2017," and reforestation will be implemented in many locations around the city [4] (p. 128).
(5) *Land*: Since the City's land supply remains fixed, PlaNYC calls for using "our existing stock of land more efficiently" and recapturing almost all vacant, unutilized and under-used land for development.

4.5. Eco-Form in PlaNYC

a. *Compactness*: Today, less than 4% of the city's buildings account for roughly 50% of the city's built area [4] (p. 102). PlaNYC proposes various planning strategies in order to increase compactness within the City. It suggests infill "everywhere it is possible" and the development of spaces that "are now lightly used," such as parking lots in public housing areas that were developed in the 1930s [4] (p. 23). It also calls for developing underutilized areas throughout the city that are well-served by public transportation and other infrastructure; capturing the potential of transportation infrastructure investments; and decking over railyards, rail lines, and highways [4] (pp. 19–25). By *rezoning*, planners aim at "continuing to direct growth toward areas with strong transit access; reclaiming underused or inaccessible areas of our waterfront; and exploring opportunities to spur growth through the addition of transit, as our subways did more than a century ago" [4] (p. 21). PlaNYC fosters rezoning and redevelopment of brownfields, which according to the Plan represent one of the City's greatest opportunities, and which cover some 7600 acres throughout the five boroughs [4] (p. 41).

b. *Density*: New York is a dense city. Overall population density today stands at is 25,383 (persons per square mile), and the highest density in the city is 128,600 [6]. The planning strategies suggest further density intensification.

c. *Sustainable Transport*: The city's current transportation systems are in poor condition. More than half of the city's subway stations are awaiting repairs, and the city is more than $15 billion short of what it would cost to get the transit and road networks back into good shape. To make matters worse, trains are crowded, half of the subway routes experience congestion, and a large number of New Yorkers have no access to mass transit; [4] (p. 76). PlaNYC proposes a "sweeping transportation plan" to enable the city to meet its needs through 2030 and beyond. The plan includes strategies to improve the transit network through major infrastructure expansion; improved bus service; an expanded ferry system and the completion of a master bike plan; and reduction of the increasing gridlock on the roads through better road management and congestion pricing [4] (p. 13). In addition, PlaNYC pursues transit-oriented development and uses rezoning to direct growth toward areas with strong transit access [4] (p. 21). As a result of these policies, New Yorkers will experience more comfortable travel, reduced travel times, and greater reliability, thus achieving a new standard of mobility [4] (p. 97).

d. *Mixed Land Uses*: PlaNYC encourages mixed land uses in future development, mainly by mixing transportation uses with residential areas and open spaces. Moreover, the plan encourages co-location of the 43,000 acres of city-owned land with other uses. Most of this land is developed for government operations, "but significant opportunities exist for housing to co-exist with the current use—from libraries to schools to parking lots" [4] (p. 22).

e. *Diversity:* PlaNYC recognizes that "the mixture of residents will determine, more than anything else, the kind of city we become," and that "by expanding supply possibilities to create healthier

market conditions, we can continue ensuring that new housing production matches our vision of New York as a city of opportunity for all." "If New York loses its socioeconomic diversity," planners warn, "its greatest asset will be lost. We can—and must—do better" [4] (p. 27). On a practical level, however, PlaNYC neglects issues of socioeconomic and cultural diversity, including crucial socio-spatial issues such as segregation. It also fails to promote a wider variety of housing types.

Moreover, Brian Paul [70] (p. 3) argues that though, "the dense residential development that PlaNYC has encouraged in Long Island City and Greenpoint-Williamsburg through rezonings and "green" mega-developments like Hunters Point South threatens to undermine economic and social diversity in these mixed-use neighborhoods instead of encouraging it".

f. *Passive Solar Design*: Although PlaNYC does not pay significant attention to passive solar design, it does suggest "greening" the Building Code of New York, with an emphasis on implementing the city's energy efficiency strategies, streamlining the process for incorporating new sustainable technologies into construction, and adapting to climate change. It also proposes focusing on reducing the amount of cement used in concrete, as cement production is an energy-intensive process that releases one ton of CO_2 for every ton of cement produced [4] (pp. 106–107).

j. *Greening*: In New York City today, the standard park area per thousand residents is 1.5 acres, and there is an average of one playground for every 1250 children. Furthermore, in 97 out of the city's 188 neighborhoods, the number of children per playground is higher [4] (p. 30). In this context, PlaNYC adopts greening as a major strategy and proposes three primary ways to ensure that by 2030, nearly every New Yorker will live no more than a 10-min walk from a park: (1) by upgrading land already designated as play space or parkland and making it available to new populations; (2) by expanding usable hours at current, high-quality sites; and (3) by re-conceptualizing streets and sidewalks as public spaces. The combined impact of these policies will be the creation of over 800 acres of upgraded parkland and open space across the city [4] (p. 31). PlaNYC also calls for beautifying the public realm and undertaking "an aggressive campaign to plant trees wherever possible, in order to fully capitalize on tree opportunities across the city" [4] (p. 38). In addition, planners call for the expansion of "Greenstreets," a program that since its inception in 1996 has successfully transformed thousands of acres of unused road space into green space [4] (p. 38). They also suggest offering incentives for green roofs, which can reduce the volume of runoff by either absorbing or storing water and aiding other natural processes [4] (p. 60). Since the launch of PlaNYC, 200,000 trees have been planted across the five boroughs [6] (p. 3). Moreover, the PlaNYC's formal website suggests that "as of 2014, the New York City Department of Parks and Recreation (DPR) has led the City's efforts in adding 109 acres of new parkland. The City has also worked to expand its Bluebelt wetland system, increase opportunities for recreation along our waterways, and restore coastal ecosystems".

Yet, the plan's goal of every New Yorker being within 10 min of a park or open space has been criticized as meaningless by park advocates and in fact has not been implemented. McDonnell *et al*. [71] found that "New York City's planning and zoning actions are shaping development patterns across the City in ways that may not align with the City's goals for the use of its infrastructure and assets such as parks. In addition, the goal of putting in bike lanes is simply a repeat of a goal set out in the transportation department's 1997 bicycle master plan, and even when it is fully implemented NYC will remain far behind other major cities in bike infrastructure."

h. *Renewal and Utilization*: Across the city, there are dozens of sites that are no longer suitable for their original intended use. PlaNYC proposes adapting unused schools, hospitals, and other outdated municipal sites for productive use as new housing [4] (p. 23). It also calls for cleaning and utilizing as many as 7600 acres of contaminated brownfields across the city [4] (p. 41) and suggests strategies to "make existing brownfield programs faster and more efficient; to create remediation guidelines for New York City cleanups; and to establish a city office to promote brownfield planning and redevelopment" [4] (p. 44). And, as we have seen, it calls for cleaning the water supply system and opening New York waterways for the use of residents [4] (pp. 51–69).

i. *Scale*: PlaNYC focuses on plans for the inner city, streets, vacant and underused sites, buildings, and roof levels, but almost completely overlooks another important planning scale: the neighborhood.

In summary, evaluating PlaNYC from the perspective of Eco-Form reveals that the plan actively promotes compactness and density; enhance mixed land uses; sustainable transportation; greening; and renewal and utilization. Its shortcomings are in passive solar design and planning for diversity (see Table 1).

Table 1. Eco-Form Matrix PlaNYC.

Design Concepts (Criteria)	New York Plan
Density	1. Low 2. Moderate 3. **High**
Diversity	1. **Low** 2. Moderate 3. High
Mixed Land Use	1. Low 2. Moderate 3. **High**
Compactness	1. Low 2. Moderate 3. **High**
Sustainable Transportation	1. Low 2. Moderate 3. **High**
Passive Solar Design	1. **Low** 2. Moderate 3. High
Greening	1. Low 2. **Moderate** 3. High
Renewal and Utilization	1. Low 2. **Moderate** 3. High
Planning Scale	1. **Low** 2. Moderate 3. High
Total Score	

4.6. The Integrative Approach of PlaNYC

PlaNYC advances an ambitious agenda for measures that aims to "create a sustainable New York City," which "will require tremendous effort: on the part of City officials and State legislators; by community leaders and our delegation in Washington; from the State government and from every New Yorker" [4] (p. 140). Nonetheless, planners acknowledge that "the existing organizations, programs, and processes are inadequate to implement these policies" and "no organization is currently empowered to develop a broad vision for energy planning in the city that considers supply and demand together as part of an integrated strategy" [4] (p. 104). The plan concludes that "there is a clear need for a more comprehensive, coordinated, and aggressive planning effort, focused on the specific needs of New York City," and therefore calls for the establishment of the New York City Energy Planning Board [4] (p. 105). It also calls for "changes at the City, State, and Federal levels-for transportation funding, for energy reform, for a national or state greenhouse gas policy" [4] (p. 11), and for "creating a new regional financing entity, the SMART Financing Authority, that will rely on three funding streams: the revenues from congestion pricing and an unprecedented commitment from New York City

that we will ask New York State to match" [4] (p. 13). In addition, it suggests establishing a City office to promote brownfield planning and redevelopment [4] (p. 45). In the ways mentioned above, PlaNYC promotes an integrative approach to the issue of climate change on the formal institutional level. Nevertheless, it fails to effectively integrate civil society and grassroots organizations, such as the 59 Community Districts and the Boards of New York City.

4.7. PlaNYC and Ecological Energy

One major focus of PlaNYC is the city's energy sector. Its main aim in this realm is to provide cleaner, more reliable power for every New Yorker, by upgrading the city's energy infrastructure [4] (p. 99). To this end, the plan calls for encouraging new cleaner power plants, renewing the city's most inefficient plants, and developing a market to increase the supply and use of renewable energy [4] (pp. 103–115). In order to maximize energy efficiency, PlaNYC calls for focusing on buildings, the city's largest energy consumers [4] (p. 107). Over two thirds of the city's energy is consumed within buildings, compared to a national average of less than one third. According to the Plan, "the City has 5.2 billion square feet of space parceled into almost a million buildings" [4] (pp. 107–108). By 2030, at least 85% of the city's energy will be used by buildings that already exist today. In this way, energy saving measures in existing buildings will result in a seven million ton reduction in global warming emissions. This is significant, for without the measures outlined in the Plan, emissions would have risen to almost 80 million metric tons by 2030 [6] (p. 39). PlaNYC also forecasts a 30% reduction in the city's greenhouse gasses by 2030 [4] (p. 103).

In addition, the Plan proposes an extensive education and training campaign in the realm of energy awareness [4] (p. 110). It also encourages a shift to mass transit and various ways to promote fuel efficiency, the use of cleaner fuels, cleaner or upgraded engines, and the installation of anti-idling technology [4] (p. 13). According to the Plan, the most effective strategy is to reduce the number of vehicles on the road and to simultaneously expand the city transit system and implement congestion pricing [4] (p. 136). Planners predicts that approximately 50% of reductions in CO_2 emissions will come from increased energy efficiency in buildings, while 32% will result from improved power generation and 18% from changes in transportation. Planners explained their decision to not rely on "the widespread use of solar energy in this plan because its costs today are too high for general use" [4] (p. 136). In sum, Angotti [5] suggests that "after weeding through the 127 projects in the plan's matrix, it seems energy efficiency received the highest priority". Brian Paul [70] suggests that a review of 2009 mayoral press releases about the 2030 plan revealed that two thirds deal with energy efficiency, climate change and efficient transportation.

4.8. Ecological Economics in PlaNYC

According to the authors of PlaNYC, improving the city's energy infrastructure and lowering demand will reduce energy costs by billions of dollars over the next decade; watershed protection will make multi-billion-dollar investment in new water filtration plants unnecessary; and improving public transportation and reducing congestion will reduce the economy's annual $13 billion loss due to traffic delays [4] (p. 133). By managing demand, increasing the energy supply, and saving energy in existing buildings, the city's overall power and heating bill will plunge by $2–4 billion, resulting in an

estimated annual savings of approximately $230 for the average household by 2015. Congestion pricing is projected to generate net revenues of $380 million in the first year of operation, increasing to over $900 million by 2030 [4] (p. 96). To this end, PlaNYC proposes an amendment to the City Charter requiring that New York City invest an amount equal to 10% of its energy expenses in energy-saving measures each year. Planners also note that the measures required to execute these initiatives "will create thousands of well-paying jobs" [4] (p. 133), and that this will mean that the city will have "not only a healthier environment, but also a stronger economy" [4] (p. 13).

However, as we have seen, planners did not dedicate sufficient thought to solar energy in terms of design or as an alternative energy. PlaNYC suggests providing incentives to renewable energy and pilot emerging technologies, primarily for solar energy with the greatest potential. However, the Plan also stipulates that "solar energy is still not as cost-effective as gas-fired electricity," and that New York City is uniquely expensive because taller buildings require more wires and cranes to carry equipment to rooftops, resulting in solar installation costs that are 30% higher than in New Jersey and 50% higher than in Long Island [4] (p. 112). In order to increase future solar use, the Plan suggests introducing property tax abatement for solar panel installations.

In these ways, PlaNYC provides a number of economic engines to promote climate change objectives and a cleaner environment. Its well-grounded conclusion is that "adapting to climate change and investing in mitigation not only ensures the city's long-term economic vitality, but it will encourage public and private investments in the city's infrastructure, support green jobs, and improve the quality of life and level of service enjoyed by New Yorkers today" [6] (p. 38).

5. Conclusions and Planning Recommendations

Based on the above evaluation of PlaNYC 2030, this paper offers the following conclusions:

(1) Like other cities around the world, New York's human, ecological, economic, and urban structures and spaces are at risk and face an increasing level of uncertainty due to the shifting parameters of climate change. In light of these uncertainties, there is a need to rethink and revise the concepts, procedures, and scope of conventional approaches to planning. In order to meet the challenges posed by climate change, planning is in need of a more coordinated, holistic, and multidisciplinary approach, as planning in the context of such great uncertainty is unprecedented in our modern history.

(2) Using the proposed conceptual framework to evaluate New York City's PlaNYC 2030 provides an informative, easy to grasp, effective, and constructive means of illuminating the Plan's strengths and weaknesses.

(3) The assessment reveals some of the merits of PlaNYC. It proposes effective measures for planning the physical dimensions of the city. In terms of eco-form, it promotes greater compactness and density, enhanced mixed land use, sustainable transportation, greening, and renewal and utilization. With regard to the concept of uncertainty, it addresses future uncertainties related to climate change with institutional measures, and enhances the urban adaptive planning capacity of the city. PlaNYC recommends efficient ways of using the city's natural capital assets and pays special attention to strategies for providing New York with cleaner and more reliable power. From the perspective of ecological economics, the Plan

creates a number of mechanisms to promote its climate change goals and to create a cleaner environment for economic investment. Finally, PlaNYC offers an ambitious vision of reducing emissions by 30% and creating a "greener, greater New York," and links this vision with the international discourse and agenda on climate change and sustainability (see [2]).

(4) According to the assessment, PlaNYC has three major shortcomings. The first is its failure to adequately address the social planning issues that are crucial to New York City, the most diverse city in the world (see [2]). PlaNYC does not effectively address issues of equity, such as social justice, diversity, race, and economic segregation. It also fails to address the issues facing vulnerable communities due to climate change. New York City is "socially differentiated" in terms of the capacity of communities to meet climate change uncertainties, physical and economic impacts, and environmental hazards.

(5) The second shortcoming of PlaNYC relates to the plan's adaptation strategy, which focuses on emissions reduction alone and fails to prepare the city and its physical infrastructure for potential disasters caused by climate change shifting. Unfortunately, PlaNYC did not make a sufficiently radical shift toward planning for climate change and adaptation. This being the case, it seems clear that the authors of PlaNYC have not taken the lessons of Hurricane Katrina as seriously as they should have done.

(6) The Plan's third shortcoming is that although PlaNYC calls for an integrative approach to climate change on the institutional level, it fails to effectively integrate civil society, communities, and grassroots organizations into the process. The lack of a systematic procedure for public participation throughout the city's neighborhoods and among different social groupings and other stakeholders is a critical shortcoming, particularly during the current age of climate change uncertainty (see [2]).

(7) Another important lesson we can learn from applying the proposed evaluation framework to PlaNYC is that when planning for climate change, planners must not overlook any one of the eight concepts of assessment. The framework is not a mere collection of unrelated concepts. Rather, they are interconnected, with each concept playing a specific role in the evaluation and influencing the others. Based on the measures advanced in PlaNYC, New York City could certainly be "greener," but in order to truly be "greater," planners must better incorporate its main treasures-socio-cultural diversity and the people of the city–into the planning process and into the Plan.

Conflicts of Interest

The author declares no conflict of interest.

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