Assessing Climate Change Planning In Indian Cities: Bridging The Gap Between Climate Change Research And Practice

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ABSTRACT

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Climate change is a multidimensional observable fact and is regarded as one of the greatest challenge human society is facing in the 21st century. Debates on climate change advocate that, urban areas not only contribute to climate change by emitting huge amounts of carbon-dioxide gas into the atmosphere, but also play a vital role in addressing climate change. In the context of, rapidly evolving policy frameworks in India, this research assessed whether urban planning policies in master plans target climate change mitigation. This research undertook a qualitative content analysis of the policy framework of master plans that are involved in the sample and developed climate change mitigation indexes for all the sampled master plans by assessing urban policies against climate change mitigation evaluation protocols. This research significantly contributes to the field of urban planning and public policy by analyzing the relationship between urban planning policies and climate change. This research supports the use of master plans as an effective tool in mitigating climate change thereby promoting low-carbon regions through urban planning. This research has an implication for mainstreaming climate change planning in urban planning. Conclusions emphasize the application of urban planning as a policy tool for mitigating climate change..

Key Words: Climate change mitigation, climate change planning, urban and environmental planning, public policy, India

Introduction

Urban areas as huge emitters of CO_2 not only contribute to climate change, but also experience the resulting impacts of climate change (Bell & Batterson, 1978). Impacts of climate change such as loss of ecosystem, heat related illness, increased mortality rates and high economic losses are expected to have an effect on almost all aspects of human life (Post & Altman, 1994). Recently, scientific evidence reveals that all over the world, almost 160 million people residing in 20 coastal cities are expected to

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be affected by the rising sea levels (Nicholls, 1995). Hence, the impacts of climate change are very alarming and it is necessary to address climate change.

In most countries, urban planning refers to the spatial distribution of residential, commercial, industrial and recreational activities over a widespread area and generally involves integration of various components of planning namely land use planning, transportation planning and environmental planning (Levy, 2010). Through urban planning, regional and local governments have an ability to respond to the changing social, economic and environmental conditions by controlling the distribution of various land uses and planning decisions related to local development (Berke, Godschalk, Kaiser & Rodriguez 2006; Berke & Conroy, 2000; Agyeman, Evans, & Kates, 1998). Hence, urban planning policies by incorporating coordination among land use, transportation and environmental planning might have an ability to reduce climate change thereby mitigate climate change.

Although, the Intergovernmental Panel on Climate Change (IPCC) and various United Nations (UN) agencies have repetitively acknowledged that urban planning practices can significantly reduce Climate change. However, lack of empirical evidences that emphasize the impact of urban planning policies on Climate change, to some extent has hampered the mainstreaming of CO_2 reduction policies in urban planning. Nevertheless, International negotiations such as U.S. Mayors Climate Protection Agreement and Local Governments for Sustainability (ICLEI) have put forth noticeable efforts to reduce CO_2 levels in the atmosphere by developing local climate change action plans which consist of activities that are relatively consistent in reducing Climate change. However, these climate change action plans lack the regulatory framework and institutional capacity to achieve their goals and objectives (Wheeler, 2008). So, it is essential to formulate policy discussions related to CO_2 reduction in accordance with their applicability at the regional as well as at the local level.

Wilbanks (2003) advocate that climate change is a multidimensional concept, and any effort taken to mitigate climate change must take into account its multi dimensions. According to him, climate change can be effectively mitigated at the urban level by incorporating a comprehensive approach. However, Wilbanks (2003) highlights that a comprehensive approach requires urban areas to mainstream CO_2 reduction strategies into respective land use, transportation, environmental and developmental policies to mitigate climate change.

Furthermore, Betsill and Bulkeley (2007) identified that, individual commitment is one of the main reason to effectively address CO_2 reduction at the regional as well as at the local level. Acknowledging the fact that regional authorities with their regulatory power have an ability to promote behavioral changes. Urban planning can be used as a pro-active tool to influence individual and organizational behavior and to incorporate comprehensive approach. Thereby effectively reduce Climate change.

Urban Planning

Urban planning is a diverse field and can be viewed from various perspectives. Environment planning involves a range of activities designed to promote the growth and development of the built environment in a sustainable manner (Kaiser, 1995). Since the 1900s, the field of environmental planning has undergone a gradual shift from an initial emphasis on the promotion of architectural beauty to urban reform movements with concern about improving the living conditions of people, focusing on issues of equity, social and environmental justice. Faludi (1973) asserts that planning is a 'rational' process and must be approached from a scientific and technical perspective. Accordingly, rational planning mainly emphasized on identifying and focusing on the best methods for practicing planning and future courses of action with regard to the city.

Gradually in the mid 1970s with the introduction of political discourse into urban planning and later, in the 1980s with the launch of John Friedman's context-value laden nature of participatory, action oriented, communicative and radical approaches, planning was viewed as a mutual learning process involving consensus building rather than a rational decision making process. As such in the 1990s the field of planning witnessed a significant shift in its use of 'rationality' from one that views plan making (providing an outline of the various development strategies, policies, and activities taken at the different planning scales) and plan implementation (putting plans into effect) in isolation to one that views plan making process and plan implementation as a single activity (Friedman, 1969).

In the mid 1970s, Friedman (1971) describes implementation as an inseparable activity from plan making process, as such involving the inclusion of a wide-range of actions in the process of shaping and making of plans. Friedman (1971) through his action model of planning highlights the political process involved in the implementation of the plans. He advocates that a

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planner must be like a facilitator or communicator trying to promote participatory planning among all interest groups, discussing issues with the public and developing a hierarchy of goals and workable strategies for plans with the public interest and also put them into action with the help of the public. Accordingly Friedman (1973) highlights that, planning is a form of undertaking action, and implementation means thoroughly carrying out the planning.

Friedman (1971) emphasizes that planning is a mutual learning process and a participatory action process where in both the planner and the public participate together in the plan making process and put into action as such work towards the reformation of the project undertaken. According to him, the radical planning process is the best approach to practice planning since they are created with the public interests within the social context and is value laden (Taylor, 1998). Thereby highlights that for effective implementation of a plan, the planner must act as a facilitator, researcher and must be skilled at contacting, communication and negotiating with others (Friedman, 1973; Forester, 1989; Healey, 1992; Taylor, 1998).

Later in the early 1990s, John Forester (1989) coined the phrase communicative planning highlighting that negotiation was a pre-requisite skill for a planner. Since then, implementation was widely used to imply that decision-making processes for the city has been widened out, with a restructuring of the relationships between city government officials, planning professionals, non-profit organizations (NGOs), stakeholders and the public (Forester, 1989). As such, radical planning demands for more participation in decision-making and underscores the need for planners to involve clients in debate and dialogue to effectively implement urban plans.

From a public policy perspective, this approach to implementation is referred as the "bottom-up; action centered" approach of implementation. From this point of view implementation is seen as "action perspective" which is in contrast to the "policy centered" approach. The latter considers implementation to be "putting policy into effect" whereas action-perspective claims that instead of formulating policy first then going on with the implementation; policy could arise as the plan was implemented.

Challenges of urban planning

Friedman (2005) highlighted that most of the countries in the world were originally based on the European urban planning tradition. Accordingly most of the countries influenced by the European planning practice emphasized on land use planning and architectural urban design as a solution for most of their spatial urban problems, without much regard to the specificities of context (Friedman, 2005). Cohen (2006) describes the characteristics of urban planning by highlighting the enormous challenges urban planners' experience. One of the most common challenges is the unregulated growth and expansion of the cities due to urbanization. In many cities, unregulated growth has led to an increased pressure for land thereby, intensifying sprawl and congestion. Farvacque et al. (1992) identifies the existence of inappropriate and obsolete planning regulations and codes and the dominance of the comprehensive long range planning as some of the challenges related to urban planning.

However, in the late 1980s, with the growing realization that planning can significantly influence the livability of cities if its environmental, socio-cultural and economic dimensions are fully explored many developing countries broadened their scope of urban planning by incorporating sustainable planning in their planning agendas. Accordingly, this has led to a shift from traditional planning concerns about land use, to concerns about the promotion of the sustainable development in many developing countries (Friedman, 2005).

Public policy in urban planning

Comprehensive, development and master plans are regarded as a means of managing growth and directing development in order to achieve the desired goals of a community. These plans generally include elements of land use, urban design, transportation, housing, energy, environment, public facilities and economic development (Berke, 2006). This type of cross-thematic integration between development policies and various plan elements of a community along with the underlying regulatory framework are regarded as a viable tool in managing the growth and development of a community thereby help in accomplishing the goals and objectives of a community (Berke, 2006). Hence, these plans are regarded as the necessary policy document that promotes urban planning process in the city (Kaiser, 1995).

Across the world, public participation in environmental planning process is widely accepted to be efficient (Tauxe, 1995). The principles of public participatory planning in urban planning mainly emphasizes the stakeholders rights to be informed, to promote innovative issues and also assess alternative solutions during the planning process (Godschalk & Mills, 1966). According to Barrett and Fudge (1981), implementation that develops as a response to actions is referred as an action-centered approach as such involves an action in planning. Research on environmental planning and policy formation methods analyzes the effectiveness of decision making through public participation to be an effective practice for the implementation of planning goals (Friedman, 1973; Barrett & Fudge, 1981).

Traditionally environmental planning structure has been a regarded as public policy that is shaped by power (Kaiser & Godschalk, 1995a). Research emphasizes the role of urban planning policies in promoting sustainability (Berke and Conroy 2000), in environmental management (Brody, 2003), intergovernmental collaboration (Godschalk, 1994) and promoting natural resiliency performance and mitigating natural hazards (Nelson and Steven, 2002; Berke and Beatley 1992; Brody 2005). This aspect of public policy within environmental planning process, that lies beneath the urban planning documents symbolizes the regulatory framework, the integrative, collaborative nature and the scope for public participation to develop innovative solutions in planning process. Accordingly, environmental planning and public policy have the ability to mitigate climate change and also the potential to increase governance to mainstream climate change mitigation policies in environmental planning respectively. Thereby providing the regions an opportunity to be more responsive towards climate change mitigation.

Environmental response to climate change in India

Impacts of climate change are very extensive and it is urgent to address these challenges. India has 17 per cent of the world's population and contributes nearly 18 per cent of the total global greenhouse gas emissions. While US contributes approximately about 30% and the European countries contribute nearly 23% of GHG emissions. In terms of per capita CO_2 emissions, India also has high per capita emissions of nearly 10 MT CO_2 (about 33% of the global average) compared with 24 MT CO_2 in US and 17 MT CO_2 in EU per capita emission. According to WRI (2009), India emits an estimated 1.7 TCO2 emissions per capita per year (WRI, 2009).

India looks forward and participates in global negotiations on climate change. The country believes that developed countries are mainly responsible for the climate change problem, due to increased urban and economic growth. As growth will continue to happen, there is a need for developing countries to manage the growth and act accordingly by reducing their GHG emissions. In order to meet the demands of living and raise their living standards, total GHG emissions are bound to increase in India as well as in other developing countries.

India being committed to a pathway of sustainable development, recently adopted a National Action Plan on Climate Change (NAPCC) that consists of various urban CO_2 emission reduction missions. The NAPCC outlines national level policies that address climate change mitigation as well as adaptation. The action plan identifies eight core areas and refers them as national missions to effectively mitigate and adapt climate change. They are "*National solar mission*", "*National Mission for Enhanced Energy Efficiency*", "*National Mission on Sustainable Habitat*", "*National Water Mission*", "*National Mission for Sustaining the Himalayan Ecosystem*", "*National Mission for a "Green India*" "*National Mission for Sustainable Agriculture*" and "*National Mission on Strategic Knowledge for Climate Change*" (NAPCC, 2008).

The NAPCC through these eight missions emphasize the need to maintain high standards of air quality, living conditions and economic growth. Accordingly, identifies strategies that promote sustainable development objectives and at the same time addressing climate change. Being a member of the Asia Pacific Partnership on Clean Development and Climate, the country actively participates at the UN Framework Convention on Climate Change (UNFCCC) and various international conferences to collaboratively develop and promote the usage of clean and environment friendly technologies.

National level climate change planning in India

Planning is the fundamental process required for promoting development. In India, the *"National Action Plan for Climate Change"* under its eight missions' only highlights the aims and goals related to CO_2 emission reduction, which the country has to achieve (Raparthi, K. 2015; Raparthi, K. 2014; Biesbroek et al., 2009). For instance within the NAPCC, the aim of the "National Solar Mission is to promote the development and use of solar energy for power generation and other uses with the

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ultimate objective of making solar competitive with fossil-based energy options." Likewise the goal of this mission is "to increase the use of solar thermal technologies in urban areas, industry, and commercial establishments". Therefore, the key role of the regional/local planning officials is to coordinate climate change (CO_2 reduction) activities/policies that are dominant in reducing climate change, and accordingly include such activities in the planning process to effectively reduce Climate change (Raparthi, K. 2015; Raparthi, K. 2014; Biesbroek et al., 2009).

In India, the idea of community participation and multi stakeholders in urban and regional planning is an accepted phenomenon in current day practice. The bottom up approach in Indian urban planning may be traced back to the late 1980's when Lindblom (1963) ideas of incremental planning, Davidoff's advocacy model and John Friedman's action-oriented model planning were widely welcomed among Indian urban planners, due to evident failures of the long-term master plans, concerning over-optimistic growth estimations and socio-economic problems of large scale development.

As such, India constitutional mandate (73rd & 74th Constitutional Amendment Act 1992) laid the foundation of citizen and stake holder's participation in urban / rural planning and also entrusted local Non-Governmental Organizations' (NGOs) and Community Design Centre (CDC) with the responsibility to intervene in the implementation process of plans with the participatory action of the public in great way. As such NGOs and CDCs advocates for participation in planning and they became the staging ground for professionals for such work.

Since, 1999, India has been actively engaging in multilateral negotiations in the UNFCCC. One of the main concerns of these negotiations is to reduce Climate change in the country. India as a developing country receives funding from the World Bank to focus on their emission reduction and the national government commissioned municipal governments to work towards emission reduction.

In regard to climate change, Betsill and Bulkeley (1999) identified that, lack of individual commitment to reduce Climate change is one of the main reason for not being able to effectively address CO_2 reduction. Hence, it is essential for communities to be effectively involved in the climate change planning process. As such planning for CO_2 emission reduction/climate change mitigation in Indian cities is necessarily a response to the environmental pressures and also to the pressures from the planning officials.

In sum, the interconnections between climate change and environmental planning and the potential role of public policy in dealing with climate change planning are prevalent. The theoretical framework of planning discourses and climate change response planning in India illustrates the significant interrelationships between the city's internal and external factors that shape local level actions. These interrelationships emphasize the technical political and policy aspects involved in the process of planning for climate change.

Need for the study

The main interest in undertaking this research is based on the fact that, many developing countries like India and China due to urbanization, emit high levels of CO_2 emissions into the atmosphere, in comparison to many developed countries (OECD, 2010). As a result, developing countries not only contribute significantly to climate change, but as a result also experience large number of calamities that result from climate change such as intense rainfall, flooding and high temperatures (IIR, 2010).

In response to climate change mitigation and natural calamities, this research focuses on a developing country like India and puts forth an effort to evaluate the ability of urban planning policies in reducing CO_2 emissions.

Impacts of climate change are expected to adversely affect many developing countries in the world. Environmental planning policies have been considered as a significant tool in promoting and regulating the development of cities (Raparthi, K. 2015; Raparthi, K. 2014; Kaiser & Godschalk, 1995). Adequate research has been conducted in analyzing the role of environmental planning policies in natural hazard reduction (Berke, Roenigk, Kaiser & Burdy, 1996), environmental protection (Berke et al., 1999) and promoting sustainability (Berke & Conroy, 2000). Recently, it has been analyzed that environmental planning polices also have an ability to address public health (APA, 2013).

Hence, environmental planning policies with their capability to influence growth and development patterns may also significantly mitigate or adapt to climate change (IPCC 2007; Bulkeley, 2006; Wilbanks & Kates, 1999). Nevertheless, research focusing on analyzing the impact of environmental planning policies on climate change is limited.

The purpose of this research is to evaluate the influence of environmental planning policies on climate change. Accordingly, this research puts forth an effort to assess whether environmental planning policies of Indian metropolitan regions help in mitigating or adapting to climate change. Specifically, the research questions this paper tends to answer is: Do India's master plans include and promote environmental planning policies that target climate change mitigation or adaptation?

Sample frame

Sample-frame for this research comprises of all the 64 metropolitan regions/urban agglomerations in India. These regions adopted master plans in year 2004 and implemented their policies by 2007.

The census in India is carried by the "*Office of the Registrar General and Census Commissioner*" under the "*Ministry of Home Affairs*". In 2005, The National Government of India identified and defined metropolitan regions/urban agglomerations as (a) an area consisting of a densely populated urban area (the central built-up area of a place and the suburbs which are usually linked by urban areas), (b) places having population of one million (1,000,000) or more, (c) with a local government (Municipal Corporation) and (d) at least three fourths of the adult male population employed in pursuits other than agriculture (Indian Economic Census, 2005).

In areas within the jurisdiction of municipal corporations, the flagship urban programs of Government of India (such as JnNURM) provide large funding to municipal corporations to undertake sustainability projects, climate change mitigation and adaptation projects and development of city infrastructure (water supply, drainage, solid waste management etc.).

Climate change researchers suggests that regional level needs to be priority targets for climate change mitigation action since, they are the primary population and economic centers As a result of high CO_2 emissions thereby contributing to climate change (IIR, 2010). Moreover, these 64 metropolitan regions/urban agglomerations represents a well organized administrative jurisdiction thereby tends to be appropriate for policy analysis. For all the above mentioned reasons, sample-frame for this research comprises of all the 64 metropolitan regions/urban agglomerations in India

Research methodology

The research identifies whether or not master plans of metropolitan regions/ urban agglomerations include and promote policies that target climate change mitigation. For this reason, it was necessary to understand the extent to which the master plans included climate change mitigation policies and also the extent to which they are successfully implemented.

A mixed method methodology was used to address the research question. Qualitative content analysis is used to conduct an in-depth analysis of policy framework of all the selected regional master plans. Later quantitative climate change mitigation policy index and climate change mitigation implementation index are developed and theoretically conceptualized as the measure of the extent to which urban planning policies within the development plans promotes climate change mitigation. Finally grounded theory approach is undertaken to generate a theory of planning action, which urban planners may tend to incorporate in their early stages of planning steps to address climate change.

The two climate change mitigation indexes (1) climate change mitigation policy index that identified the extent to which master plans developed climate change mitigation policies and (2) climate change mitigation implementation index that highlighted the extent to which the sampled master plans implemented (put to practice) the climate change mitigation policies. These indexes were developed by conducting an in-depth analysis of policy framework of all the for all the sampled 64 regions. master plans

Accordingly, the sampled master plans were evaluated against two evaluation protocols (table 1 and table 2). Grounded theory was used to develop the evaluation protocols. These protocols were developed based on the existing literature on environmental planning, climate change and plan implementation evaluation.

Calculating Climate Change Mitigation Index

The Climate change mitigation policy index in this research was calculated by using the *"Developing Index method"*, which was widely used by many researchers in evaluating the quality of a plan. The climate change mitigation implementation index was calculated by using the *"Plan Implementation Evaluation (PIE) method"* which was used by planning researchers to evaluate the implementation success of plans. Since, much of the research till date that focused on evaluating urban plans have adopted the above mentioned methods to develop indexes to evaluate comprehensive plans and their success in implementation (Raparthi, K. 2015; Raparthi, K. 2014; Laurian et al., 2007; Berke, 2007; Portney, 2003, Edwards, 2007 & APA, 2013). This research also tends to use the same technique. Accordingly the climate change mitigation policy index and implementation index for all the sampled 64 master plans were developed.

Climate Change Mitigation Policy Index

The development of the index includes five steps: The first step was to assign the scores for each policy on a scale of 0-1-2. Scores will be assigned based on the presence of the indicators that are mentioned in the evaluation protocol (see table 5.1). If the indicator was absent within a policy then, the score of the policy was "0". A score of '1' was assigned to policies which address the indicator but tend to be a suggestive policy. Words such *as 'may', 'should', 'prefer', 'encourage', 'suggest'* indicated the suggestive character of the policy. If the indicator was present in the policy and the policy was a mandatory policy then that policy receives a score of 2. Mandatory policies usually addressed keywords such *as 'shall', mandated', 'must', and 'will'*. The range of these scores was from 0 to 2 (Berke & Conroy, 2000; Edwards, 2007; APA 2013).

The second step was to sum all the indicator scores within each plan component. The third step involves calculating the fractional scores of each plan component. This was achieved by dividing the total of assigned scores for each plan component by the maximum possible scores of the plan component. (Maximum possible scores imply that all the indicators are mandatory. For example, if there were 5 indicators in a plan component, then the maximum possible score of that plan component was 10).

In the fourth step, the fractional scores were standardized by multiplying the fractional score by 10. So that scores for each plan component can be scaled on a range between 0 and 10 (as shown in equation 1).

$$SC_j = \frac{10}{2m_j} \sum_{i=1}^{m_j} I_i \quad \text{(Equation 1)}$$

Where SC_j represents the jth plan component standardized score; m_j represents the number of indicators within the jth plan component (scale 0-10); I_i represents the ith plan components' scores (sale 0-1-2).

The fifth step involved calculating, the mitigation policy score of a city's master plan. This was achieved by adding up the standardized score of all the plan components (as shown in equation 2).

$$\text{Policy Index}_{City1} = SC_a + SC_b + SC_c + \cdots SC_j \quad \text{(Equation 2)}$$

Where policy index$_{city1}$ represented the climate change mitigation policy index of region 1's master plan, SC_a, SC_b, SC_c....SC_j represented the standardized scores of the plan components in region 1's master plan.

The climate change mitigation policy index ranges from 0 to 100. Assuming that there were 10 plan components and all the plan components achieved a standardized score of 10. Then the raw mitigation index of such a plan is 100.

Climate Change Mitigation Implementation Index

In addition to the master plan's policy evaluation for climate change mitigation, the implementation potential of the master plan was also assessed using the plan implementation capacity evaluation protocol that consists of ten implementation indicators (table 5.2). Absence of the implementation indicator was coded as '0'. A score of '1' was given if the implementation indicator was *"mentioned but not in detail"* (suggestive). Indicators that were *"mentioned in detail"* (mandatory) were assigned a score of '2'.

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The implementation index" of a city was calculated as the ratio of the indicator capacity score received by each city's plan to the maximum possible score any city plan can achieve and multiplied it by 100 (In this research, the maximum possible points any city can achieve is 20 points (10x2) since there were 10 indicators against which the implementation capacity of a city was being evaluated.)

$$\text{Implementation Index}_{City1} = \left(\frac{\text{Indicator Capacity Score}}{20}\right) \text{ X100} \quad \text{(Equation 3)}$$

The climate change mitigation implementation index ranges from 0 to 100. Assuming that for a city's plan all the 10 implementation indicators were *"mentioned in detail"* then the Implementation Score is (10 x 2)/20 multiplied by 100 which is 100.

Accordingly, by calculating both the climate change mitigation policy index and implementation index for each city master plan, it was able to deduce whether planning polices within the master plan had an ability to influence climate change mitigation within the city. Thereby addressing the research question - Do master plans include and promote policies that target climate change mitigation?

The climate change mitigation policy index was developed by evaluating the planning policies within the master plans against the policy evaluation protocol (table 1). Likewise, the climate change mitigation implementation index was developed by evaluating the planning policies against the plan implementation protocol (table 2). Accordingly, these protocols evaluated the plans for their ability to address mitigation projects and their ability to successfully implement the addressed projects. These policies were scored/ coded based on an indicative scale of the meanings for the values that are to be assigned and eventually the climate change mitigation index was developed. As such, climate change mitigation indexes were theoretically conceptualized as the measure of city master plans to include and promote urban planning policies that significantly promote climate change mitigation/ adaptation.

Findings: Evaluation Protocols

Using the grounded theory two evaluation protocols (table 1&table 2) were developed. These protocols consist of a set of indicators that tend to have a significant impact on climate change mitigation and ability of the policies to be successfully implemented are developed.

In specific planning policies related to land use, urban design, physical planning, building specifications, transportation, environment, incentive tools, educational tools, attainment tools and physical infrastructure were analyzed. Table 1 describes the protocol against which the master plans were evaluated for the presence of climate change mitigation policies. In addition, it was necessary to evaluate the plans for their implementation capacity. Accordingly, table 5.2 describes the protocol against which the master plans were evaluated for their implementation capacity.

As such, conducting a detailed analysis by evaluating the master plan against the two developed evaluation protocols helped in analyzing the presence and success of implementation of the listed climate change mitigation related policies in the master plans.

Table 1 Policy Evaluation Protocol

Plan Component	Recommended Climate Change Mitigation indicators
1.Land use	Promotes: 1. Mixed use development 2. Brownfield (or Greyfield) redevelopment 3. Infill development 4. Limiting use or limits use of hazardous areas/ marginal areas (Overlay zones/ reduced densities)
2. Urban Design	Promotes: 5. High density development

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	6. Urban landscape development
	7. Has proposals/actions to decrease urban heat island effect (urban forests, tree lined streets)
	8. Has regulations on building height/ orientation guidelines, street width to building height ratios
3. Physical planning	Requires:
	9. Site plan review for land suitability assessment
	10. Setbacks/Buffers
	11. Subdivision regulations
4.Building specifications	Requires/Promotes use of :
	12. Solar PV panels and wind turbines on roofs
	13. Storage, collection and recycling of wastes
	14. Water-efficient construction
	15. Recycling of grey-water
	16. Rainwater harvesting
	17. On-site water treatment
	18. Building standards/code for enhanced protection.
5. Transportation	Requires/Promotes use of :
	19. Creating /implementing /enhancing public transportation systems
	20. Transit oriented developments
	21. Car sharing and car pooling
	22. Increased public transportation stops/nodes
	23. Creation/ upgrading of bicycle paths
	24. Creation/ upgrading of pedestrian facilities
	25. Management of no traffic zones
6. Environment	Promotes:
	26. Environmentally sensitive area protection (national/state parks)
	27. Conservation of forests, vegetation, and riparian areas
	28. Creating wildlife corridors
	29. Preventing habitat fragmentation
	30. Sediment and erosion control regulation
	31. Wetlands restoration
7. Incentive tools	32. Subsidized mass transit / incentives for car pooling
	33. Impact fees for development in ecologically sensitive areas
	34. Density bonuses
8. Educational tools	35. Education and outreach program during plan implementation
	36. Training/Technical assistance to developers or property owners
9. Attainment tools	37. Land and property acquisition
	38. Transfer/Purchase of development rights
10. Physical Infrastructure	39. Maintenance of public Infrastructure
	40. Capital improvements for developments

Source: Developed by the author

Table 2 Plan Implementation Protocol

Implementation Indicators
1. Initiation of NGOs, CDCs, Research Institution
2. Designation of responsibility for implementation
3. Funding for implementation
4. Timetable for implementation
5. Sanctions for failure to implement
6. Regular update of the projects
7. Provisions for technical assistance
8. Monitoring of environmental and human impacts
9. Public participation process in monitoring and review
10. Provision of plan response to new information/ data

Source: Developed by the author

5. ANALYSIS

It was analyzed that planning policies related to development and urban design such as promote high density development, building height/ orientation guidelines, street width to building height ratios, inter connected street system, proposals/actions to decrease urban heat island effect (urban forests, tree lined streets), providing commercial services to reduce frequent travel and locating schools within a five minute walk and work places close to homes are important planning tools with potential for reducing climate change and promoting the development of a low carbon footprint regions.

Moreover, mandating site suitability analysis studies helps in directing the growth and development away from vulnerable areas. In addition, setbacks and subdivision regulations can be used to increase density of development in safe locations which are away from vulnerable areas. In this context, an extensive coverage of the above mentioned planning polices in the master plans is encouraged because they tend to be effective in mitigating climate change at the urban level.

Likewise, transportation planning policies were also capable of enhancing climate change mitigation at the urban level. Transportation sector was one of the most important target for reducing climate change since, use of fossil fuels by private vehicles emit huge amounts of CO_2 into the atmosphere and these vehicular emissions continue to increase until unless the need for driving is reduced (Potter, 2003). Vehicular emissions can be controlled by significantly promoting planning policies that tend to promote opportunities that focus on reducing vehicle miles travelled (VMT) and increasing the use of mass transit or other alternative forms of transportation. Primarily, local transportation planning policies that promote public transit, bicycle paths, walk ability and intelligent transportation systems can further enhance CO_2 emission reduction at the urban level through master plans.

Planning policies related to education tools component received a mean standardized score of 5.68 points which is nearly 60% of the maximum possible standardized score. This planning component was considered to be important within the framework of policy support and communication for mitigating climate change. Theoretical research conducted by earlier researches suggested that it is essential to enhance civic capacity within a community which is achievable through awareness of climate change and promotion of education activities. Hence, the policies related to educational and technology planning component

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prove to be effective in implementing climate change mitigation policies at the urban level (Raparthi, K. 2015; Raparthi, K. 2014; Brody, Zahran, Grover, & Vedlitz, 2008).

As the relatively moderate standardized score against the education tools component indicate that most of the master plans within the sample have an adequate coverage of planning policies that focus on education and awareness but are not mentioned in detail. Hence, it is possible to promote climate change communication and knowledge within the community by addressing these policies in detail. Eventually, an increased community involvement and information on issues related to climate change mitigation will promote mainstreaming of climate change mitigation at the local level through an appropriate policy action.

On the other hand, it was analyzed that, planning polices related to building specifications received a standardized score of 5.30. Till date, most of the research related to climate change suggests that design standards such as use of solar PV panels and wind turbines on roofs, recycling of grey-water, storage, collection and recycling of wastes, on-site water treatment and building standards/code for enhanced protection are important tools for mitigating climate change (Raparthi, K. 2015; Raparthi, K. 2014; Steemers, 2003).

In addition, a low mean standardized score for incentive tools (5.39) was also indicated. Lack of policies concerning these indicators within the master plans is alarming. Deficiency of planning policies addressing building specifications and incentive tools within the master plans is expected to impede climate change mitigation efforts. Since, these policies have an ability to motivate members of the community to support and adopt initiatives and programs that are inclined towards personal costs. There is a need for communities to address these policies much more in detail to effectively mitigate climate change.

With regard to climate change implementation indexes, the overall mean implementation index scores was 65 points. This implementation index score highlighted that most of regional master plans were implemented. Results of the implementation scores highlight that implementation aspects that were important for the planning polices to be implemented were addressed in detail in the master plans. Thereby, indicating that most of the sampled plans included a range of climate change mitigation policies and most of the addressed policies were promoted. On the other hand, it was also identified that even though some plans had potential policies written, there was a lack of adequate capacity for the plans to be implemented.

Implications for Practice of Climate Change Planning In India

This research involved identifying whether or not master plans promote and include policies that target climate change mitigation. Results of this research tend to have considerable policy implications and recommendations for urban planners.

Climate Change Mitigation Indexes

This research findings highlight that, it is necessary to bridge the gap between research and policy-making or integrate research with policy-making and plan implementation, which tend to happen more often in isolation. Detailed content analysis of the policy framework of all the sampled master plans and textual analysis of case studies/publications of metropolitan regions/urban agglomerations that attained high policy and high implementation indexes highlights that most of the climate change mitigation initiatives were carried out in a bottom-up, action oriented, communicative and mutual – learning approach.

Successful implementation of climate change initiatives of high indexed metropolitan regions/urban agglomerations mainly emphasized three principles. They are: a) promoting interactions and discussions with researchers and policy makers as such emphasizing mutual learning, b) undertaking research and implementation simultaneously and c) documenting the initiatives with case studies.

The city of Delhi emphasized on promoting interactions and discussions was carried out by conducting a series of events, workshops that aimed at linking both the researchers and the policy-makers. Accordingly, this helped researchers and policy-makers to share views understand the barriers and discuss the challenges of CO_2 emission reduction within the city and develop strategies that were able to be practiced on ground.

The city of Mumbai highlighted that it was essential to undertake research and implementation simultaneously to effectively implement the climate change mitigation initiatives. Most of the projects in this city were undertaken in collaboration

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with research organizations and universities in the city. Accordingly the partnership resulted in highlighting the benefit of using "*Scheffler parabolic dishes for solar powered air conditioning*" in Thane. As such, by linking researchers with policy makers and integrating them with the act of plan-implementation is double- folded. The government officials had the opportunity to gain knowledge about new cost effective technologies for air conditioning thereby reducing climate change Likewise, this helps researchers gain insights of the on-ground challenges of implementation which included but not limited to financial and budget issues. As such the city was successful in implementing the pilot project.

Besides, from the case study publications it can realized that it is essential to communicate and document the local pilot projects that promote sustainable development. Communicating the projects through web-knowledge platforms as well as documenting the projects and programs, in the form of case studies helps to learn lessons from experiences and also helps in identifying challenges and barriers. Publications of case studies have the ability to showcase the complex and technical innovations in a comprehensible manner. Thereby help in sharing and gaining knowledge as well as promote awareness of sustainable development.

In sum, master plans have the ability to introduce institutional solutions across thematic areas, such as land use, transportation, urban design and zoning that target the respondent. In this context, master plans tend to be the ideal tool for climate change mitigation as they impact all aspects of community growth and implement national and regional level commitments that tend to be effective in reducing climate change. Master plans therefore should be the logical choice for local action.

This research highlights that most master plans contain a number of planning policies that address climate change mitigation. However, to comprehend the potential of climate change mitigation policies in the master plans, it is essential to facilitate the implementation of the urban planning policies that reduce climate change at the local level.

Generally, lack of efficient policies and implementation procedures tend to limit the achievement of climate change mitigation benefits. Hence, it is necessary for metropolitan regions/urban agglomerations to continue developing climate change mitigation policies and implement them. The planning policies that were identified by using the climate change mitigation protocols (table 1 and table 2) can be helpful in providing climate change mitigation benefits. Hence, it is necessary to effectively develop and implement policies based on those indicators that were listed in the evaluation protocol to continue mitigating climate change at the local level

Besides, successful implementation of the developed policies can be achieved by working with NGOs, integrating research, policy making and plan implementation, strengthening and promoting public participation, clearly designating responsibilities to the responsible management, creating a timetable for monitoring and regularly updating the climate change mitigation policies in the master plans. These are some of the urban planning actions that tend to be helpful in effectively implementing the climate change mitigation policies in the master plans of Indian metropolitan regions/urban agglomerations. Moreover, developing an institutional framework to mitigate climate change at the local level and an appropriate allocation of the necessary funds might prove to be help in the successful implementation of planning policies in the master plans.

Overall, the most important policy implication of this research is the need to instigate local level, action oriented strategies that mitigate climate change. Many international negotiations and researchers contend that climate change mitigation is a global, national and state level issue. They advocate that climate change mitigation requires analysis at national (macro) levels and cannot be essentially achieved at the regional level. However, the results of this dissertation highlight that climate change mitigation can also be achieved at the regional level by analyzing the socio-economic characteristics of the community and also by influencing individual and organizational behavior to promote behavioral changes that lead to reduced emissions..

Besides, detailed textual analysis of the policy framework and their implementation framework highlights that there is the need to work with NGOs and bridge the gap between research and policy making. This can be achieved by integrating research, policy making and implementation through mutual learning as such by selectively drawing the opportunities and skills of practitioners and researchers.

Results of this research also emphasize the need to identify potential conflicts between local city priorities and climate change mitigation goals. Generally, cities tend to host a large pool of skilled manpower required for many commercial activities and they are mostly considered as a market place for most of their finished goods (Sassen, 1991). However, this study highlights that cities with intense commercial activities tend to have increased CO_2 emissions. So, from climate change mitigation perspective, it is necessary to regulate the growth of commercial sector within a city. Even though new commercial services have

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a potential in improving the local economy, they are most likely to result in an increased CO_2 emissions thereby reducing the ability of the city to mitigate climate change. As a result, climate change mitigation policies have a tendency to contend with the local socio-economic opportunities.

For this reason, it is necessary to explore new innovative means and integrate research with policy making to limit local emissions. One possible way is to promote the development of regional emissions control partnerships, wherein a group of cities can share the economic benefits while keeping CO_2 emissions under control. Another option can be that of promoting regional carbon credit exchange thereby allowing commercial industries to trade emissions. Cities that have higher carbon emissions can negotiate with cities that have lower carbon emissions (exchange of carbon credits) and as a result maintain an equal share of CO_2 emissions.

Results of this research also highlights that employment in NGOs has a negative relationship with CO_2 emissions. Likewise, female literacy also has a negative relationship with CO_2 emissions. These results are in line with some of the findings from various NGOs located in India. Most of the NGOs in India are mostly carried/ administered out by women; as such have high female employment within the NGOs. Accordingly, cities that have high female literacy are employed in the NGOs and most of the climate change policies are usually implemented by the NGOs. This has been described briefly in chapter 3 of this dissertation. Hence, results regarding female literacy and percentage of employment in NGOs tend to support Wheeler and Hammer (2010) and also tend to be true in India.

Based on the overall results, the final recommendation are to a) mainstream climate change mitigation in urban planning and b) integrate NGOs, climate change research, policy making and plan implementation. This can be achieved by developing an integrated framework that bridges the gap between researchers, policy makers' and integrating climate change mitigation goals with the developmental objectives. If development policies are effective and are sensitive towards climate change mitigation then, it can be anticipated that the ensuing development would be sustainable and can further enhance urban sustainability.

Currently, Indian metropolitan regions/urban agglomerations have very limited resources to achieve a sustainable development. However, there is an immense pressure from higher levels of governance to allocate resources towards climate change mitigation. Allocation of resources towards climate change mitigation is a unique opportunity to develop an integrated urban planning strategy at the regional level wherein master plans acts as a tool for implementing the climate change mitigation actions. For instance, an urban planning policy that focuses on increasing the accessibility and availability of public transportation is mostly regarded as an economic necessity.

However, this research highlights that the same urban planning policy also tends to have climate change mitigation benefits. Hence, use of such policies that have an ability to serve the dual purpose of climate change mitigation as well as local development are most likely able to facilitate cities in accessing climate change mitigation funds thereby add to the local resources that are available for mitigating climate change at the local level. Convergence of urban planning policies will not only help in achieving an efficient utilization of resources but also facilitates a sustainable development.

Hence, this research highlights that there are benefits that arise from integrating research and policy making. From the research perspective integration emphasizes that incorporating the research results to frame policies. From the policy perspective, integration highlights framing the policies based on research insights. This may involve the identification of the needs of both researchers and policy makers, translating and communicating back and forth research findings from researchers to policy makers and research needs from policy makers to researchers, developing forums for sharing information's and mutual learning. As such, this type of integrating needs deep interactions and requires development of bottom-up governance structures that focus on collaboration and sharing power rather than structures that are built to enforce or control.

Besides, academics may focus on encouraging more policy oriented research and mixed method research towards climate change and sustainable development, Thereby develop climate change research proposals that incorporate active involvement of the researcher in conducting research and exploring innovative social ideas that can effectively mitigate climate change.

REFERENCES

Agyeman, J., Evans, B., & Kates, R. (1998). Greenhouse gases special: Thinking locally in science, practice and policy. Local Environment, 3(3), 245-246.

Bell, B. D. G. K., & Batterson, C. (1978). Service utilization and adjustment patterns of elderly tornado victims in an American disaster. *Mass Emergencies, 3*, 71-81.

Berke, P. R., & Conroy, M. M. (2000). Are we planning for sustainable development? An evaluation of 30 comprehensive plans. *Journal of the American Planning Association, 66*(1), 21 33.

Berke, P., & Godschalk, D. (2008). Searching for the good plan: A meta-analysis of plan quality studies. *Journal of Planning Literature, 23*(3), 227-240.

Berke, P. R., Godschalk, D. R., Kaiser, E. J., & Rodriguez, D. (2006). *Urban land use planning: 5th edition*. Champaign, IL: University of Illinois Press.

Berke, P. R., Godschalk, D. R., Kaiser, E. J., & Rodriguez, D. (2006). *Urban land use planning: 5th edition*. Champaign, IL: University of Illinois Press.

Berke, P., Backhurst, M., Day, M., Ericksen, N., Laurian, L., Crawford, J., & Dixon, J. (2006). What makes plan implementation successful? An evaluation of local plans and implementation practices in New Zealand. *Environment and Planning B-Planning & Design, 33*(4), 581-600.

Berke, P. R., & French, S. P. (1994). The influence of state planning mandates on local plan quality. Journal of Planning Education and Research, 13, 237-250.

Berke, P., & Godschalk, D. (2008). Searching for the good plan: A meta-analysis of plan quality studies. *Journal of Planning Literature, 23*(3), 227-240.

Betsill, M., & Bulkeley, H. (2007). Looking back and thinking ahead: A decade of cities and climate change research. Local Environment, 12(5), 447-456.

Betsill, M., & Bulkeley, H. (2007). Looking back and thinking ahead: A decade of cities and climate change research. Local Environment, 12(5), 447-456.

Birkmann, J. (2007). Risk and vulnerability indicators at different scales: Applicability, usefulness and policy implications. *Environmental Hazards, 7*(1), 20-31.

Brody, S. D. (2003a). Are we learning to make better plans? A longitudinal analysis of plan quality associated with natural hazards. *Journal of Planning Education and Research, 23*(2), 191-201.

Bulkeley, H. (2006). 'A Changing Climate for Spatial Planning' in 'Is the Issue of Climate Change too Big for Spatial Planning?' *Planning Th eory and Practice*, 7(2), pp. 201–30.

Faludi, Andreas. (1973). A reader in planning theory. Oxford; New York: Pergamon Press.

Friedman, John. (1973). Retracking America: A Theory of Transactive Planning. Garden City, NY: anchor Press

Godschalk, D. R., Beatley, T., Berke, P., Brower, D. J., & Kaiser, E. J. (1999). Natural hazard mitigation: Recasting disaster policy and planning. Washington, DC: Island Press.

Godschalk, D. R., & Mills, W. E. (1966). A collaborative approach to planning through urban activities. Journal of the American Planning Association, 32(2), 86-95.

Godschalk, D., Parham, D., Porter, D., Potapchuk, W., & Schukraft, S. (1994). Pulling together: A planning and development consensus building manual Ensuring sucess: Meeting & management. Washigton DC: Urban Land Institute.

Godschalk, D., Edward J. Kaiser, & Berke, P. R. (1998). Integrating hazard mitigation and local land use planning. In R. J. Burby (Ed.), *Cooperating with nature* (pp. 85-118). Washington, DC: Joseph Henry Press.

Hunt, A., and P. Watkiss (2007). 'Literature Review on Climate Change Impacts on Urban City Centres: Initial Findings'. ENV/EPOC/GSP(2007)10. OECD, Paris, France.

Hunt, J. (2004). How can cities mitigate and adapt to climate change? Building Research & Information, 32(1), 55-57.

Kaiser, E. J., David R. Godschalk, and F. Stuart Chapin, Jr. 1995. Urban Land Use Planning, 4th ed.

Laurian, L., Day, M., Backhurst, M., Berke, P., Ericksen, N., Crawford, J., Dixon, J., & Chapman, S. (2004). What drives plan implementation? Plans, planning agencies and developers. *Journal of Environmental Planning and Management, 47*(4), 555 - 577.

Portney, K. (2003). Taking Sustainable Cities Seriously: Economic Development, the Environment, and Quality of Life in American Cities. Cambridge, MA: The MIT Press.

Post, J., & Altman, B. (1994). Managing the environmental change process: Barriers and opportunities. *Management, 7*(4), 64-81

Nicholls, R. J. (1995). Coastal megacities and climate change. *Geojournal, 37(3)*, 369- 379.

Raparthi, K. (2014). Assessing Smart Growth Strategies in Indian Cities: A Grounded Theory Approach to Planning Practice". Journal of Urban planning and development. 10.1061/(ASCE)UP.1943-5444.0000267 , 05014031. ISSN (print): 0733-9488. American Society of Civil Engineers.

Raparthi, K. (2015). Analyzing the Relationship between Environmental Planning Policies and Climate Change: Multinomial Logit Regression Model Evaluation of Tarrant County, Texas. Current Urban Studies, 3, 1-10

Revi, Aromar (2008). 'Climate Change Risk: An Adaptation and Mitigation Agenda for Indian Cities', *Environment and Urbanization*, 20(1), pp. 207–30, April.

Tauxe, C. S. (1995). Marginalizing public participation in local planning: An ethnographic account. Journal of the American Planning Association, 61(4), 471-481.

Wheaton, E., & Maciver, D. (1999). A framework and key questions for adapting to climate variability and change. Mitigation and Adaptation Strategies for Global Change, 4(3), 215-225.

Wheeler, S. M. (2008). State and municipal climate change plans: The first generation. Journal of the American Planning Association, 74, 481-496.

Wheeler, D. and Hammer, D. (2010). The Economics of Population Policy for Carbon Emissions Reduction in Developing Countries. CGD Working Paper 229. Washington, D.C.: Center for Global Development. http://www.cgdev.org/content/publications/detail/1424557

Wilbanks, T. J. (2003). Integrating climate change and sustainable development in a place-based context. Climate Policy, 3(Supplement 1), S147-S154.

Wilbanks, T. J. (2005). Issues in developing a capacity for integrated analysis of mitigation and adaptation. Environmental Science & Policy, 8(6), 541-547.

Wilbanks, T. J., & Kates, R. W. (1999). Global change in local places: How scale matters. *Climatic Change, 43*(3), 601-628.

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