Editorial Board

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EDITORIAL

Unlocking urbanization: lessons from India on the state of practice

Editor-in-Chief: Prof. Thallak Gundurao Sitharam

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Welcome to the Volume 2 Issue 1 of the Journal of Sustainable Urbanization, Planning and Progress (JSUPP). It gives me great pleasure to introduce the special edition titled "*Unlocking Urbanization: Lessons from India on the State of Practice*". In keeping with the journal's mission to provide leadership in research in the areas of urbanization and planning around the world and progress made in Asia, in particular, this special edition addresses urbanization issues and efforts for transformative change in Indian Cities. The papers in this issue bring out the challenges faced by a fast-urbanizing city of Bengaluru in south India and the approaches that have been evolved to address them.

Urbanization, while bringing prosperity, has also led to environmental degradation and infrastructure problems, like poor quality of air and water, unreliable power, and traffic congestion. Often, our basic need for clean air, water and environment conflict with those of economic goals of growth and therefore, adopting sustainable practices is a decision that needs to be made consciously and consistently. This special edition examines a globally emerging economic powerhouse and a fast-urbanizing world city, Bengaluru, India, from the lens of sustainability and how the typical 40 to 100 year lock-ins of planning decisions made today will impact the city's live ability and its competitive status in the global economy. It shows how urbanization presents a tremendous opportunity in creating momentum for solutions, thus bringing about a virtuous cycle of positive change across urban sectors and ultimately enhancing the quality of life for a large number of residents.

Encouraging cities to embrace a more sustainable path requires initiating a process towards efficient use of natural resources, empowering people and building capacity in governance. There is a need for extensive outreach aimed at strengthening capacities, sharing best practices and providing a learning platform for all stakeholders. Given that the next decade present a unique opportunity to influence policy and decision makers to intelligently leverage investments being made in cities, the paradigm shift needed is the ability to seamlessly translate ambitious schemes and reforms on-ground. In this scenario, are there institutions, processes and solutions which can incrementally address the challenges urbanization presents? This is an urgent need to insert and establish sustainable best practices and the six cases presented in this edition explicitly examine the methods adopted for incremental change where the principal goal was to improve systems and decision making in urban sectors. This was done by applying tools to carry out assessments and using the results to identify and push for reforms.

The papers on unlocking urbanization and participatory planning speak to the theme of building capacity of various stakeholders and how equipped with information and the right tools, they can enable trans-formation in cities. The papers on Bengaluru's public transport and reimagining of its Peripheral Ring Road papers address the infrastructure issues in the city and how ensuring transport and land use integra-tion can not only address the current problems but can ensure the future sustainability and viability of these networks and the city. The papers on Water and Bengaluru's solar potential deal with the pertinent issue of how to efficiently utilize and manage resources and contribute to a circular economy. Several of these papers highlight case studies to illustrate a symptomatic problem, its genesis and potential solutions, further analysing with respect to scale. Summary of each of the contributed paper in Volume 2 Issue 1 of JSUPP is as follows:

The first paper talks about the "Unlocking Urbanization"

India is going through the early phase of urbanization with 33% of its citizens currently living in urban areas, with the number expected to go up to 40% by 2030. The sudden growth in Indian cities has led to challenges in infrastructure provisioning and service delivery which have not kept pace. Evidence in the form of case examples from across cities point to the possibility that there is

room for leveraging disruptive innovation in filling the space in efficient service delivery via institutions outside the formal public setup. In the context of the gaps in governance, this paper seeks to examine the role of institutions and the potential of coalitions as 'agents of change' that can empower and equip the government and citizenry with technical capacity and methodologies for action, enabling sustainable development and eventually, triggering broader cross-sectoral, city-wide transformation.

Second paper discusses on the Participatory Planning in Indian Cities

In some states, at the level of the smallest administrative unit, i.e. the electoral ward, there are institutionalised processes that enable citizen engagement through ward committees. However, in most cases, with limited mechanisms to enable participatory planning processes, the impact is diminished. Supporting programs such as capacity building for government officials and awareness building amongst citizens to engage effectively, guidelines to be followed for effective participative processes are integral for effective engagement. This paper analyses and evaluates practises of participative local area planning in India, particularly at the level of electoral wards and highlights successful models of engagement and processes that allow for effective participatory planning and identifies learnings that help overcome barriers to the process.

Third paper discusses about how to Enhance Bangalore Public Transport

This paper models trip scenarios emphasising increase in public transport supply and generates sustainable transport models for the city. This study also identifies two major barrier to the enhancement of the city's public transport network – lopsided investments in mass transit modes and the presence of a fractured institutional framework for transport in the city. Where conventional solutions addressing congestion within the city – such as road widening, creating one ways and building grade separators such as flyovers and underpasses – have failed to address the issue, and at the current rate of increasing vehicular volumes, the city's roads are forecast to be completely saturated by 2025. This paper's premise is that public transport serves as the sole sustainable solution to Bengaluru's chronic congestion and that only a large mode-shift towards public transport by 2025 can help reduce congestion on the city's roads.

Fourth paper highlights regarding the Ring Roads as a Catalysts for the growth of the city

The Peripheral Ring Road (PRR) was envisioned as a mere bypass to 'decongest an already crowded Outer Ring Road (ORR) and prevent long distance private vehicles from entering the city centre'. This approach led to the mega project being imagined as a mere strip of road on the ground, intersected by a few National Highways that entered the city, and land was sought only for the road's proposed length and width. As a result, the inherent potential of the PRR to increase the value of the adjoining land; surge the change of land use and building construction applications along with it and increase in the frequency of land transactions was not recognised. PRR could be reimagined to not only be financially more feasible and time bound for government agencies, but also to serve as a catalyst to plan and finance urban expansion.

Fifth paper discusses on an important problem of water and presents Making Water Flow in the city of Bengaluru

Today as one of the fastest growing cities in the world, Bengaluru is unusual in the fact that it is an old city, located at a distance from perennial sources of fresh water. This paper traces the evolution of Bengaluru's water supply infrastructure from the precolonial past into the present day. We posit that the shift of the city's dependence on water from local to distant sources, with the advent of technology and the introduction of centralized piped water, has weakened local residents' and policy makers' awareness of the importance of conservation of local ecosystems. The resulting degradation and conversion of the city's water bodies have reduced the resilience of Bengaluru to flooding and drought, especially affecting the poorest and most vulnerable of its residents. In an era of increasing climate change, the study stresses the need to develop an integrated perspective that considers the importance of local ecosystems as commons for increased urban resilience.

Sixth paper talks about the Solar Potential in the city

Solar energy is a key component of cities' climate mitigation and energy security plans, due to its ease of installation & operation and drastic decline in costs. In Bengaluru, residential, commercial and industrial (C & I) consumers contributed to around 85% of the electricity consumption and resultant emissions during 2014 and 2015. What are the options for these consumers within the ambit of current policies to procure solar power? Are changes required in these policies to scale up the adoption of solar power? The study explores two possible options – off-site procurement, where grid-connected solar power projects in Karnataka, commissioned before 31 March 2018, were exempted from payment of wheeling, banking charges and cross subsidy surcharge for the first 10 years for sale to 3rd party customers, which, for certain categories of

consumers (commercial), made solar energy more viable and on-site procurement which allows export of excess power to the grid of solar energy.

References

[1] Dhindaw J, Ganesan K and Pai M, 2017, Unlocking urbanization – leveraging coalitions for transformative change in Indian cities. *Journal of Sustainable Urbanization, Planning and Progress*, vol.2(1): 4-17. http://doi.org/10.18063/JSUPP.2017.01.006

[2] Maiti S and de Faria J V, 2017, Participatory planning processes in Indian cities: its challenges and opportunities. *Journal of Sustainable Urbanization, Planning and Progress*, vol.2(1): 18-33. http://doi.org/10.18063/JSUPP.2017.01.001

[3] Mukherjee A, Toshniwal R and Mulukutla P, 2017, Enhancing Bengaluru's public transport network: approaches and challenges. *Journal of Sustainable Urbanization, Planning and Progress*, vol.2(1): 34-46. http://doi.org/10.18063/JSUPP.2017.01.005

[4] Mathews R, Pai M, Sebastian T, *et al*., 2017, Reimagining the peripheral ring road of Bengaluru as an area development project. *Journal of Sustainable Urbanization, Planning and Progress*, vol.2(1): 47-62. http://doi.org/10.18063/JSUPP.2017.01.004

[5] Unnikrishnan H, Mundoli S and Nagendra H, 2017, Making water flow in Bengaluru: planning for the resilience of water supply in a semi-arid city. *Journal of Sustainable Urbanization, Planning and Progress*, vol.2(1): 63-72. http://doi.org/10.18063/JSUPP.2017.01.002

[6] Thanikonda A K and Krishnan D S, 2017, Strategies to harness Bengaluru's solar potential. *Journal of Sustainable Urbanization, Planning and Progress*, vol.2(1): 73-82. http://doi.org/10.18063/JSUPP.2017.01.003

RESEARCH ARTICLE

Unlocking urbanization – leveraging coalitions for transformative change in Indian cities

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Abstract: India is going through the early phase of urbanization with 33% of its citizens currently living in urban areas, with the number expected to go up to 40% by 2030. The sudden growth in Indian cities has led to challenges in infrastructure provisioning and service delivery which have not kept pace. Evidence in the form of case examples from across cities point to the possibility that there is room for leveraging disruptive innovation in filling the space in efficient service delivery via institutions outside the formal public setup. In the context of the gaps in governance, this paper seeks to examine the role of institutions and the potential of coalitions as 'agents of change' that can empower and equip the government and citizenry with technical capacity and methodologies for action, enabling sustainable development and eventual, triggering broader cross-sectoral, city-wide transformation.
Keywords: leverage investments, coalitions, agents of change, service delivery, governance, urbanization

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1 India's Urbanization

India, though rapidly urbanizing, is in the early phases of urbanization with 40% of its citizens expected to live in cities by 2030. Five states – Tamil Nadu, Gujarat, Maharashtra, Karnataka and Punjab – are likely to have more urban than rural populations. Of these, Mumbai and Delhi will be among the five largest cities in the world by 2030[1]. This means that an additional 220 million people will call urban India home over the next decade and a half. While Indian cities' global presence has led to increased incomes, negative externalities such as overstressed infrastructure, unequal access to water, unreliable power supply, air pollution and traffic congestion in the city, have also arisen.

As per World Bank, India will lead the world's urban population surge by 2050 along with China, Indonesia, Nigeria and the United States. A study at IIHS estimates that India will add at least 300 million in the next three decades (2011–2031) and have 78 cities with a population of over a million – the second largest urbanization in human history, after China's[2]. While urban transformation is not being viewed with urgency in India, China is internally developing every element of the urbanization

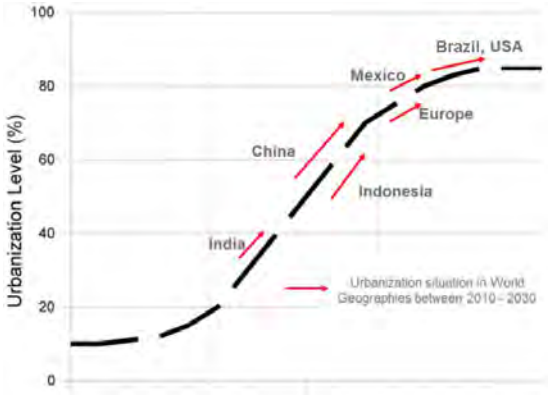

Figure 1. 2010 and 2030 Urban Population Projections in World Geographies plotted on an urbanization S curve.

operating model, right from funding, governance, planning, sectoral policies, to the pattern of urbanization, both across the nation as a whole and within cities themselves. When compared to China, India spends only 1/10th of per capita on capital investments on its urban infrastructure annually – i.e., India's $17 vs China's $116. Moreover,

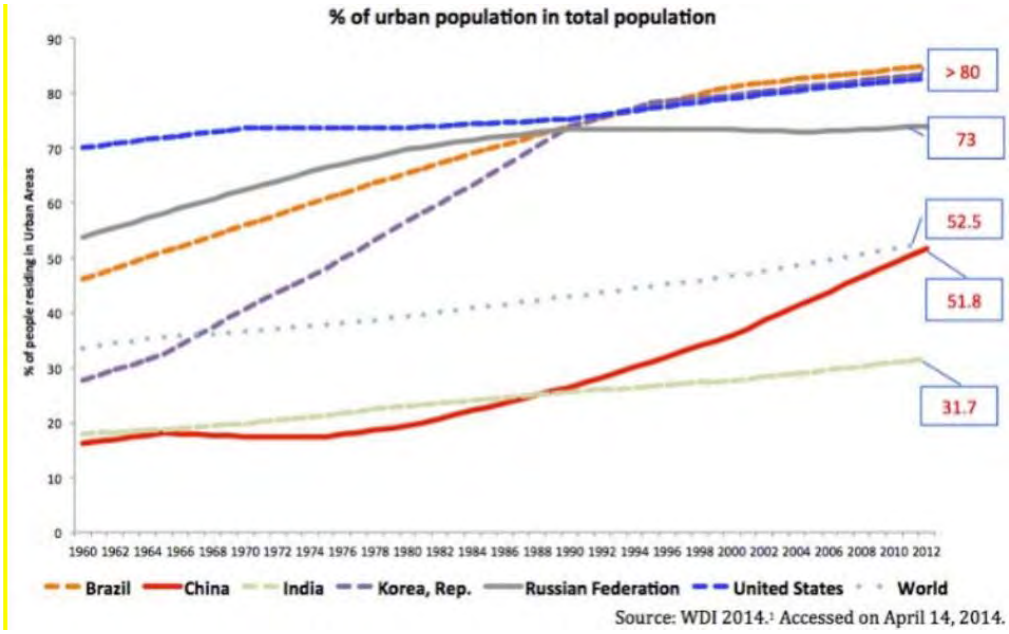

Figure 2. Percentage of urban to total population in countries.
Source: World Development Indicators 2014, World Bank

China has a mature planning regime with powerful political appointees as mayors, as opposed to India's devolved power and accountability to its cities.

Of the 220 million expected to be living in India's urban areas in 2030, 100 million will be born in or go to the top 10 cities in India. The remaining will be born in or go to the next 90 cities of India's top 100 cities. Most of the immigration in top 10 cities will be into slums or on the urban periphery. This makes regional thinking, data-based planning and sustainable paths for cities essential. It requires initiating a process towards efficient use of resources, smarter mobility, infrastructure, economy, environment, livability, people-centered development and governance.

The prospective growth over the next 20 years presents a unique opportunity to influence policy and decision makers to intelligently leverage investments being made in the city, however, there are several challenges that a growing economy presents.

2 Pressures of Growing Economy Challenges

Economic reforms and growing employment opportunities in cities will accelerate the pace of urbanization. Since the spatial expansion of Indian cities is not fully stabilized, an urban demographic shift of this stature would require 200% to 400% more urban area to accommodate this growth[3]. According to a World Bank report, the reason most Indian cities are not able to fully realize their potential for prosperity and a good quality of life for their citizens, is due to 'messy' and 'hidden' urbanization. Messy is reflected in the poor quality of life, the lack of access to basic services and amenities for all citizens and the widening demand-supply gap for various urban services. Urbanization is also hidden, as much of the growth happens outside a city's municipal boundaries versus inside, thereby understating the share of the city's population living in areas with urban characteristics. Unfortunately, this growth is largely unplanned, creating a high risk of unsustainable sprawl. The negative externalities of sprawl on social, economic and environmental aspects are well documented and are already being experienced by major cities in India. Messy and hidden urbanization are symptoms of the failure to effectively plan for and address the pressures that growing economies place on infrastructure, services and the environment on a regional scale. Some of the challenges India's growing economy presents are below:

Skewed Political Representation: In India's federal governance structure, cities are underrepresented. The rate of urbanization of national politics lags behind the rate of actual urbanization. Today India has 30% urban population and 10% urban representation in parliament. Though cities are the primary drivers of economic growth, the state leaders lack incentives to fix cities due to political underrepresentation of the urban population. In general, the comprehension of how urbanization will pan out is also very low[2].

Infrastructure Investment Required: Over the next few years, the requirements for Indian infrastructure investments are estimated at one trillion USD. The top 100 cities in India account for 16% of the population, and occupy

.026% of the land, which is projected to increase by at least five times. An increase of almost 35 times in overall investment in urban areas from 2012−2031, as compared to investments made under the JNNURM (Jawaharlal Nehru National Urban Renewal Mission) from 2006−2011, has been proposed by the High Powered Expert Committee (HPEC) for estimating investment requirements for urban infrastructure services.

Disconnected Planning Process: Cities and regions in India do not integrate land use and sectoral (transport, water, power, etc.) planning and implementation to create or guide structures for sustainable growth. Many decisions are influenced by principles of 'modern planning' from the early 20th century designed around automobiles, with precedence for sprawl, moving away from traditional walkable districts. In addition, the plans have been developed in a technocratic top-down approach, rather than a participatory and inclusive process with no focus on improving implementation. As a result, they become irrelevant for several groups of the populations, especially the vulnerable.

Inequity in Development: Equity is a big issue in India. For example, in Bangalore, 20% of the population consumes 80% of the electricity. In Mumbai, 3% of the population uses automobiles to go to work but 75% of the investment in the last decade has been on improving car mobility[4]. A deeper understanding of the possible impacts of new policies, regulations and projects on different sectors and especially the urban poor/disadvantaged is required.

Need for Capacity: At this − early but accelerated − stage of urbanization the rate of transformation of all systems is very rapid and institutional and systematic solutions that require stability are difficult to implement. As this is the first or second decade of urbanization, technical capacity to ensure high quality implementation is extremely limited. In general, technical and human resource capacity is low across all stakeholder groups − government, private sector and civil society. Extensive outreach aimed at strengthening capacities, sharing best practices and providing platforms for learning for all stakeholders is required.

The above challenges and lack of evidence-based planning along with technical and political difficulties in delivering on mandates, have influenced infrastructure decisions that have lock-in effects of 40−100 years. Institutional responses to manage rapid urbanization have also been weak. With budget constraints, unclear targets and fragmented governance systems, the city's ability to realize transformative change is limited. A paradigm shift is necessary to seamlessly translate ambitious schemes and reforms to on-ground change.

2.1 What can be Changed?

Given the socio-political challenges coupled with the pressures of a growing economy and recognizing that structural changes in governance will not be immediate, incremental systemic interventions can be leveraged to bring about transformational change in cities.

Literature and case studies from cities around the world reveal that under these conditions promising solutions arise by the intervention of 'change agents' who have the potential to empower and equip the government and citizenry with technical capacity and methodologies for action by building coalitions. Several successful cities such as New York and Portland have used this to drive transformational change.

In order to understand whether change agents forming coalitions can enable such transformative urban changes in Indian cities, this study will examine the potential of these approaches across a few city-level case studies, based on the following questions:

- Can coalitions bridge the governance gap in Indian cities to become catalysts that lead to or support transformative urban change?
- What, if any, is the framework for successful coalitions? How can a variety of stakeholders lead new coalitions that respond to local market dynamics and facilitate sustainable decision-making/avoid unsustainable lockins.

There is a pressing need to understand the forces and processes that shape the transformation in cities in order to scale-up and replicate their 'people-centered' actions. Thus, this paper will examine the role of institutions and the potential of coalitions as an approach to trigger broader cross-sectoral, city-wide transformation.

2.2 Role of Civil Society Institutions and Coalitions

A coalition is a group of people, groups, or countries who have joined together for a common purpose (Webster's Dictionary). It maybe a purpose-oriented and/or a means-oriented arrangement, that allows distinct people or organizational entities to pool resources and combine efforts in order to affect desired changes. The coalitions could be temporary or long term depending on the cause.

As groups of individuals and institutions who come together around a specific theme, subject, philosophy or profession, coalitions bring with them the collective knowledge and wisdom of their members and global networks. They can create a space for members to experiment freely with innovative approaches and are flexible enough to adapt to local situations and respond to local needs. They have the potential to establish a good rapport among stakeholders and are able to communicate at all levels, from the

citizens to the top levels of government. They are able to facilitate active participation and recruit both experts and highly motivated staff and volunteers.

3 Scope and Limitations

This paper outlines the state of practice, current approaches and experiences of various Indian cities with coalitions as agents of change.

The case studies presented in this paper are derived based on the following criteria−

1. In order to demonstrate conclusive evidence of performance and outcomes, the coalitions should have formed prior to 2012 to allow for their gestation and maturity to be able to more accurately measure demonstrated outcomes and cull out substantive learnings. However, given their dynamic nature, they may or may not be viable presently.
2. Since coalitions affecting transformative change in Indian cities have emerged at various scales and levels with a vast spread in terms of sectors, the study does not look at these cases through a specific sectoral lens but considers it a framework with which to evaluate the relevance of coalitions and extend that to suggest strategies that can be adopted for instituting effective coalitions.
3. Given that coalitions as potential solutions, for governance gaps in the context of rapidly urbanizing cities, is being explored for the first time, the study limits itself to cases where there was a documented outcome, either in the form of programmatic success, failure or institutional relevance. Although all the cases are in public domain, not all have been documented via academic discourses. Therefore, the study relies on media and other relevant and credible mediums as well and the data is limited to that available in the public domain.

4 Methodology

The method for the study was qualitative case study based, where literature review was conducted and relevant case studies were identified. This was followed by formulating a broad framework for evaluating the case studies to showcase and highlight common principles and strategies. Key and pertinent learnings and recommendations were then derived based on the framework.

5 Case Studies

The case studies presented here explicitly examine the role of coalitions of public, private and civil society actors and how it leads to a sector or citywide transformation. The paper analyzes the enabling framework for successful coalitions through the case studies.

5.1 Accessing Government Programs: Tata Institute of Social Sciences (TISS) + M Ward Convener Forum, Mumbai

At a macro level a city struggles with the challenges of a growing economy, and the pressures on various sectors and civic bodies, at the micro level, resettlement colonies and slum rehabilitation areas often suffer neglect, and over time end up becoming one of the poorest parts of the city, with deteriorating living conditions. The M-Ward in Mumbai is one of the consequences of the exponential population growth of the city. It is a resettlement and rehabilitation colony of people affected by the city's infrastructural projects. Over time, it has become one of the poorest parts of the city. Despite having a population of over 807,720, the residents struggled with sub-par services and were denied access to basic amenities. Unhygienic conditions and open defecation due to dirty and dilapidated toilets, were synonymous with this area and were the leading cause of diseases. It also had one of the highest infant mortality rates of around 66.47 per thousand live births (Mumbai's average is 40 per 1,000 births), 1,490 out-of-school children, 6−14 years of age (an equal number of boys and girls), and malnourishment was evident in more than 50 percent children (HDR, 2009)[5]. The ward lacked even a basic database of details of residents and as a result there was also no system in place to ask for available obligatory services. In November 2011, the neighboring Tata Institute of Social Sciences intervened in the area, starting with baseline studies and socioeconomic surveys of households to first create a database. Over time, through collaboration with the residents, they were able to add the needs and aspirations of slum communities to the database, and eventually conduct a micro-planning exercise of 78 communities. In the health sector they facilitated routine checks of maternal health and nutritional quality of child health for children under five years of age, to tackle the high infant mortality rate in that area. Over time, they successfully established an M-Ward Convener forum to enable the community to have a voice for themselves. Since then, this forum, along with the project staff have been actively involved in advocacy initiatives, including dialogues with the government (Municipal Corporation of Greater Mumbai), and evaluating government programs that are implemented in the ward.

This led to the implementation of several government initiatives in the previously neglected community. The community benefited from several initiatives such as a large school mid-day meal scheme, mobile health clinic, and constant community based monitoring of schools to reduce dropouts. These initiatives had a huge impact on the community and brought about a transformational

change contributing towards better living conditions and community empowerment[6].

5.2 Health Systems and Governance: City of Surat, Gujarat

Cities under crisis call for expedited decision making and immediate action at multiple levels. In such situations, a top-down approach in decision making only slows down the mitigation process and exacerbates the crisis as opposed to a decentralized system. A successful example of a city which overcame a crisis through decentralization strategies, would be Surat when it was hit by plague. Surat, often referred to as a 'transit camp' for migrant workers, had been struggling to cope with a population explosion. Though the city's economic activity increased manifold through the growth of its industries and its diamond trade, the living conditions of people continued to deteriorate. The development of basic amenities did not keep pace with the growth in the city's population and as a result the plague which struck Surat in September 1994 played havoc with the city and its occupants. A few hundred thousand residents (over 60% of the population) fled the city overnight to escape a possible quarantine and huge losses were faced by the businessmen (estimated loss of Rs.12 billion)[7]. An epidemic of pneumonic plague was reported, and government officials declared an international public health emergency. The citizens and the government civic bodies blamed each other for their lack of civic sense. The Surat Municipal Corporation did not have an elected civic body for the city at that time. The city underwent a complete transformation from a dirty, garbage-strewn city, to one of the cleanest cities in the country, largely due to the formation of a coalition between the Surat Municipal Corporation (SMC) and the efforts of the community. The crisis which impacted them, connected with the masses, hence they had a vested interest to problem-solve. Decentralized decision making, accountability and transparency in governance systems led to empowerment of various rungs of administrators in the urban local body who could make immediate decisions at the ground level without being stuck in red tape. The municipality was categorized into six zones and subdivided further into 52 sanitary districts for more efficient waste collection and better administration, decentralization of garbage collection and outsourcing the same, construction and maintenance of roads and maintenance and repair of sewage and water plants. Citizens were incentivized by the municipality through an initiative called Anudan for following best practices[8]. Prior to the onset of plague, Surat was tantamount to open drains, up to 40% of the population lived in slums, groundwater sources were highly polluted, waste was dumped in the open, sewage overflowed in the city and public toilets were very few. Improvements to public health, climate resilience, efficient provision of services like water supply and waste management, and poverty alleviation through clean development was brought about through administrative restructuring and policy reforms to shake off the image of being highly unhygienic[9]. In a macro-environment, the government proposed a Disaster Management Policy to avoid situations like the chaos in September 1994. It has one of the most commendable grievance redressal systems in the country.

5.3 Participatory Planning: Kerala Sasthra Sahitya Parishad (KSSP), Kerela

Participatory planning entails self-governance and empowering citizens. However, in certain socio-political scenarios, the idea of participatory planning or self-governance is often perceived as a threat, owing to misrepresentation and misinformation. This thereby denies the citizens an open dialogue on how to trigger change in the milieu of vested interests. Such situations are salvaged with the presence of a third-party intervention, that initiates a dialogue and finds ways to mobilize public support for the participatory planning process, as demonstrated in Kerala where participatory planning included village administrations or as they are locally known, the *gram panchayats*. The Left-led government found the very idea to be against their principles and they opposed it. After all, they came from the school of thought that people have to struggle for their rights. However, there were also popular Leftists who supported the idea because it resembled the Gandhian idea of Gram Swaraj. The Kerala Sasthra Sahitya Parishad (KSSP), a science and technology based organization, stepped in to support the (CPIM) – dominated Panchayats to enable a nuanced understanding of participatory planning. KSSP created awareness that the aim of participatory planning was to find an effective development path and not to divest power[10]. The KSSP managed to gain patronage from the government to lay the groundwork for the entire campaign of the policy, including conducting resource mapping exercises well before the onset of the actual policy. KSSP stimulated the idea that power does not rest with the Panchayat since it was bound by State-made policies. It advocated a diffused authority at the local level. Founded in 1962, KSSP has grown into a movement dedicated to dispersing information on science and technology with the motto of "Science for Social Revolution".

5.4 Women's Empowerment: Self-Employment Women's Association (SEWA), Gujarat

Women empowerment has been in the forefront of any socio-political scenario and development economics discourse. However, there is a certain complexity to addressing women empowerment, given that, unlike as for other

marginalized groups, empowerment would occur at different levels and has different layers to it. Addressing the issues at a grassroots level would be more effective than a top-down trickle down. One such successful model in India is that of Self-Employment Women's Association (SEWA). SEWA primarily focused on empowering marginalized working women in the informal sector to secure employment and become self-reliant. Started in 1972, as a group of poor, illiterate women working as casual laborers in the wholesale textile markets, SEWA's membership has grown to 535,000 in its home state of Gujarat, and to around 700,000 throughout India[11]. Apart from the formal election and governance arrangements, its members were engaged in other ways as well.

1) Union − The Union enabled members in their collective struggle for access to justice, to markets, services and fair treatment. With an urban as well as rural representation, the union handled varied issues. The urban branch focused on upgrading skills in changing markets and seeking better wages and benefits whereas, the rural branch worked towards creating alternative employment through handicrafts and high value crops, thus reversing a trend of declining agricultural wages and seasonal migration of female agricultural workers.

2) Cooperatives − The Cooperatives helped members produce and market products, and build assets. They helped women improve the quality of handicrafts, woven items, and anything else that they produced. They were taught the importance of consistency, timely delivery, and salability and were helped to improve their marketing strategies. Cooperatives, besides being a rural marketing organization and a Trade Facilitation Center, also promoted new agricultural products, and techniques that added value to traditional products.

3) Member services − Women could also avail member services that were partly financed by users, in part by donors, and by government departments. Thus the women could avail services in the key areas of health care, child care, insurance, and housing. Over time SEWA was able to influence policies dealing with maternity benefits, insurance schemes, getting banks to provide subsidized credit etc. SEWA was instrumental in getting recognition for these women within the national five-year plans. SEWA affiliated organizations such as the SEWA Bank, addressed the need for savings for underprivileged women and supported employment by providing them with a working capital. The SEWA Bank also provided housing loans for the purchase of a new house and also for repairs. The schemes insisted on women's ownership of the house, which enabled them to be independent, with an asset in their name. A sister organization, Mahila Housing SEWA Trust (MHT), led the shelter division and advised those who levy loans on buying new houses and improvements and extensions to existing ones. Parivartan or the Slum Networking Project (SNP), a program of SEWA in Ahmedabad, worked on improving the socio-economic conditions and quality of life of residents of slums making it a community based intervention where the needs and aspirations of the residents greatly influenced the planning.

5.5 Environment Support: Parisar, Pune

Rapid urbanization often leads to short-term decisions to mitigate the immediate, rather than decisions that are based on working towards a projected growth, and therefore long term solutions. Urban planning is not looked at holistically and is localized, without taking into account the larger context and implications. Under these circumstances, educating the citizens about the implications of these decisions is very essential. Such an urban milieu creates a space for a coalition body, that acts as an interface between the government and the citizens, that educates them about the implications of governmental policies and enables them to take informed decisions and actions. This can be seen in the work of Parisar, a civil society agency formed in response to deteriorating environments in Pune. Parisar worked on lobbying and advocacy for sustainable urban transport and development. Pune like any other Indian city grew haphazardly, affecting human development and quality of life[12]. Since its inception in the 1980s Parisar has attempted to find solutions to urban issues. It was in the forefront for challenging the modifications to the Pune Development Plan sanctioned in 1987 and also opposed construction in certain areas that were reserved for a public use in the development plan. The sanctioned plan would have converted the reserved area to a residential zone. Through these advocacy movements, they were successful in making people aware about damage to the environment. Parisar was also actively involved in reducing the number of road accident related deaths in Pune[13]. It supported non-motorized transport use and creating efficient public transport options, which it believed could greatly reduce congestion and pollution. Parisar along with other NGOs like Bombay Environmental Action Group (BEAG) and Indian National Trust for Art and Cultural Heritage (INTACH) was also involved in urban heritage conservation and campaigns against the building of flyovers and other private vehicle oriented structures which could harm both built and natural heritage structures. The Urban Heritage Conservation Committee was set up for this purpose. Through its initiatives, Parisar has been successful in pulling people together and creating an institute that enables a new kind of a governance structure. One of the reasons for the successful interventions by Parisar has been that its appeal was very simple − it made the case for a certain quality of life, in the urban scenario, which connected with the masses. Everyone wants better quality of life and can relate to the agenda. It also utilized media strategically to mobilize people to spread that message and keep the momentum up through

sustained media engagement.

5.6 Urban Development: Centre for Urban and Regional Excellence (CURE), New Delhi

Urbanization and its related pace of growth often leaves the marginalized neglected. In order to ensure sustainable urban development, local agencies with capacities for sustainable development need to be strengthened and integrated in the processes of city development. An organization which works in this realm is Centre for Urban and Regional Excellence (CURE). CURE is a Development NGO, based out of Delhi which works with urban informal and low-income communities and local governments, with the intent to improve access to basic services, through community participation and eventually contribute to local government planning and design, thereby ensuring inclusive development.

CURE assisted the Delhi Urban Shelter Improvement Board (DUSIB) in the *in situ* development of four slums in Kalyanpuri, Delhi. Different types of housing that were sustainable and self-sufficient in design, and methods to procure them, were worked on through community participation. A public health program related to maternal, newborn and childhood health was also initiated in the slums of Delhi. CURE, in order to improve hygiene among poor children, helped schools in East Delhi improve Community Toilet Complexes (CTCs) and school toilets within slums[14]. In EDMC (East Delhi Municipal Corporation), a geo-spatial plan using GIS mapping of solid waste and sanitation resources in every ward was designed to support the Corporation in implementing its mandate under the Swachh Bharat Mission. CURE also worked towards restoring one slope of the Aravali Bio-Diversity Park under the Delhi Development Authority which had been ruined by waste accumulation over the years.

One of the primary focus areas of CURE was the water-rich city of Agra which deteriorated to a great extent due to rapid urbanization and degradation of its water source. Through the Mukhaymantri Jal Bachao Abhiyaan, CURE worked at helping Agra go back to being the water resilient city it once was, by revitalizing the traditional hydrological structures, recharging of groundwater sources, and setting up facilities for treatment and reuse of wastewater and rainwater harvesting at several community sites[15]. A community-operated, Decentralized Waste Water Treatment System (DEWATS) was built by CURE using an existing storm-water drain in a low-income settlement in Agra[16]. It was involved in making the city slum-free under the Rajiv Avas Yojana (RAY) through a geospatial mapping process and socio-economic survey of all 410 slums in the city. GIS mapping of slums and their topography was done to help reach urban public services to these areas. It put forward proposals to reform land title procurement and strengthen community engagement. It also set up heritage walks in order to create sustainable livelihoods for the urban poor of Agra. A similar plan – Slum Free City Plan of Action (SFCPoA) – was initiated for the cities of Ludhiana, Gangtok and Bhubaneswar as well.

5.7 Planning and Service Delivery: Bangalore Groups, Bangalore

Bangalore is one of the few metro cities to have taken account of something most cities in India have missed out on, which is regional planning through the Bangalore Region Governance Act where instead of concentrating on the city core, the larger urban agglomerations are taken into consideration for formulation of growth and expansion plans. It has played around with various planning modalities (often ending in failure) by which authorities have largely taken into consideration the need to keep sections of the society contented. Private enterprise has been the latest entrant in the city-development process, however, there has always been a general lack of enthusiasm about corporate entities having a broad and all-empowering agenda for all sections of the society.

The initial group of change-makers called the Bangalore Agenda Task Force (BATF) was set up in 1999 by the then Chief Minister, SM Krishna. While it had prepared road maps to resolve issues faced by Bangalore city at that time, it died a slow death due to several proposed projects being shelved. There was also the controversy that BATF tried to trump the Municipality into submitting to all its plans[17]. This led to Chief Minister BS Yeddyurappa setting up his own task forces called the Agenda for Bengaluru's Infrastructure and Development Task Force (ABIDe)[18]. The task force was publicized as being established in order to solve bottlenecks between various government agencies that need to function together for the delivery of a single service. ABIDe also set out to develop action plans in sectors like traffic management, urban poor etc. With the failure of ABIDe to see any of the proposed plans through to implementation, with the next election, other new coalition bodies were formed by the government. What was noticeable was that though it consisted of persons from business and industry, several representatives of the city were absent. The aim of this vision group was to find solutions to resolve the city's infrastructure and civic bottlenecks. The formation of the group was in the light of earlier plans not taking off as per plan, however, the group had only recommendatory power and little power to act. Partisan politics, political pressure and a failure to learn from earlier groups' experiences led to this group's becoming redundant.

6 Comparative Analysis Across Case Studies

Evaluation parameters to assess the case studies are categorized into eight broad themes on the basis of the knowledge derived from understanding the operations and framework of coalitions under each condition. The eight parameters that are used for evaluating are as follows:

- Enabling framework
- Access to resources
- Governance/institutional structure
- Institutional capacity
- Operational approach
- Agents for primary change & participation mechanism
- Sustainability/Efficiency
- Scalability

Enabling framework –

Presently, service delivery in Indian cities is mostly through archaic and bureaucratic systems which lack clear structures. While in some cases coalitions came into being as a response to a crisis which the masses connected with and which impacted them, so there was an inherent need for the participants to resolve problems. In others it was a reaction to systemic gaps in service delivery which impacted the quality of life or responsiveness by the administration.

Access to resources –

Ability to access resources plays a crucial role in the manner in which coalitions are able to plan, establish and sustain the change they catalyze over time. This maybe in the form of access to human or capital resources which aid service delivery and affect sectoral/ cross-sectoral changes in the city.

Governance/Institutional structure –

The way in which coalitions organize themselves and impact changes in the institutional/governance structures of the city to help deliver on mandates more efficiently and effectively, is very important. In most cases this is about decentralization and devolving powers – both administrative and financial – to the local level with increased accountability.

Institutional capacity –

This parameter refers to the composition of the coalition in terms of public and private actors and citizens along with their sectoral expertise. It also specifically evaluates the technical capacity of the institution such as the ability to convene technical advisory groups or leverage experts to push for and bring about the required reforms. This is a crucial component to the longevity of coalitions.

Operational approach –

There are several factors that differentiate the workings or approaches that coalitions adopt to affect change. Under this parameter the methods of functioning and empowerment were studied. This helped assess how systematic the approaches were and whether or not they facilitated active citizenry as part of their strategy.

Agents for primary change and participation mechanism –

Coalitions typically have primary change agents who form the core group, which through strategic questioning involves citizens, leverages experts and people with influence and networks, in addition to using coalition developed tools (technology, etc.) to help execute reforms. These groups come together mostly with a com-

Comparative Case Study Analysis

	Enabling Framework	***Access to resources***	***Governance /Institutional Structure***	***Institutional Capacity***	***Operational Framework /Approach***	***Primary Change Agents***	***Sustainabilty /Efficiency***	***Scalability***
M Ward	M-ward had extremely poor sanitary conditions which caused several health issues. Neighboring TISS conducted socio-economic studies that enabled measures that improved the quality of life of the residents.	Project staff in dialogue with the government assisted the neighborhood access government sponsored schemes	TISS empowered the neighborhood citizens to help them systematize available and obligatory services and hold the local bodies accountable	Technical experts with sectoral socio-economic expertise at TISS (public sector institute) leveraged data for citizens' empowerment to bring about reforms	1. Data collection & surveys in the non-notified area enabled citizens to access basic services 2. This empowered the formation of citizen-led M ward convener forum 3. The forum has led to a constant dialogue with the government to access and evaluate programs implemented in the area	TISS along with the government was the primary change agent in this coalition and used surveys in the community to leverage engagement	A database of community needs and aspirations that was created served as the blueprint for establishing the Convener Forum and further advocacy initiatives and programs	The initiative resulted in a convener forum through which citizens could voice their needs and concerns and form a partnership with the government to aid service delivery.

Continued

	Enabling Framework	*Access to resources*	*Governance /Institutional Structure*	*Institutional Capacity*	*Operational Framework /Approach*	*Primary Change Agents*	*Sustainability /Efficiency*	*Scalability*
Surat	A public health crisis (plague of 1994) led citizens to question the capacity of the urban local bodies. This paved the way for reforms across multiple sectors resulting in effective governance systems being put in place.	Decentralization of municipal government enabled better access to resources, decision-making and accountability giving each local zone the ability to invest in programs they deemed important.	Decentralization of local government for effective implementation at the micro level was the hallmark of the intervention in Surat. This led to empowerment of various rungs of administrators in the urban local bodies.	Local government built sectoral technical capacity in addition to empowerment of administrators.	1. Local bodies were decentralized and empowered 2. Citizens were incentivized to follow best practices 3. A grievance redressal system was put into place 4. State government instituted a policy for disaster management	Government bodies and active citizens were the primary agents who brought about changes in the governance systems.	A decentralized approach involved city administrators in the ULB and improved governance processes. The public health crisis was addressed in a period of 1.5 years. As a result, a new wave of productive economic activity flourished in the city.	The decentralization approach scaled across sectors for effective governance. The waste collection department has one of the most effective grievance redressal system in the country. The state of Gujarat instituted a disaster management policy thereafter.
KSSP	Participatory planning as a rapid and effective development tool to mobilize people was encouraged at the local (gram sabha) area level by capacity building of citizens & government through knowledge dissemination by KSSP	KSSP- a science and technology based organization with patronage from the government laid the groundwork for promoting policy	KSSP campaigned for diffused authority at the gram sabha level and strengthening them so that power does not rest solely with the Panchayat	KSSP leveraged science for social revolution. Technical experts across domains advocated change by making information and knowledge accessible to all.	1. KSSP developed the groundwork for promoting gram sabhas for participatory planning through information, education and communication initiatives 2. They conducted resource mapping exercises to mobilize citizens & government to support participatory planning	KSSP, a civil society organization with backing from the government was the primary change agent promulgating the idea and policy for self-governance/participatory planning	The coalition has become a movement dedicated to disseminating information for better governance. Participatory planning in Kerala is now a legacy	The approach of diffused authority to strengthen gram sabhas has gained state-wise acceptance and has led to several programs for the benefit of citizens
SEWA	With the goal of empowering women in the informal sector, SEWA worked with poor, self-employed women to achieve secure employment and self-reliance	SEWA was instrumental in accessing resources from the World Bank and local cooperatives to enable micro-finance lending to support employment and entrepreneurship	Put in place a highly structured institutional framework with unions, cooperatives and member services to enable members to access services, get representation and build assets	SEWA partnered with and co-opted a full range of technical experts to bring about reforms for women in various sectors including health, finance, housing	1. Organized, enabled and empowered women to rights, services through skill upgradation, alternative employment, market products and build assets 2. Supported employment by providing working capital 3. Assisted in accessing housing (improvement) loans improving socio- economic conditions and quality of life	SEWA was the primary change agent active within urban and rural areas in Gujarat enabling and empowering women by way of access to finance, services and self-governance	Several organizations and programs for women's benefit have evolved from SEWA, with it being instrumental in gaining recognition for women in the national 5-year plans	Started as a group of poor women working as casual labor in the textile industry, SEWA has scaled enormously programmatically & institutionally within and outside Gujarat in several sectors such as housing, banks, electricity supply, etc. by partnering with other public and private institutions

Continued

	Enabling Framework	*Access to resources*	*Governance /Institutional Structure*	*Institutional Capacity*	*Operational Framework /Approach*	*Primary Change Agents*	*Sustainabi lity /Efficiency*	*Scalability*
Parisar	The deteriorating environment and quality of life of residents due to urbanization in Pune, led to a coalition of civil society actors coming together to advocate for sustainable development	Parisar with patronage from its (public, private) partners used knowledge, information and communication to advocate for environmental support in the city	Parisar used advocacy to campaign for a better environment and quality of life for citizens with the local government especially as it related to sustainable mobility and the environment	Comprised of technical experts who by way of knowledge-partnering and lobbying raised awareness in citizens and the government about environmental issues	1. The coalition organized itself and opposed the modifications in the Development plan to preserve public commons 2. They then focused on reducing road accident related deaths and promoting sustainable mobility 3. They partnered with civil society organizations to rally support for preservation of heritage sites	Parisar, comprising of citizens and influencers was the primary change agent in advocating sustainable development in Pune	The coalition is active through collaborations & has widened its network through key partnerships within and outside of Pune	The initiative on heritage conservation has scaled resulting in setting up of the Urban Heritage Conservation Committee which reviews/opposes building of private vehicle-oriented structures which harm heritage buildings
CURE	Recognizing the need to build resilient cities, CURE worked with low-income communities and local governments to improve access to basic services, inclusive and participatory governance and building of community based information system	Assisted in accessing resources and implementing government schemes and programs in the low income/vulnerable areas of the city	CURE enabled communities access services in-situ thereby upgrading living conditions and also helping the municipal corporation implement mandates through on- the-ground interventions	Technical experts with sectoral expertise at CURE partnered with government to leverage data to bring about reforms and build resilience in low-income communities	1. CURE was engaged in a consulting capacity by the government 2. They conducted scoping exercises in an area/community which invoved gathering data 3. Post analysis, they assisted in execution/ implementation of recommendations	CURE along with the government was the primary change agent which affected resilience planning in communities	CURE's model of collaborating with the government and providing assistance to vulnerable communities in utilizing government schemes, especially in sanitation and slum-development/upgradation continues to benefit communities	The coalition has scaled to many cities in India while spawning and implementing several government-led missions and programs
Bangalore	Bangalore was one of the few cities in India where Regional Planning was enabled through regional governance act. Recognizing that growth pressures were leading to poor infrastructure provision, service delivery and quality of life, the government instituted a task force to aid in preparing road maps to resolve issues faced by the city	The instituted committees consisted of influencers with power and access to resources within the government	The coalition was a closed group of individuals with stakes in the city. The committees constituted external technical advisory groups and consulted with citizens' advisory groups to put forth recommendations to the government	The committees acted as conveners and technical advisors to the government often by co-opting technical experts	1. Tasked with creating a better environment and quality of life for citizens, the committee was to help create sectoral roadmaps for the government 2. Established in order to resolve bottlenecks between agencies which need to coordinate in order to deliver a single service	Influencers with stakes in the city were the primary change agents	Both ABIDe and BATF were dictated by the political milieu of the time and hence were unable to implement several proposed projects. Both committees were short lived and did not evolve beyond mandate. They were also mired in controversy resulting from the perception that they were trying to trump the urban local bodies into submitting to their plans and functions, which was not constitutional	Both coalitions were unsuccessful and disintegrated because of partisan politics

mon agenda and use different participation mechanisms and terms of engagement (convening, volunteering) to do so.

Sustainability/Efficiency –

One of the key indicators of the success of coalitions measures efficiency in terms of timeliness of actions initiated or completed. It also looks at the longevity of the coalition's existence beyond the crisis and at mobilizing citizens to focus on a deeper awareness leading to systemic changes in the society and governance structures.

Scalability –

Scalability of coalitions is largely determined in two ways – linear growth and nodal growth. In the linear growth model the coalition expands *in situ*, gaining credibility and prominence. In the nodal growth model, their efforts offshoot into other cross-sectoral programs being instituted or lead to formation of innovative partnerships or institutions as a response to the gaps in governance and service delivery.

7 Learnings – How can Coalitions Intervene and Help Unlock Unsustainable Growth Patterns?

The case studies presented explicitly examine the role of coalitions of public, private and civil society actors in affecting cross-sectoral and/or area-wide transformation, where their principal role was to improve decision making in urban sectors by applying coalition developed tools to carry out assessments and use the results to identify and push for reforms. Further, the coalitions in the case studies, examined, aided with problem perception and shaping public opinion as well as followed an iterative process of policy formulation and implementation while engaging with civil society to create ownership. Analyzing the role of coalitions as a mechanism to catalyze change impresses that such institutions can be most impactful in growing cities where cross-sectoral coordination is needed for effective governance and thereby city-wide transformation.

Key Learnings from the cases presented are as follows:

- A coalition can platform social dialogue about challenges plaguing a city. It can be instrumental in bringing different groups together and can provide a platform for public commitment to work towards common goals.
- Decentralization of power, both administrative and financial, as well as building institutional capacity is crucial to the efficient functioning of cities. In this context coalitions of citizen groups and civil society organizations can optimally act as accountability mechanisms.
- In the context of service provision in India, there exist multiple coalitions between government and non-government agencies or other private sector organizations and citizen groups, primarily in order to fill the gap in mechanisms to deliver services relevant to community requirements.
- In terms of the enabling framework, often a crisis or severe gaps in public service delivery that impacted the quality of life of citizens were the triggers for mobilizing coalitions.
- Access to resources, human and capital, was pivotal to the success of these coalitions. While the human resources in most cases came from civil society institutions and individuals, access to capital resources was mostly driven through patronage of the government. In some cases, such as Surat, the coalition leveraged the private sector and cooperatives for financial assistance. This also points to the fact that partnering with government is essential to the success and viability of coalitions.
- Coalitions were most effective when they played both the advocacy and technical advisory roles, fulfilling the demand and supply of good governance and strategically partnered with the government, which was the key to their success.
- The role of private sector was also key in several instances (such as Surat) where they partnered with CSOs and the government, playing a pivotal role in project formulation and implementation. Trust between these actors formed the basis for business generation and strengthening of the revenue base in cities.
- Involvement only at the local level without political buy-in from the district or state level bureaucracy can be detrimental to the efforts of the coalition and its sustenance as was the case with KSSP.
- Coalitions can help cities take concrete steps to reform their plans, planning processes, institutions and governance. This includes evidence-informed decisions on incorporation of legislations, local area planning and the use of GIS to plan, implement and monitor city development.
- In terms of functioning and operations, coalitions worked best when there was a mutual cognizance of the strengths of each actor involved and overlaps were minimized for efficiency. The group should have the ability to communicate at all levels, from community to the top levels of government, and should be able to facilitate active participation by recruiting both experts and highly motivated staff.
- All coalitions were driven and co-created by an agent of change which was either an institution, individual(s) or infrequently the government.
- Once active and entrenched, the aim of most coalitions was to problem-solve and then focus on deeper

awareness which leads to behavioral change in governance and/or citizens. They also relied on self-propagation of an idea through empowerment of communities which was pivotal for programmatic success.
- Most coalitions aimed at promotion of actions leading to self-governance, asking for due process and access to services versus pushing agenda. Most of the successful cases demonstrated, used technology and data as a platform for awareness and outreach.
- The coalitions engaged citizens in an open dialogue and discussion on how to trigger change in the milieu of vested interests and how to then leverage the powers of the constitution. This type of communication was often instrumental in aligning a broader civic engagement through a common agenda.
- Cases such as the planning groups in Bangalore, explicitly reinforced the fact that for sustainability, efficiency and scalability, coalitions should function independent of political milieu and focus on empowering decision-makers to better understand critical challenges and potential solutions. Also, working along with the community, so that ideas come from them and hence there is ownership, goes a long way in acceptance of implementation strategies.

Failures to address systemic gaps in governance at the city level due to lack of active coalitions can mostly be attributed to the manner in which they function, resulting in the lack of success to get buy-in and participation from citizens. This is often due to multiple factors, such as lack of awareness among people, political milieu, absence of a dedicated core group, overemphasis on targets and time bound programs, vested interests, distrust of civic agencies and lack of decentralized approach.

8 Conclusions

Despite the magnitude of looming urbanization, the 74th Constitutional Amendment Act has failed to empower cities, with the state still playing a dominant role in city administration resulting in weak accountability. Indian cities are largely governed by politicians and bureaucrats who have limited tenures. A strong mayor with a long tenure, vested interest in a city's development and clear accountability – a system practiced in most advanced countries, is missing.

At the municipal level there is a lack of organizational structure which results in inefficient service delivery and very slow decision-making. Encumbered by lengthy and time-consuming processes with undefined goals and budgets, and lack of capacity, urban local bodies struggle to meet the ever-rising developmental demands that cities place on them.

The power to be able to shape one's own developmental future is a critical feature that underpins the intentions in the urban missions in India today. At this stage of urbanization in the city, the rate of transformation of all systems is very rapid. Institutional or systematic solutions require stability and will be difficult to implement at this stage. This is a great moment to insert and establish sustainable best practices. However, as this is the first or second decade of urbanization, technical capacity across all stakeholders to ensure high quality implementation is extremely limited. There is therefore the need for strong and creative support and extensive outreach aimed at strengthening capacities, sharing best practices and providing platforms for learning for all stakeholders.

Encouraging cities to embrace a more sustainable path requires initiating a process towards efficient use of resources, people and governance. Coalitions can provide cities with strategies that accomplish this by bridging gaps in governance, capacity building local agencies, mobilizing resources, engaging citizens and assisting in implementing reforms. Moreover, civic technology and coalition-developed tools present an opportunity for people to focus their efforts and technical know-how to resolve challenges facing the public sector. Ultimately coalitions can create the conduit needed for regional level thinking and data-driven planning needed to empower key decision-makers to better understand critical challenges and deliver solutions. Leveraging coalitions can ensure that concrete steps are taken to reform the city's plans, planning processes, institutions and governance. This can help improve quality of life and sustainability in cities by triggering a virtuous cycle of transformative, inclusive and holistic interventions that are cost-effective and have a high impact. Indian cities can thus move on to a path of improved livability and maintain their competitive status in the global economy.

8.1 Building an Effective Coalition

As observed from the case studies, an effective coalition should:

- Act as a convener bringing together groups with cross-sectoral interests and individuals, around a common crisis that impacts quality of life, so that they may collectively generate, implement or replicate innovations.
- Seek to bridge gaps and build capacity among local organizations and stakeholders to enable better service delivery.
- Act as a mediator between actors – typically citizens and government.
- Use coalition-developed tools/technology for information, education and communication.
- Seek representation from low-income, vulnerable and marginalized groups.

- Collaborate on program implementation as a resource.
- Create a platform for policy makers to learn about, adapt and scale innovations.

Civil society groups need to come together with the private sector to address issues with which the government is struggling. Coalitions can thus be established with a joint and a mutual commitment between stakeholders and municipal government to ensure seamless service delivery allowing inclusive, comprehensive and sustainable development.

8.2 Steps in Setting up a Coalition

An effective coalition should address a broader process on urban issues, survive multiple administrations and be bipartisan, become part of the civic culture and be embedded in a politically sustainable way. The steps in setting up such a coalition are:

Step 1

Come together – Coalitions often emerge during a crisis or when citizens become frustrated with the governance systems leading to poor service delivery. The first step is usually to set up a stakeholder process. Various views are collected by a core group who then conduct research on options. Public stakeholders are co-opted and buy-in is achieved from all relevant actors.

Step 2

Establish an action plan – The plan of action that is decided upon should support the administration in such a way that the envisioned changes are a result of innovative planning which translate into dynamic action which in turn go on to create binding commitments for the city or stakeholder on a long term basis.

Step 3

Delegate responsibilities – Thematic, administrative and legal working groups should be set up. These may comprise of volunteers with specific agenda or domain expertise and/or the core group consisting of influencers. Often the administrative and legal group are prioritized, as these are needed to map current institutional responsibilities, laws, and experience of existing bodies. Each working group should come up with their goals.

Step 4

Create Information, education/awareness and communication (IEC) – Sound channels for sharing of information should be set up and the coalition developed tools and technology to be used for data gathering, analysis and dissemination should be agreed upon. Progress should be monitored closely and local agencies should be empowered for optimal results.

Step 5

Set up participatory roles – The local government partners with and/or actively participates in the implementation of the plans and programs. This helps link back to the program mandates and break barriers for entry for the disenfranchised. Media coverage ensures visibility and scaling of initiatives.

As citizens and change agents continue to push for accountability and pursue paradigm shifts in governance, coalitions can fill interim gaps and provide cities with practical and actionable strategies to move towards a sustainable and equitable city for all. Coalitions can empower and equip change agents to demand, support and deliver on the need for good governance through actionable solutions. There are thus reasons to believe that despite limited uptake in cities and some unsuccessful cases, leveraging coalitions is possibly the way forward to actualize sustainable development in Indian cities.

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References

[1] Sankhe S, Vittal I, Dobbs R, *et al*. 2010, *India's urban awakening: building inclusive cities, sustaining economic growth*, McKinsey Global Institute, Mumbai, 124–131, viewed January 1, 2017, http://www.mckinsey.com/global-themes/urbanization/urban-awakening-in-india

[2] Ravi A, 2013, *India's urban transformation: the way forward*, 34–37, viewed January 1, 2017, http://www.slideshare.net/Aromar/indias-urban-transformation-the-way-forward-symbiosis-4-march-2013

[3] Rayle L and Pai M, 2010, Scenarios for future urbanization: carbon dioxide emissions from passenger travel in three Indian cities. *Transport Research Record: Journal for Transport Research*, vol. 2193: 124–131. http://dx.doi.org/10.3141/2193-15

[4] *Comprehensive Traffic & Transport Plan*, 2008, Mumbai Metropolitan Region, MMRDA.

[5] Bose A, 2010, How Mumbai's most underprivileged ward is trying to help itself, viewed October 15 2016, http://www.firstpost.com/mumbai/how-mumbais-underprivileged-m-ward-is-trying-to-help-itself-551508.html

[6] TISS, 2010, Social economic conditions and vulnerabilities: a report of the baseline survey of M (East) Ward, Mumbai, TISS, Mumbai, viewed October 15, 2016, http://urk.tiss.edu/images/pdf/M-Ward-Report.pdf

[7] Jariwaala P, Selvakumar S, Ghanekar A, *et al*. 2015, *Transformations of heal th systems and governance: case study of Surat, Gujarat* – Proceedings of the Tenth Annual International Conference on Public Policy and Management, IIM Bangalore, August 3–5, Institute of Human Settlement s (IIHS), Bangalore, India, viewed October 15, 2016, http://iihs.co.in/knowledge-gateway/wp-content/uploads/2015/08/TRANSFORMATION-OF-HEALTH-SYSTEMS-AND-GOVERNANCE.pdf

[8] Bhattacharjee P, 2014, *Surat: where waste is not wasted governance now*, last viewed January 1, 2017, http://www.governancenow.com/news/regular-story/surat-where-waste-not-wasted

[9] Institute of Development Studies (IDS), 2007, *Governance screening for urban climate change resilience building and adaptation strategies in Asia: a ssessment of Surat City, India*, viewed January 1, 2017, https://www.ids.ac.uk/files/dmfile/Surat.pdf

[10] Chathukulam J and Moolakkattu S J, 2002, *Five years of participatory planning in Kerala: rhetoric and reality*, Economic and Political Weekly, 4917−4926, viewed October 16, 2016, https://www.researchgate.net/publication/262122576_Five_Years_of_Participatory_Planning_in_Kerala_Rhetoric_and_Reality

[11] Blaxall J and Nanavaty R, 2004, *India's Self-employed Women's Association (SEWA) − employment through mobilization of poor women on a large scale: a case study from reducing poverty, sustaining growth − what works, what doesn't and why a global exchange for scaling up success*, Scaling Up Poverty Reduction − A Global Learning Process and Conference, Shanghai, May 25−27, 2004, World Bank, viewed October 15, 2016, http://web.worldbank.org/archive/website00819C/WEB/PDF/INDIA_SE.PDF

[12] Menon A, 1992, *Pune citizens keep watchful eye on their city*, viewed October 15, 2016, http://www.downtoearth.org.in/coverage/pune-citizens keep-watchful-eye-on-their-city-30355

[13] Mehta A and George A, n.d., *Road Safety Week: Punebased NGO advocates sustainable urban transport system to prevent accidents*, viewed October 15, 2016, http://www.dnaindia.com/locality/pune/road-safety-week-pune-based-ngo-advocates-sustainable-urban-transport-system-prevent-accidents-81817

[14] Khosla R, 2015, Community participation for inclusive urbanisation: moving from tokenism to genuine participation, in Shrestha K K, Ojha H R, McManus P, *et al*., *Inclusive Urbanisation: Rethinking Policy, Practice and Research in the Age of Climate Change*, Routledge, London, 27−38.

[15] URAIA, 2016, *Agra-connecting the disconnected*, viewed October 16, 2016, http://www.uraia.org/case/agra-connecting-the-disconnected

[16] *Decentralised wastewater treatment system at Kachpura village in Agra*, 2017, Centre for Science and Environment (CSE), viewed January 1, 2017, http://cseindia.org/node/3770

[17] Nair J, 2006, 'Social municipalism' and the new metropolis, in John M E, Jha P K, Jodhka S S (eds.), *Contested Transformations: Changing Economies and Identities in Contemporary India*, Tulika Books, New Delhi, 125−146.

[18] Goldman M, 2011, Speculating on the next world city, in Roy A and Ong A (eds.), *Worlding Cities: Asian Experiments and the Art of Being Global*, Wiley, Oxford, 229−251.

RESEARCH ARTICLE

Participatory planning processes in Indian cities: its challenges and opportunities

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Abstract: Historically, India has had strong local governments and probably drawing from this, is the spirit in which the country enacted the 73rd and the 74th constitutional amendment acts (CAA), in 1992[1]. This amendment aimed at a redistribution of powers to enable local bodies which are closer to local issues to respond more quickly and efficiently, rather than relying on a distant central body. However, the practices in participatory planning in Indian cities have been, at best, tokenistic in nature in the face of the challenge of implementing an effective decentralisation processes. The paradigm of citizen engagement and participative planning today must shift from one of the traditional redressal of grievances to that of collaborative solution building bringing both the government and citizen together in the development of local areas. This paper aims to analyse and evaluate participative local area planning practices in India, particularly at the level of the smallest administrative unit, i.e. wards. The study has been categorised in mainly two aspects: institutionalised and non-institutionalised processes dealing with participation at the bottommost rung of planning. This study is an attempt to highlight successful models of engagement, institutional structure and processes that allow for effective participatory planning and to identify possible ways of overcoming challenges of inclusiveness, budgeting and financing and the disconnect between citizens and administration in this process.
Keywords: local area planning, Ward Committees, fair representation, budgeting, citizen engagement, citizen-led initiatives, 74th amendment

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1 Introduction

Participatory processes have been hailed as a robust method for improving development projects, assuring community buy-in and significant rates of implementation since the mid-90's, with multilateral organizations such as the United Nations and the World Bank, being strong advocates.

According to the World Bank, participatory planning is "a process that convenes a broad base of key stakeholders, on an interactive basis, in order to generate a diagnosis of the existing situation and develop strategies to solve jointly identified problems[2,3]". This process can vary significantly, depending on the methods used, the players involved, the source of financing, and its level of institutionalization.

The implementation of the UN's Local Agenda 21 is a good example of how citizen participative processes can serve different objectives, from environmental protection, to social development, local area planning, adaptation to climate change, or emergency responsiveness[4,5].

In India, the 73rd and the 74th constitutional amendments (CAA) enacted on 1st June 1993 extends constitutional status to municipalities, empowering people and locally elected representatives the power to act in common interest and have a say in how their communities should develop[6]. The amendment looks to empower the ward council as an enabling platform for local solutions to local problems to bridge the lacunae in bureaucratic top down schemes[1].

The case studies following this section, exhibit diversity in participatory processes in India. The study has been categorised in mainly two aspects: institutionalised and non-institutionalised processes which cover initiative by citizens, government heads and other organisations, all of which deal with issues at the bottom-most rung of planning. The first part will deal with how the 74th amendment has been adapted across different states in

the country, primarily through the constitution of ward committees and Area Sabhas. The second part, studies non-institutionalised initiatives across cities like Delhi, Mumbai, Pune and Bangalore, looking at the methodology and financial mechanisms adopted, and the stakeholders involved. The conclusions and discussion section highlights key recommendations and learnings from the examples that can essentially help make participatory planning processes more effective in urban areas in India.

2 Scope and Limitations

This paper aims to analyse and evaluate practices of participative local area planning in India, particularly at the level of the smallest administrative unit, i.e. administrative and electoral wards. This qualitative study is an attempt to highlight successful models of engagement and processes that allow for effective participatory planning and identify possible ways to overcome challenges faced in implementation. While the subject matter itself is broad, with varied contexts and examples to draw from, this particular paper will limit its scope of study to urban areas.

3 Institutionalised Efforts

Historically, India has had strong local governments. Before the British rule, local bodies comprised of residents administered villages throughout the country. It was from this system that Mahatma Gandhi drew inspiration and envisioned India's administrative system. It was also with that spirit in mind that the country enacted the 73rd and the 74th constitutional amendment acts (CAA), in 1992[1].

Both CAAs tackle the issue of decentralization and local government, while the 73rd CAA deals with rural settings, the 74th addresses urban areas. The 74th CAA establishes a three-tiered administrative system, with the empowerment of urban local bodies with civic functions – defined by state legislatures, together with the sources of revenue and election methods. At the local level in a municipality, citizens are empowered to participate in the municipality's political life through bodies known as ward committees[1]. The ward committees were to be the vehicles of decentralised administration, initiating a bottom approach to city planning.

Ward Committees

India divides its urban areas, cities and towns, into electoral and administrative units, called wards. India's 74th CAA mandates the establishment of ward committees, comprised of one or more wards in the geographical area under a municipal corporation with a population of more than 300,000 people. States are required to enact or amend municipal regulations towards this objective, granting those committees with certain powers and responsibilities[1]. In general, ward committees are composed of elected representatives, a government officer and civil society participants, with responsibilities that include the recommendation and supervision of municipal budget in the ward-level.

Up to 2006, only 19 out of 29 states enacted related legislation, out of which only seven were actually implemented[7]. In most cases, the devolution of responsibilities was not accompanied by the devolution or creation of revenue sources to fund those responsibilities. Below is an in-depth look into the composition, functioning and powers of ward committees in cities in Karnataka, Kerala, Maharashtra, and West Bengal.

3.1 Case 1: Cochin, Kerala

In 1996, the Government of Kerala decided to move away from the conventional approach and went in for large scale fiscal devolution and opted for full and immediate devolution of funds, designating 35%−40% of the state's development budget to the local selfgovernment institutions. The local governments received almost 90% of the funds to prepare their own schemes and implement them. The broad policy framework for the distribution of funds for urban areas were: 10% of funds in productive sectors not more than 50% on roads and at least 10% for Women component plan[8]. This was a direct departure from the traditional step-wise reform model of decentralization. To support the participatory process, Kerala carried out one of the most extensive adult education and empowerment programs in India's history[9]. Training occurred on three levels: state, district, and local. They also took measures to institute these changes, primarily by establishing the Committee on Decentralization of Powers. In 1999, the government comprehensively amended the Kerala Panchayati Raj Act of 1994, incorporating the lessons learned from feedback and interaction with the campaign. Implementing these changes quickly protected the People's Plan Campaign from losing ground when a new government came back to power. Although subsequent amendments were made to the Kerala Panchayati Raj Act and some of the decentralized powers were curtailed, local level planning continues, supported by the processes, institutions, and funding structure that they developed and institutionalized early on.

The success of decentralisation has seen success at different levels. Cochin has 74 ward committees, each connected to one electoral ward and with strong participation of neighbourhood groups and resident welfare associations. Ward committees' meetings in Cochin are generally open-ended, with participation via vocalization, when participants can raise their own issues and agree or disagree

with prepositions by rising their voices or remaining in silence. However, the slow response of the municipal corporation to ward committees' requests, due to red tape, bureaucracy, and its own limited powers that require approval from the State, makes many citizens' organizations skeptical about ward committees' effectiveness.

3.2 Case 2: Mumbai, Maharashtra

Maharashtra has four municipal acts that govern its local urban bodies, and 19 out of its 23 municipal corporations have constituted ward committees. Ward committees are open for elected councillors, ward officers and, at maximum, three representatives of neighbourhood groups and resident welfare associations. However, only seven functioning ward committees have civil society representatives as members. Among their responsibilities, ward committees in Maharashtra have to deal with the redressal of citizens' grievances and make recommendations on expenditures and grant administrative approval and financially sanction ward-level projects of up to INR 5 lakhs (approximately only 0.2% of the collective development funds available to councillors in an administrative ward)[10].

Maharashtra introduced its own Community Participation Law (CPL) to ensure the continuous funding from JNNRM, but did not enact it. The Community Participation Law also termed as the Nagar Raj Bill is an elaborate law that prescribes the structure, powers and functions of the Area Sabhas well as prescribes the constitution and governance of ward committees. As per the law the hierarchy of the representation after municipal body would be ward committees followed by area Sabhas[10].

Legislation restricts the number of ward committees in Mumbai to no higher than 25, despite the city's 227 electoral wards and 24 administrative wards (each administrative ward is composed of 8−10 electoral wards). Until 2010, only 16 committees were constituted[10], resulting in, on an average, 14 electoral wards make up a ward committee, with population between seven and eight thousand people each. Additionally, only seven ward committees included civil society representatives as participants, and only after a judicial decision. The process of selection of civil society representation is tightly controlled by councilors, making the committee to vulnerable to political pressures[10,11]. Alongside the complex political pressures that are faced by ward committees their functions are further usurped by ALMs who are preferred by local governments to implement infrastructure and maintenance projects[10].

While ALMs can be perceived as a duplication of ward committees the nature of their compositions and functioning are distinct. The ALMs are organised usergroups engaged in maintenance and operational services while ward committees voice concern of all citizens of the ward and have small planning and decision making roles. ALMs provide a channel of engagement for middle class residents to co-ordinate with the executive wing of the local government while ward committees are seen as channels of engagement for vulnerable groups[11].

3.3 Case 3: Bangalore, Karnataka

The State government approved an ordinance[12] with amendments to the Karnataka Municipal Corporation Act in 1994 without any debate, and four years later, published the rules on ward committees. The state government can nominate up to five experts on municipal administration and two civil society representatives. The elected representatives and participants nominated by the State government, have equal voting rights, and this created conflict and resistance from the elected councillors[13]. There is very little defined in terms of qualification for nomination into the committee, the attendance required for the meeting by the officers or format of matters to be discussed[13]. The process of selection is often biased and not considered transparent. Furthermore, Karnataka's citizen participation law is void of real citizen power and influence, given the veto power awarded to the councillor[14].

Despite disparate sizes and varying resident populations, wards receive a standard budget with no connection to their projects or property tax collection. Furthermore, ward committees do not have a budget under the State regulation, but only have administrative approval to works not exceeding a nominal 50,000 INR despite their multiple responsibilities (INR 100,000 in the case of Bangalore)[13].

Up until 2010, the only municipal corporation to have implemented ward committees was Bangalore. Mangalore has an informal ward committee functioning since the 1980's. Bangalore has had functioning ward committees since 2004, after a brief run between 1999 and 2001 (Between April 1999 and November 2001). However, after the Municipal corporation elections of November 2001, the formation of ward committees was delayed by two and a half years and formed only in July 2004[15]. Its regulation allows no more than 30 ward committees, which means committees usually comprise three or four wards and have between 10 and 15 thousand voters. Ward committees have an array of responsibilities, though these overlap with the functions of the municipal corporation. Under the supervision of the municipal corporation, committees in Bangalore are responsible for, among others, garbage collection, health immunization, slum improvements, citizens' grievance, numbering of streets and premises, apart from monitoring and supervising property tax collection, the utilization of budget grants, the execution of public works not exceeding one lakh rupees (this being subject to availability of the funds) and the issuance of birth and death certificates[13]. The allocated funds for projects form a very small percentage of the total average budget allocated to wards, ranged between 10 million INR to 40

million INR[16].

3.4 Case 4: West Bengal

West Bengal is one of the few states to quickly constitute functional wards committees following the 74th CAA[13]. Presently West Bengal is constituted of 127 Urban Local Bodies with 2,819 wards, and among these Ward Committees have been constituted in 2,534 wards[17].

The State introduced amendments to the West Bengal Municipal Act in 1994 and published ward rules in 2001. Under these regulations, each ward in a municipal corporation that meets the population requirements shall have its own ward committee, constituted both by elected and nominated members. Nominations come from the elected councillors and the number of nominated members is contingent on the population of the ward. Under 2,500 people, there are seven nominated members, additional members added with every extra 500 people up until 17 members. To ensure diversity in the committee, the rules state that at least two members must come from the community development societies created for West Bengal's poverty alleviation program (at least three if the committee has more than nine members). All members need to be residents of the ward[10].

Ward committees do not do physical planning, but are required to prepare a list of schemes for deciding priorities, which is prepared and submitted within three months of the constitution of the committee. The list should be for two time frames, short-term (1 year) and long-term schemes (5 years). The participation in the preparation of the draft development plans is conducted with the widest range of stakeholders, building on existing grass root structures such as Ward Committees, Neighbourhood Groups (NHG), Neighbourhood Committees (NHC), and Community Development Society (CDS)[18]. Neighbourhood Groups (NHG) are constituted by 15−20 families and may have volunteers that work in micro neighbourhood scales in education, planning and health. All NHGs in a ward together form an Area Development Society (ADS) and the ADS in a municipality form a part of a registered society called the Community Development Society (CDS)[19]. Neighbourhood Committees (also known as MohollaSamitis) represent polling booth areas in civic elections and need a representation from at least 10% of residents of the area[20].

The regulations allow the Ward committees in West Bengal to generate resources for the municipal corporation, 60% of which are available for committees to spend in projects in the ward. As sources of revenue, committees can use government lands for commercial use, private land for joint ventures, water bodies for pisci-culture or entertainment, among others. Ward committees can implement development projects, but do not have planning powers[10,21]. However, ground realities show that one of the biggest drawbacks in the functioning of the ward committees have been the lack of funds for development work and that the committees have not been entrusted with any power to generate resources.

Additionally, the nominations of members to the committee, while mandated to be publically vetted, the system of selection ends up being completely up to the discretion of the councillor and leading to them becoming political organisations[13].

Alongside decentralized administration and a bottom up approach to city planning, another premise of the 74th CAA was to set up democratic involvement of all citizens in the planning of urban areas. This goal though has not been achieved at a great extent in Indian cities due to a host of issues, pertaining to the structuring and language of the CAA, the institutional and financing gaps and the lack of clarity with regards to implementation processes.

The case examples are evidence to some clear challenges faced by ward committees alongside developments and strategies that have proven effective in supporting devolution of powers. Some of the challenges evident are:

- Restricted autonomy for ward committees
  - Many projects need state government approval
  - Political pressures and perceived threats of erosion of powers
- Erratic selection process of ward committee members and insufficient civil society representation
- Lack of dedicated funding streams for projects
- Limited capacity to conduct participative practises of planning and limited platforms for citizen engagement

On the positive side, the legislative provisions made in the states of Kerala and West Bengal may be considered as model ones, with many provisions providing frameworks for institutional, financial and capacity building support[10]. The provisions that allow for a percentage of generated revenues to be redirected back for ward works create an incentivised model for the ward. The educational program run by Kerala has been extensive with trainings running in state, district and local levels[9].

4 Non-Institutionalised Initiatives

The historically top-down and high-level master planning approach for cities is typically been disconnected from smaller scale planning needs and the desired outcomes often stop short of successful implementation[1,22]. Along with evident gaps between Master Plan proposals on paper and its on-ground translation, the limitation of the broad stroke approach to address local needs are emerging as significant pitfalls in the planning process. Adding to this, the complicated mesh of intergovernmental agency

Table 1. Ward Committee Policy Provisions by State.

	Kerala	Maharashtra	Karnataka	West Bengal
How members are chosen				
Maximum number of members	• Changes with population	• Fixed	• Fixed	• Changes with population
Non-civil society representation	• Councillors from elected wards Nominated rep from every political party	• Councillors from electoral wards • Officer of ward	• Councillors from electoral wards • Participants nominated by state	• Councillors from electoral wards
Civil Society representation:	• 15 elected reps from RWAs and 20 from neighbourhood groups • All heads of educational institutes • 20 nominations by councillor from civil society	• 3 nominations by councillors from civil society	• 3 nominations by councillors from civil society	• 9–17 members nominated by the councillor and municipality from the residents, depending on population • 2–3 members from community development society
Designated responsibilities				
Planning	• Information gathering for plans • Identify the lapses in building regulation and implementing spatial planning • Formulate proposals on development schemes for the municipal area	• To grant administrative approval and financial sanction to the plans for municipal works • Redressal of common grievances of citizens, regarding municipal services	• Numbering of streets and premises, monitoring and supervising property tax collection,	• To identify the areas of priority and to take part in preparation of development plans in respect of the ward area • Prepare list of schemes for municipal plans (5 and 1year plans) • Separate sections in policy for administrative and planning functions, including timeline of tasks
Role in Budgeting of projects	• Discuss budget plans and audit reports	• Make recommendations for budgets and sanction them	• Make recommendations for budgets and sanction them	None
Other responsibilities	• Formulate literacy programs • Assist in the public health centres • Prepare list for beneficiaries for various schemes • Provide assistance for social welfare programs		• Garbage collection, health immunization, Slum improvements, Citizens' grievance,	• To supervise and monitor civic services being provided in the area • To assist the Municipality in various works related to the ward concerned • Constitution of beneficiary committees
Participation levels				
Meeting and availability of information	• Regular meetings once in 3 months • Master Plan must include statement of community involvement	• Meetings once every month • Annual Ward Committee meeting not open to citizens nor can they access proceedings	• Meetings once every month	• Monthly meetings • 2 meetings with all residents annually • Annual Ward Committee meetings open to citizens

coordination[23] makes it difficult to hold any single authority accountable, resulting in a sorry state of affairs on ground with citizens feeling helpless or apathetic to the situation. As a response from the end user, many programs and projects have been initiated to integrate citizen voice into existing planning process. While many of the projects mentioned below are citizen-led, projects such as Bhagidari in Delhi and LAP have been led by the government agencies. The Bhagidari scheme and the Local Area Planning (LAP) project of Municipal Corporation of Delhi, both have been categorized as non-institutionalized initiatives in this paper. The Bhagidari program was led by the then Chief Minister of Delhi and was never institutionalized and the program was discontinued after the completion of the minister's tenure. The USAID FIRE-D Local Area Planning process, similarly, did not become an institutionalized process. The cases discussed below look at the projects in the aspects of the methodology adopted, key players that made it possible and financing mechanisms concluding the on the positives and the learnings from them for effective participative processes.

4.1 City: Delhi

Context:
Delhi has seen a piecemeal planning approach. The restriction to recycle land (redevelop land) until the 2001 Master Plan meant that new development consistently happened outside of original municipal limits leading to unplanned sprawl. The city's severely constrained supply of land, coupled with its vague and broad Master Plan, created without population input, and single building code, has led to a significant difference between plan and reality. Also Delhi's direct connection to the federal government can be an impediment when it comes to managing day-to-day issues. The city municipal corporation has been inefficient in overcoming the shortcomings which have only become starker with the gradual increase of Delhi's population. The city has suffered with the increase of several urban issues, including water supply deficits and electricity theft.

4.1.1 Case 1: Local Area Planning (FIRE-D, USAID)

Starting point and developments:

Top-down approach. In order to deal with the inconsistencies between the Master Plan and reality, MCD started a reform process by the end of 2003. With USAID as its main partner, MCD looked into possible alterations of Delhi's bylaws that might soften those inconsistencies and produce policies closer aligned with local necessities and aspirations. By 2005, the project produced draft amendments to the bylaws and to the DMC Act, as well as guidelines for the preparation of local area plans. In that same year, the project was continued and local area pilot plans with input from local stakeholders were developed. By 2008, when USAID published a report on the project, the pilot projects were near delivery[24].

Lessons learned:

Lack of institutional capacity:

USAID identified a lack of capacity in both the government and the private sector[24]. The MCD had a small number of urban planners among its staff, while the consultants hired to implement the pilot projects had little to no experience in such a complex process. In fact, most consultancy firms did not have the multidisciplinary team the process required, and were forced to assemble professionals from elsewhere, which was, in some cases, detrimental to the projects.

Challenges to LAP boundaries:

Each local area has its own characteristics that need to be taken into consideration when the determining LAP boundaries. Its density, built environment, land use, *etc.* should make an area somewhat homogeneous, so that issues are clear and unique, and there is no under or over-representation of a group. Additionally, LAP boundaries have to conform to higher level plans (such as Delhi's Master Plan).

Data:

LAP requires data on an area's properties, population, services, infrastructure *etc.* These need to be accurate and up-to-date, as well as easily accessible and understandable that is, available in the form of statistics, charts, maps, *etc.* MCD's data was inaccurate and outdated, which demanded an effort on surveying the pilot areas for a more accurate diagnosis of the area's ailments and advantages[24]. One particular issue on which is hard to obtain information was property ownership.

LAP cannot substitute a Master Plan:

As mentioned above, LAPs have to conform to higher-level plans. If those plans are restricting or outdated there is little LAP can do to overcome those features.

Challenges of public participation:

Stakeholders can often concentrate in their own interests and overlook others' concerns. Urban settings, in particular, can present a complex quilt of stakeholders and competing interests. Hence, participation processes need to use tools that lead towards unity and consensus. The government also needs to be able to respond to citizens' concerns and commit to the results so that trust is built with users.

Greater political context:

As mentioned above, when the pilot projects started, the consultancy firms had to perform area surveys to produce updated and accurate data. However, simultaneously, the authorities started a policy of sealing and demolishing illegal constructions that made efforts for surveying any given area particularly difficult. Furthermore, buy-in from authorities is crucial to assure the project's credibility with

citizens as well as assure the project in taken forward.

4.1.2 Case 2: Bhagidari Scheme

Starting point and developments:

Top-down approach. The Delhi government, with aid from a consultancy firm, created the program's concept and structure and launched it in 2000. Bhagidari sought to promote a partnership between government and citizens to improve life in Delhi, enlisting partners, or Bhagdars, to collaborate with government agencies on identifying and solving urban issues. Bhagdars were mainly representatives of resident welfare associations (RWAs) and bureaucrats from public utility agencies, but also members of market and industrial associations and authorized residential colonies[25]. Despite being a volunteer-based program, more than a thousand Bhagdars would join the program during the following decade.

While the program lacked planning features, it allowed for the improvement of services provision and the implementation of small urban improvement projects. Projects such as drainage systems and signage used funds from the My Delhi, I Care Fund, which allotted up to INR 50.00 lakhs for each of Delhi's revenue district. During its tenure, the program underwent a decentralisation process, with the creation of coordinators at the revenue district level. The administrative structure of the scheme also included a Bhagidari cell in the Chief Minister's office and nodal departments in the general administration department, which provided financial and administrative support.

Lessons learned:

Resistance to a new concept:

Bhagidari had to deal with resistance, both from government officials and citizens. Bureaucrats felt threatened by the perceived erosion of power, as well as, for some, the increased accountability that would shed light into and hinder corrupt practices[25]. At the same time, citizens were used to have communication with the government through channels for the redressal of grievances, instead of sharing responsibility in moulding and improving Delhi.

Elite capture:

Bhagidari has been accused of systematically excluding renters, squatters and low-income citizens in favour of middle-class property-owners[26]. The scheme only allowed RWAs to participate, although such bodies represent only a small percentage of residents (less than 25% in 2004, according to a government report). Additionally, the close connection the program fostered between participants created a parallel system of governance, granting those representatives unmatched access to government officials and shutting out other citizens. Furthermore, while participants who are granted such access see their projects advance, other participants complain about the low implementation rate and the lack of accountability by lower level officials.

Failure to institutionalise:

The government that introduced Bhagidari was never able to institutionalise it. In fact, the program relied heavily on the political influence of then Chief Minister of Delhi, Sheila Dikshit. Hence, when a new political party came to power, the program did not continue, despite overall approval from citizens. Today, there is no active Bhagidari cell.

4.2 City: Bangalore

Context:

Like many other cities in India, Bangalore does not have a strong municipal government. In fact, despite the mandate by the 74th Constitutional Amendment for devolution of responsibilities, State agencies provide and regulate many of Bangalore's basic services (like water and electricity). There is a disconnect between citizens' aspirations and agencies actions, which has inspired several organizations to act. Below, case studies involving Janaagraha, Next Bangaluru and the Neighborhood Improvement Partnership Challenge are summarised.

4.2.1 Case 1: Janaagraha

Starting point and developments:

Given this context, in 2001, Janaagraha, a non-governmental organization (NGO) was created to promote democratic participation as a means to improve the city. Janaagraha's first campaign, executed between December 2001 and May 2002, was built around the concept of participatory budgeting – despite a lack of institutional mandate for so. The NGO worked to involve citizens in the allocation of resources for local development at the ward level. Following, Janaagraha had a campaign focused on creating a "vision" for each ward with citizens' input between June and December 2003.

Lessons learned:

Issues with coverage:

Despite designing its first campaign to include participation from every spectrum of society, Janaagraha failed to reach to the urban poor[27]. The NGO later designed a specific campaign to cover that gap with mixed results. What is clear from this case and from the literature, however, is that the urban poor face greater challenges to access initiatives such as this one. There is a need of specific efforts to access them and include them in the participatory process.

Lack of institutional mandate or support:

The involvement of citizens, elected representatives and public administration was fundamental for the results described above. In fact, of the 15 wards Janaagraha identified as possible locations for the project, only 10 had representatives interested in it – hence only those areas participated in the project, with varying degrees

of success. Furthermore, even when there are positive results, the lack of a formal mechanism for its recognition by the government apparatus may still prevent it from being implemented[12].

Citizens' interest:

Despite the lack of a formal mandate, more than 100,000 citizens took part in Janaagraha's campaigns over a two-year period. There is a clear desire – at least in a subset of the population – to improve the urban experience.

4.2.2 Case 2: Next Bengaluru

Starting point and developments:
In 2009, under Germany's National Policy for City Development, the city of Hamburg received a project entitled Next Hamburg, aimed at creating a vision for the city through a collaborative process. Due to the success of its bottom-up approaches, the project was expanded to other cities in the world, under the realm of the NGO Next and local partners. In 2013, Next partnered with MOD Institute to implement Next Bengaluru. With two phases so far, one general about Bangalore, and another, more specific, looking at Shantinagar, Next Bengaluru is supposed to be an ongoing project.

Lessons learned:

Connection between participatory process and implementation:

Next Bangaluru produced an array of tangible solutions for urban improvement. These ideas, however, have not been further developed – there are no technical specifications or financial information. The project is ongoing, which could signify more details forthcoming. However, though Next Bangaluru so far has been successful in creating ideas and bringing people together, there has not been any infrastructural change on the ground.

Channels and tools for accessibility:

Next Bangaluru used several channels to reach citizens, allowing (theoretically) all to participate in the process of discussing the city's future. Additionally, the organization experimented with different tools for collecting and exposing ideas, making complex issues more approachable and the ensuing discussion accessible to all.

4.2.3 Case 3: The Neighbourhood Improvement Partnership Challenge

Starting point and developments:

Citizen engagement in neighbourhood planning:

In 2015, the Citizens for the City initiative was set up by United Technologies Corporation (UTC) to support community engagement for sustainable development. Under this initiative was set up the Neighbourhood Improvement Partnership challenge in the city of Bangalore to encourage citizen to engage with the city as problem solvers with local governments. The Challenge sought to select and financially support neighbourhood led sustainable civic improvement solutions to address the many problems faced by the city.

Lessons learned:

Apprehensions of engagement from the municipal corporation

Though the initiative and ideas put forth by the citizens have been widely appreciated amongst the government officials, the lack of set principles of citizen engagement led the official to take a less active role in the challenge. Also the limited engagement of local councillors/elected representatives in the wards in which these projects have been proposed was seen as possible hurdle in the successful implementation of these projects.

Limited citizen capacity to formulate replicable and scalable solutions

While many of the robust communities were able toformulate workable neighbourhood solutions, a large majority lacked the capacity to analyse the problem to its root causality, leading to many of the proposed projects being myopic in their impact. The limited ability to recognise the type of skill sets required in the team also restricted their ability to propose implementable and financially viable solutions.

Successful model of private investment in city projects

The challenge paved the way in setting up a model of engagement for citizens, experts and investors to engage with the municipal corporation to implement neighbourhood scale projects.

4.3 City: Mumbai

Context:
In 2009, the Maharashtra State government introduced legislation that allows for cluster redevelopment in the State. Based on the redevelopment model followed in Hong Kong and Singapore, the Cluster redevelopment is a form of land development where principal buildings and structures are clubbed together on a site for redevelopment and a major portion of the site is left open for recreation and infrastructural facilities. Following, a large-scale project for redeveloping Bhendi Bazaar, a 200-year-old market area of Mumbai and home to some 20,000 people with precarious infrastructure, was put forward by a community group.

Starting point and developments:

Bottom-up approach. The non-profit Saifee Burhani Upliftment Trust (SBUT) was created by the Dawoodi Bohras community, an Islamic sect that comprises about 70% of the population of Bhendi Bazaar[28]. Their goal is to improve the infrastructure of the area, while keeping the bustling characteristics of a street market this size. In order to do so, SBUT had to acquire consent from at

least 70% of the area population, which can be partially credited to the project's participatory approach.

Lessons learned:

"Homogeneous" communities:

As exemplified by the SBUT, buy-in for a project by communities bound by a common objective that arises of a homogeneity either political, economic, social or religious is usually easier to achieve. Homogeneous communities share desires/goals and share a sense of trust that puts them at an advantage from the very beginning of a participatory process towards a single agreed-upon outcome. In the present case it is suggested that the SBUT has taken up this complex and expensive redevelopment task as Bhendi Bazaar forms the religious headquarters for the Dawoodi Bohras, who constitute about 70% of the population in the area[28]. Nevertheless, the apparent homogeneity may muffle dissonant voices, forcing them to acquiesce to the majority, as some accuse the Bhendi Bazaar project of promoting.

4.4 City: Pune

Context:

As in other cities of India, Pune has a macro-level development plan that does not translate well into the reality on the ground. In particular, Pune's development plan sets out goals based on the funds disbursed on projects, instead of their impact on citizens' lives.

Starting point and developments:

NGO Janwani advocates for better quality of life in Pune. One of their projects involved the concept of local area planning as a tool to achieve that objective. Over three months, the NGO worked in three areas of Pune, trying to understand its mains issues and produce possible solutions.

Lessons learned:

Project Implementation:

While Janwani's project had no official connection to the government or local agencies[29], the NGO was able to present the results to elected representatives. The NGO is working towards including the projects in Pune Municipal Corporation's budget, at the will of the elected representatives − which illustrates the issue with a lack of a formal mechanism to translate a citizen's initiative in an official project by the local administration.

Building transparency

The Janwani Initiative has help build a lot more transparency in the functioning of the initiative with the overall municipal budget now being discussed in public forums and shared through media reports[30]. It has also made citizens aware of their rights.

Exclusive process

The process has been successful only with a few sections of the society, namely the middle upper middle class citizens. Another major aspect to note is the exclusion of the local corporators in the process which have led to problems in implementation[30].

From the non-institutionalised cases stated above is evident, the varied scales of citizen self-organisation to address issues city planning. Also evident are the levels of success of the initiatives based on the local government buy in and participation.

Programmes such as participatory budgeting in Pune and NIPC in Bangalore have paved inroads for integrating citizen voice in planning and exhibits a potential for scaling up, though limited by the lack of formal and institutionalised mechanisms and channels of engagement with local government. The unclear and less than transparent engagement process also limits the potential of sourcing private investment support, to fund neighbourhood scale civic projects, a need for many cash strapped city municipalities today.

The lack of successful participatory process is also accentuated by the inherent lack of capacity amongst citizen groups and government officials alike to engage in planning processes. This was an aspect particularly evident in the NIPC, USAID and Bhagidari programmes. Capacity building, transparent avenues of engagement for all involved emerge as key elements in shifting engagement from redressal model to participative solution finding followed by successful implementation.

5 Discussions

5.1 Devolution of Powers and Achieving Citizen Participation is an Incremental Process

In 1969, Sherry Arnstein wrote a seminal article, in which she introduced the concept of a "ladder of citizen participation[31]". Arnstein devised an eight-tiered ladder, having as a starting point, the notion that citizen participation is only possible and meaningful when there is redistribution of power. In the bottom two steps, there are methods that do not constitute participation − manipulation and therapy. The three middle steps are what the author entitled tokenism, where there is interaction with stakeholders, but not an actual redistribution of power. In this level, methods are informing, consultation, and placation. Finally, in the higher three steps, citizens display some power − through partnership, delegation of power, and citizen control.

Enabling true and effective citizen participation in an existing administrative set up is a complex process with challenges such as finding an amicable power and responsibility distribution framework, a building of additional capacity amongst both, government officials and citizens alike[24], ensuring fair civil society representation and enabling resources to support it. Decentralisation of power requires institutional, legislative and polictial support at

Table 2. Stakeholders, participation methodologies and finance models adopted by the initiatives.

	Participants involved	Methodology	Finance
Local Area Planning, FIRE-D USAID, Delhi	Lead partners: • Municipal Corporation of Delhi • USAID Other partners: • Local consultancy firms(hired by USAID) • Local stakeholders (groups not detailed)	The local area planning processes led by USAID had three main phases: • Data gathering and production (surveys and creation of maps); Participation to define each area limits and understanding • Data analysis; stakeholder involvement in the form of consultations to guide the work by consultants and assure their ideas and proposals were aligned • Proposals. so far has not included local input	USAID under the Indo-USAID Financial Institutions Reform and Expansion Project–De bt & Infrastructure Component.
Bhagidari, Delhi	Lead partners: • Initiative of the Chief Minister of Delhi • Resident Welfare Associations Other partners: • Market and Industrial Associations • Government and Public Utility Departments (Such as the Municipal Corporation of Delhi, Delhi Development Authority, New Delhi Municipal Council, Delhi Vidyut Board, Delhi Jal Board and Delhi Police and the Department of Environment and Forest) • Consultancy firms	• Membership workshops: Conducted three times a year, to introduce new Bhagdars to the scheme and train them • Thematic workshops: participants discuss specific issues in small groups to produce a solution by consensus • Review process: Meeting with RWA members in each revenue area to check status of projects	My Delhi, I Care Fund – governmental funds.
Janaagraha, Bangalore	Lead partners: • Janaagraha (NGO) Other partners • Citizens (strong middle class involvement) • Corporators • Bangalore Municipality Corporation (BBMP)	• First campaign (2002): Meetings in 65 wards and get all actors involved to negotiate local budgets. • Third campaign (2003): 5 workshops, bringing together over 2000 people in 10 wards to produce a ward vision and suggested projects, including technical and financial requirements. • Recent developments: Programs with focus on the urban poor. E-governance - allowing citizens to voice their concerns online and reach Metropolitan Agencies.	Ramanathan Foundation
NEXTBangaluru, Bangalore	Lead partners: • MOD institute Other partners • Citizens • Civic Societies • Activists	• Any citizen could send suggestions, either via their website or their local urban studio. This space held events, meetings, discussions, and workshops. • Through workshops in particular, the ideas from visitors and online suggestions were discussed and polished into possible projects. • Field trips or a cart was carried around and used to collect opinions from citizens to reach out to all populations	The German institution Robert Bosch Stiftung.
NIPC	Lead partners; • UTC Citizens of the city group Other partners • Resident Welfare associations • NGOs • CBOs/Civic Societies • Bangalore City municipality (BBMP)	• The model looked at engaging citizens as partners of change • The citizens could engage in the challenge through their local resident welfare associations or civil societies ensuring consensus and a broader and inclusive approach to problem solving. • The challenge invited ideas for across the city through a website conducting multiple capacity building workshops on formulation of ideas, projects, implementation and budgeting plans. • The selected teams would be provided with financial assistance to implement the project working in collaboration with the local government agencies	CSR funds of United Technologies Corporation
Bhendi Bazaar Cluster redevelopment	Lead partner: • Saifee Burhani Upliftment Trust (SBUT) Other partners: • Bhendi Bazaar residents (Bohras and otherwise) • Business representatives • Private Developers (?) • Government agencies	• Focus group discussions with all stakeholders.	Although current residents will occupy 80% of the project, the remaining 20% will be available for sale. Given the high real estate prices in Mumbai, those 20% should cover the project costs. SBUT will cover any shortfalls, through funds raised by the Bohras community.
Participative budgetting in Pune	Lead partners: Janwani Other partners • Citizens • Pune Municipal Corporation	• Surveys of the areas and dialogues with local residents and their representatives were conducted to identify "liveability[1] factors in areas, from physical structure to services, in order to better understand their issues and prepare local area plans.	Janwani has a number of donors and supporters, from government agencies to private companies and individuals.

varied levels of governance. Even with the considerable develolution of funds and extensive adult education and empowerment program in Kerala, the impact was considerably hampered by the inability of the system to convert vocalised concerns into implementable solutions. The Keralan model of implementation was on of 'action first, preconditions later' Reversing the order of conventional wisdom on decentralization, the LDF government earmarked the 35%−40% of funds for local self-government institutions instead of waiting for gradual building of administrative capacity[9]. This lead to many projects not seeing the light of the day and the under utilisation of the designated funding[32]. There is a need for a structured stagewise inplementation stategy for develotion of powers.

5.2 Building Trust to Enable Devolution of Powers

A general lack of clarity in roles and responsibilities in the process contribute to a perceived threat and aresistance in the devolution of powers in governance. Municipal agencies hold many of the functions recommended to be transferred to ward committees, and while transferring them could benefit residents with swifter service, it is perceived as a threat that could harm coordination at the municipal level and raise costs. This state of mistrust lies just as much between government bureaucrats and elected representatives as with citizens and governmentalike[30]. Local area projects are limited to neighbourhoods and wards and are mandated to follow city master plans[24]. While citizen groups may bring in many skill and financial resources the intent of many projects inherently remains myopic in nature. As was the case with NIPC where citizens have been encouraged to develop solutions for problems faced in the neighbourhood. It is in the onus of the administration to vet such projects for viability and ensure the integration the protection of the underlyingprinciples of the master plan.

In parallel is the perceived threat of erosion of powers leading to cases where the effectiveness of decision making and impact of local are committees are significantly hampered by red tape, bureaucracy, and required approval from the State, with state governments tending to hold most relevant powers and exercising them through the Municipal commissioner.

5.3 Fair Representation is of Paramount Importance

While the roles and responsibilities and the powers that are legislated to the ward committees are significant, the objective of the CAA is diluted, if such committees don't serve citizen representation platform for a continued negotiation with the administration. A case particular to urban areas, is the reducing proximity of the citizen to the government due to the limitation of number of ward committees[7]. In greater Mumbai, ward committees represent 7.4 lakh population, 2 lakhs in Nashik and 33,000 in West Bengal[7]. West Bengal and Kerala has been able to maintain one of the better populations to ward committee ratios. The West Bengal Municipal mandating a model of representation that varies with the changing ward population[10]. A case can be made here for alternate strategies to ensure good representation when in megacities such as Mumbai. Considering high and growing densities in the wards, the committees structure themselves can be made much more granular by the introduction of the CPL. In this case, the smallest unit of administration would be the Area Sabhas, from where representatives will be elected into the committee. Alternatively the 'Community development society (CDS) − Neighbourhood Group'[19] model in Kerala will provide a frame work for existing active civil groups to integrate into the formal decision making system.

The examples of citizen led initiatives from Bangalore and the ALMs from Mumbai exhibit varying competencies of citizens to build viable proposals. While citizens have the advantage of building solutions crafted for the neighbourhood the plans and proposals need to adhere to larger city and zonal plans and nominated members to the Committee help negotiate and ensure developing viability in solutions. There needs to be fine balance between the interest of the city and the interest of the neighbourhood and at the same ensuring a platform for citizen voice. A balance between nominated and the elected representatives and a mandated representation from all constituent stakeholders of the neighbourhood to be able to comprehensively address the diversity and complexity of different urban areas remains significant in this process.

While there needs to be strategies to ensure interests of all groups are protected and provided for, the given diversity of urban areas in Indian cities have led to an uneven representations of interests. There have been cases where the ward committees have been interpreted as platforms to protect the interests of primarily low income groups (Cases such as in Kerala[33] and Mumbai, Maharashtra) leading to citizens belonging to the middle income spectrum losing interest in the system and looking at alternate ways to engage with the government (Such as development of ALMs in Mumbai). To be fair, the needs and aspirations of different income groups may be very diverse, given the possible variations in service provision, socio-economic and cultural backgrounds and achieving consensual representation of interests may be complicated. While Ward committees are constituted by administrative boundaries of a ward, sub-dividing planning areas within on the basis of common socio-culural and economic back drops with allocated budgets might help protect interests of all groups. These plans can then feed back into an overall ward development plan.

Another strategy that might help build more homogenised approaches planning for the neighbourhood is by clubbing homogenised interests. The Siliguri model has created subcommittees within the ward committee with focus areas such as conservancy, construction and health. Siliguri Municipal Corporation has had ward committees functional even before the 74th CAA. In its subcommittees one ward council member is made the convenor and additional population is drawn from the general population to supervise developmental works and the everyday functioning of the concerned functions[10]. Beneficiary committees have been effective as well in the representation of low income and slum groups.

5.4 Enabling Resources and Support Systems

Building supportive frameworks that enable participative planning has been a gap that has not been addressed effectively by many states in the implementation of the 74th CAA. This an aspect that requires intervention not only both within the government but also within citizens. On this front, the provisions made by the state of Kerala in setting up of multiple institutional and legislative support systems remain one of the most elaborate efforts in the country. Citizen engagement is a complex process and while initiatives such as Bhagidari have tried to resolve this with capacity building workshops within the government and amongst citizens. One significant change essential is the shift in the nature of engagement with the government from purely that of redressal to one of collaborative solution building. Building viable solutions to neighbourhood level issues will help citizens to more effectively engage with ULBs. While initiative such as Bhagidari, the Kerala people movement and citizen led initiatives in Bangalore have provided good models to follow, citizen engagement itself is a complex process and local bodies may not have sufficient in-house capabilities to implement them. In such cases alternate strategies such as engaging academic institutions and other organisations to act as a mediatory will help effectively bridge the gap as has been proven effective in many cases. While Janwani in the Pune participatory budgeting imitative is one case example, the Kerala government has also looked at engaging institutions in capacity building drives as well.

The insignificant budgetary allocations have been a hindering factor for ward committees in exercising any real development responsibility. Limited budgetary allocations leave wards very little power and curtail their ability to address ground issues. In the case of the ward committees in Kerala, after the change of political leadership, a major portion of the funds initially allocated for local projects had been earmarked for state initiatives, leaving little for the committee to work with[32]. Strategies such as the provision by the Bengal state for the reallocation of a certain revenue percentage generated in the area, to the Ward committee for development works are effective models that will help incentivise ward level development works. While this model may incentivise development, such approaches may lead to prioritisation of only those projects that will contribute to increasing revenue of the area, over socially benefitting projects. The PPP model for civic interventions in Karnataka could be an alternative funding mechanism that may be adopted – as part of a municipal government initiative in Bengaluru allowed for private financing in local are civic infrastructure projects. On adhering to guidelines set up by the council to protect public interest, the model allowed the businesses to fund and implement infrastructure such as signage, street furniture, bus stops under the supervision of the local body. Models such as these if transparent will allow more citizen-led and funded projects in local areas. A similar model was followed by the Citizens led NIPC initiative and has proven successful as well. However, it must be noted that such PPP models can be effective in only bridging viability and cannot be expected to completely replace government funding.

5.5 Building Transparency Through Platforms of Active and Passive Engagement

While urban areas have master plans, there is little evidence of Local Area Plans (LAPs) supporting the planning process. LAPs have the potential to be effective platforms to enable participative local area planning for economic and social development through inclusive and transparent processes[34]. Like city master plans they hold the potential to be help plan a vision for the area and build strategies to help achieve the same by a clear process of budget allocations, prioritisation of projects and also help plan for additional resources that may need to be sourced.

Enabling multiple platforms of engagement enabling active participation will help build transparency by making information readily available. While e-governance platforms have proven to be very effective in cities across the world and India there have been many other technological platforms have been developed and are being used in the areas of collecting experience based data and allowing participation from different stakeholders. Technology tools have been designed to collect experience-based data about the living environment for both research purposes and to be used by planners. Tools have also been developed that enhance the participation of different stakeholder's processes along with allowing people to co-develop and customize them for participation in urban planning and community development, *e.g.*: Internet forums in Espoo are being used as forums for participation. The web-based arena allows to translate the inhabitants' knowledge to a form that suits the planning procedures[35]. Movements

such as open government and government 2.0 that look at encouraging open, collaborative technologies that enable easier collaboration between citizens and governments along with making available data for companies to be able to develop apps, websites and mashups for the benefit of the citizens [36].

However, the success of purely technology based engagement systems may be hindered by limited access and allow the participation from only specific sections of society. Hybrid models and on-ground engagement centres for events, works shops, providing for citizen feedback and ideas, will allow a more balanced percolation of the participative practises and dissemination of information. One of the successful models adapted by the Next Bengaluru project was setting up on ground and online interactive platforms to address the different levels of participation, given the less than homogeneous societal structure of most wards.

Effective participative planning practices can enable decentralisation of powers using multiple channels of citizen engagement, through institutionalised processes and citizen-led engagements. Ward committees and similar decentralised units of administration hold the potential to a seamless channel of direct engagement with the administrative and planning processes. They can ensure a fair representation of the ward and a fair distribution of resources, development is directed in consensus with citizens.

Devolution of power to ward committees have also been perceived as a threat that can harm co-ordination at municipal level and raise costs for administration. Participative processes may be potentially a waste of resources if the discussion is not considered seriously and is conducted in a tokenistic approach [37]. It may also run the risk of bad policy outcomes, if the discussion group do not fairly represent the community interests and voices, a fact resonating the significance of fair representation processes required in the constitution of ward committees. Participative planning processes are certainly an added cost to the government and the the question of whether the expense is better utilised in implementation is always in contention. However what needs to be taken into consideration building in a participative planning process reducing the probability of litigation, provides an opportunity for both the citizens and the government officials to be educated from each other on stances taken on specific issues, helps build trust and allay hostility and help in better policy and implementation decisions [37].

6 Conclusions

It can be argued that the process of building capacity for participative planning is an incremental one, similar to the analogy used by Sherry Arnstein and may form the basis of developing a constructive stage wise implementation strategy, starting with the lowest rung of building efficient interactive information dissemination systems. The development of powers and resources can be made available to committees incrementally, post evidence of competance in the different levels up the ladder, ensuring an impactful use of resources and a sustained implemetation.

Defining clear roles and responsibilities along with dissemination of information will help mitigate misunderstanding and perceptions of loss of power. There is also the pertinent argument that the real devolution of powers will require a reform of the urban governance structure and a localised decision making power structure (such as from office of the mayor) will help greater transparency and accountability [38].

The number of allowable ward committees and the representation per capita population, the selection and the composition, ensuring representation of diverse groups such as minorities, elderly, all genders and working sections are critical components in the devolution of power. Models that allow a granular representation such as the CPL or the Kerala CDS models may help overcome a widening citizen-administration distance. Fair representation of all interests through constitution of subject driven subcommittees can facilitate a more consensual development strategy for the area.

Financing models and capacity building still remain the enabling frameworks for the initial stages of participative planning implementation. While alternative funding models such as PPP should be made available, models such as that provided by the state of W. Bengal provide an incentivised model for area development. In the face of limited resources and capacity for participative planning, engagement of institutions to act as bridges between citizens and administration have proven to be effective and may help building in greater transparency and trust into the process. Different engagement models have proved successful in different urban areas for varied objectives. Strong citizen led initiatives also have definite associated advantages. Often formed in attempts to bridge local issues, these groups have clear and consolidated mandates, are self-organised, motivated to take ownership of projects. They are naturally homogeneous in their composition and they hold the potential to source diverse skills sets from the neighbourhood skill pool. They also are able to leverage private resources and funding due to better accountability. Considering the complexity of the issue, city governments will need to make available different channels of engagement and participation such as being able to engage with such self-organised groups, amongst other things. These engagements will also essentially need to tie together into a comprehensive local area development plan and ensure optimal utilisation of all available resources. City governments should look at citizen engagement both through institutionalised structures such as ward committees and

others such as citizen-led groups to act as active partners in the co-creation of the policy and planning process.

Conflict of Interest and Funding

No conflict of interest was reported by the authors.

Appendices

Appendix A

18 major functions were to be granted to the ULBs by the 74th Amendment[39]:

1. Urban planning including town planning.
2. Regulation of land-use and construction of buildings.
3. Planning for economic and social development.
4. Roads and bridges.
5. Water supply for domestic, industrial and commercial purposes.
6. Public health, sanitation conservancy and solid waste management.
7. Fire services.
8. Urban forestry, protection of the environment and promotion of ecological aspects.
9. Safe guarding the interests of weaker sections of society, including the handicapped and mentally retarded.
10. Slum improvement and up gradation.
11. Urban poverty alleviation.
12. Provision of urban amenities and facilities such as parks, gardens, and playgrounds.
13. Promotion of cultural, educational and aesthetic aspects.
14. Burials and burial grounds, cremations, cremation grounds and electric crematoriums.
15. Cattle pounds; prevention of cruelty to animals.
16. Vital statistics including registration of births and deaths.
17. Public amenities including street lighting, parking lots, bus stops and public conveniences.
18. Regulation of slaughterhouses and tanneries.

Appendix B

Adult education drive in the Kerala to support participatory process.

To support the participatory process, Kerala carried out one of the most extensive adult education and empowerment programs in India's history[9]. Training occurred on three levels: state, district, and local.

The state level trainees, about 600 people, received nearly 20 days of training and were deemed Key Resource Persons. The district level trainees received 10 days of training to become District Resource Persons. On the local level, more than a lakh people received at least five days of training. Through seven rounds of training, the program reached around 15,000 elected representatives, 25,000 officials, and 75,000 volunteers. Each round focused on how to carry out a specific planning activity that would be used, thus targeting the capacity to facilitate the participatory process[40].

Appendix C

Local Agenda 21

Agenda 21 addresses a lot of problems and solutions which are tied close to local activities and the participation of locals become significant for its success. Local authorities form the governance closest to the people and play a key role in the promotion of sustainable development. Local Agenda 21 aims at ensuring a better quality of life for everyone and looks at addressing economic, social and environmental issues at the local level through encouraging efficient practices. Implementation of Local Agenda 21 thus entail local authorities to enter into a dialogue with its citizen's local organisations and private enterprises to arrive at strategies for sustainable development through consultation and consensus[4].

Appendix D

Note on Janwani methodology: surveys carried about in Pune:

Throughout 2014, Janwani developed a local area planning project in three neighbourhoods, chosen for being deemed representative of different areas of the city. Following, Janwani wished to understand what were the "liveability" factors in each of these areas, from physical structure to services, in order to better understand their issues and prepare local area plans. This step required surveys of the areas and dialogues with local residents and their representatives. Janwani also had meetings with citizens' groups. The data underwent a SWOT analysis through which a list of the issues to be addressed was prepared and later organized within a timeframe and prioritized. This step involved citizen participation to ensure Janwani was reflecting their views truthfully and to aid in prioritization. The resulting projects were to be submitted to government officials.

References

[1] United Nations Development Program (UNDP), 2001, *Decentralisation in India Challenges & Opportunities*, UNDP, New Delhi.

[2] World Bank, 2016, *Social Development – Social Accountability E-guide*. https://saeguide.worldbank.org/sites/worldbank.org.saeguide/files/documents/1_Participatory%20Planning.pdf.

[3] United Nations, 2001, *Building Bridges through Participatory Planning – Part 1*, Romania Foundation for local development (FPDL).

[4] School of Planning and Architecture, *Alternative approaches to Master plan*, School of Planning and Architecture.

[5] Connelly S, 2002, *Public involvement in Local Agenda 21: the impact of local authority policy processes*, University of Sheffield.

[6] Hamid A, 2004, *74th Amendment: An Overview, Centre for Civil Society*, New Delhi.

[7] Sivaramakrishnan K C, 2011, *Revisioning Indian Cities: The Urban Renewal Mission*, SAGE Publications.

[8] George M S, 2007, *An Introduction to Local Self Governments in Kerala*, SDS CAPDECK, Kerala, India.

[9] Isaac T T and Franke R W, 2002, *Local Democracy and Development: The Kerala People's Campaign for Decentralized Planning*, Rowman and Littlefeild Publishers INC., New York.

[10] The Energy and Resources Institute (TERI), 2010, *Enhancing public participation through effective functioning of Area Sabhas*, TERI, New Delhi.

[11] Baud I and Nainan N, 2008, "Negotiated spaces" for representation in Mumbai: ward committees, advanced locality management and politics of middle class activism, *Environment & Urbanization*, vol.20(2): 483−499.

[12] Sivaramakrishnan K C, 2006, *People's participation in Urban Governance*, Concept Publishing Company, New Delhi.

[13] Sivaramakrishnan K C, 2006, *People's Participation in Urban Governance − a comparative study of the working of wards committees in Karnataka, Kerela, Maharashtra and West Bengal*, Concept Publishing Company, New Delhi.

[14] Chamaraj K, 2014, *With new Ward Committee draft rules, power to citizens still remains a pipe-dream*, Citizen matters. http://bangalore.citizenmatters.in/articles/new-ward-committee-rules-bengaluru-no-power-to-citizens.

[15] Namma Bangaluru Foundation, *Study on the functioning of the Ward Committees in Bangalore*. http://namma-bengaluru.org/PDF/Annexure.pdf.

[16] BBMP, 2010, *BBMP Budget 2010, ward-wise special grants*. https://www.scribd.com/document/37544765/BBMP-Budget-2010-Special-Grants-Ward-wise.

[17] West Bengal Department of Municipal Affairs, 2001, *The West Bengal Municipal (Ward Committee) Rule*.

[18] Roy U K and Ganguly M, 2009, Integration of Top down & Bottom up approach in Urban and Regional Planning: West Bengal Experience of Draft Development Plans (DDP) and beyond, in *National Town & Country Planners Congress*, Goa, India.

[19] Ramachandran M, 2014, *India's Urban Confusion: Challenges and Strategies*, Copal Publishing Group, New Delhi.

[20] Free Press Journal, 2015, *Form Mohalla Samiti on pilot basis: HC to IMC*. http://www.freepressjournal.in/indore/form-mohalla-samiti-on-pilot-basis-hc-to-imc/515931.

[21] Department of Municipal Affairs, Government of West Bengal, 2001, *Ward committee rules 2001*. http://www.wbdma.gov.in/PDF/TheWB_WardCommittee_Rules_2001.pdf.

[22] Ahluwalia I J, *Planning for Urban Development in India*, ICRIER. http://icrier.org/Urbanisation/pdf/Ahluwalia_Planning_for_Urban_%20Development.pdf.

[23] Aijaz R, 2015, Social marginalisation in urban India and role of the State, *Observer Research Foundation Issue Brief*, 118: 1−8.

[24] United States Agency for International Development (USAID), 2008, *Preparation of Local Area Plans: Pilot Project for Delhi, India*, The Communities Group International (TCGI) in partnership with AECOM. http://pdf.usaid.gov/pdf_docs/pnaea781.pdf

[25] Delhi Government, 1998, Bhagidari. http://delhigovt.nic.in/newdelhi/bhagi.asp.

[26] Kundu D, 2011, Elite capture in participatory urban governance. *Economic & Political Weekly*, vol.46(10): 23−25.

[27] Harriss J, 2010, 'Participation' and Contestation in the Governance of Indian Cities. *Simons Papers in Security and Development*, 3: 2−23.

[28] Goyal M, 2015, Economy: Infrastructure. http://economictimes.indiatimes.com/news/economy/infrastructure/bhendi-bazaar-rs-4000-cr-makeover-of-indias-largest-ever-cluster-redevelopment-project-could-be-a-tem plate-for-others/articleshow/49432897.cms.

[29] Menon S and Badgujar S, 2007, *Participatory Budgeting in Pune*, Centre for Environment Education.

[30] Menon S, 2013, *Participatory Budgeting in Pune: A critical review*, Centre for Environmental Education.

[31] Arnstein S R, 1969, A ladder of citizen participation. *Journal of American Institute of Planners*, vol.35(4): 216−224.

[32] Rajesh K, 2009, *Participatory Institutions and People's Practices in India: An analysis of Decentralisation experiences in Kerala State*, Institute for Social and Economic Change, Bangalore.

[33] Mohanan Pillai P M, 2016, *Social Classes and Participation in Local Planning in Kerala: A Micro Level Study*, Research Unit on Local Self Governments, Thiruvanathapuram.

[34] Ministry of Law and Justice, Government of India, *Constitution of India: Amendment acts*. http://indiacode.nic.in/coiweb/amend/amend74.htm.

[35] Centre for Urban and Regional Studies, 2008, *Digital Tools in Participatory Planning*, Centre for Urban and Regional Studies Publications, Aalto.

[36] Chernoff M, Resources: Open government. https://opensource.com/resources/open-government.

[37] Irvin R A and Stansbury J, 2004, Citizen participation in decision making: Is it worth the effort?. *Public Administration Review*, vol.64(1): 55−65.

[38] Idicula M, 2016, Opinion: Columns. http://www.thehindu.com/opinion/columns/should-mayors-be-directly-elected/article9018213.ece.

[39] Leena D and Sharma A, 2007, *Government by the people, Analysing 74th Constitutional Amendment Act 1992*,

Hazards Centre.

[40] Isaac T T, 2000, *Campaign for Democratic Decentralisation in Kerala: An Assessment from the Perspective of Empowered Deliberative Democracy*, Centre for Development Studies and Kerala State Planning Board.

RESEARCH ARTICLE

Enhancing Bengaluru's public transport network: approaches and challenges

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Abstract: In recent decades, Bengaluru as a metropolis has witnessed explosive growth – both in terms of population, which has doubled since 2001, and growth in vehicles, which have more than quadrupled in the same period (RTO 2016). This has significantly stressed the city's road infrastructure, leading to congestion and increases in pollution. Economic losses due to congestion for two of the city's Information Technology corridors alone are estimated at INR 227.7 billion annually (Bharadwaj 2015), without taking into account the health costs of increased emissions due to a surge in the number of vehicles plying in the city. 'Conventional' solutions addressing congestion within the city – such as road widening, creating one ways and building grade separators such as flyovers and underpasses – have failed to address the issue, and at the current rate of increasing vehicular volumes, the city's roads are forecast to be completely saturated by 2025.

This paper's premise is that public transport serves as the sole sustainable solution to Bengaluru's chronic congestion; only a large mode-shift towards public transport by 2025 can help reduce congestion on the city's roads. The paper advocates the Avoid-Shift-Improve strategy to achieve this, focusing on transport-specific improvements required to incentivise commuters to shift to public transport and identifies institutional and financial changes in the way of enhancing public transport in the city. The paper also forewarns against neglecting the city's conventional bus system in favour of other, capital-intensive modes of mass-transit, forecasting that buses will continue to meet over 75% of the city's public transport demand even after the completion of Phase I and II of the city's metro and the introduction of a functional commuter rail system.

Keywords: congestion, public transport, city development

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1 Introduction

India is urbanising rapidly. While 68.84% of India's population still lives in villages, the 2001–2011 decade marked the first occasion when India added a higher population to its cities than its villages[1]. With Indian cities as engines of growth and primary contributors to the country's GDP (60% currently; expected to reach 75%–80% by 2030[2]), economic migration to urban agglomerations will only increase. India is projected to add approximately 404 million citizens to its urban population by 2050 – the largest increase in the world[3]. Recent increases in population have also been accompanied by increases in incomes across India's middle and aspiring middle class[4]. Among other aspects, this increased income has been funnelled into the purchase of two and four-wheeler vehicles, the numbers of which have nearly quadrupled[1] since 2001 at a Compounded Annual Growth Rate of 10%[5].

City infrastructure – especially road infrastructure – has struggled to keep up with this increase in utilisation, leading to endemic traffic congestion across India's cities and poor road safety records. Vehicular growth has led to worrying increase in emission levels, which are estimated to cause close to 40,000 premature deaths in the country annually[6]. 'Conventional' solutions to alleviate road congestion – widening roads and building grade separators such as flyovers and underpasses – have failed to relieve gridlock. The current challenge, thus, calls for a far stronger and more inclusive approach to improve mobility in Indian cities.

This paper focuses on the city of Bengaluru, the fastest-growing metropolis in India[7], as a case study discussing the current transport scenario in the city. It then highlights how only a significant mode-shift to public transport can avert the city's road network from saturation within the next decade, while also focusing on institutional and fi-

[1]From 54.99 million to 2001 to 182.45 million in 2013 (MORTH 2013).

nancial challenges in the way of improving the city's public transport network. Our research advocates multiple approaches to enhance public transport in the city on a mode-wise basis over the span of the next decade, a holistic foundation upon which further improvements can be made.

1.1 Bengaluru – Brief Overview

Bengaluru, the capital of the state of Karnataka, is India's fifth most populated metropolis[8]. Founded in 1537, the city's strategic location and mild weather attracted the British who established a cantonment within the city in 1809, providing a fillip to trade and growth. The city's economic growth accelerated significantly after India's independence in 1947, with the establishment of numerous public heavy industries and educational institutions in the city[9]. More recently, Bengaluru has become a hub for Information Technology (IT) and biotechnology, attracting professionals from across the country. In this context, it is not especially surprising that Bengaluru's urban population growth rate of 46.68, between the 2001 and 2011 Censuses, was the highest for any district in the country[10].

Unfortunately, Bengaluru's spatial growth – to the tune of 264 square feet a minute between 2006 and 2012[11] – has been largely unplanned, and population and vehicular increases have severely overburdened the city's infrastructure. With a quadrupling of the number of registered vehicles plying in the city from 2001[12] to March 2016[13], most arterial roads in the city experience volumes of traffic in excess of double the installed capacity for smoother flow[14]. As per estimations by the Consortium of Traffic Engineers and Safety Trainers, average traffic speeds acoss 12 major arterial roads in the city have dropped from 35 km/h in 2005 to just 9.2 km/h in 2014[15]. The city was ranked sixth in IBM's Commuter Pain Index in 2011, a survey focusing on the emotional and economic toll of commuting[16]. The average citizen in Bengaluru spends more than 240 hours per annum stuck in traffic[17]. Significant increases in travel time to established industrial clusters have resulted in corporates such as Hewlett Packard altering their work timings. Others, such as Capgemini, have even decided to exit Bengaluru. It is estimated that the loss due to traffic snarls in Whitefield and Outer Ring Road is INR 227 billion per annum[18].

Traffic congestion, thus, is an issue that needs to be tackled urgently in Bengaluru. The succeeding paragraphs focus on the existing transport scenario in Bengaluru, followed by transit scenarios for the future and their ramifications for the city.

2 Existing Transport Scenario in Bengaluru

Unlike other large Indian cities such as Delhi, Mumbai, Kolkata, and Chennai, Bengaluru does not currently possess substantial rail-based capacity for intracity passenger-trips, and thus still relies overwhelmingly on its road network for city transit. Multiple studies have attempted to understand modal split – the distribution of overall passenger-trips in a city by different modes of transport – patterns in Bengaluru. Three of the most recent analyses are listed in Table 1.

Figure 1 highlights the current composition of vehicles in Bengaluru. As is evident, two-wheelers form the bulk of vehicles on Bengaluru's roads at 69%, with private cars the second highest demographic. Buses form a miniscule proportion of total vehicles at less than 1%.

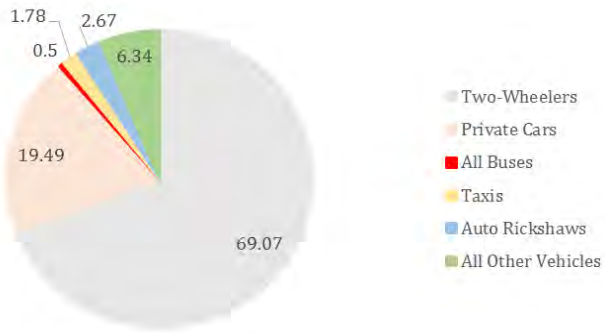

Figure 1. Vehicular composition percentage in Bengaluru, March 2016. Data from http://rto.kar.nic.in > Vehicle Statistics > Bengaluru Metropolitan City as on March 2016. Accessed 10 May 2016. All figures in percentages.

As seen in Table 1, while different surveys differ on the exact composition of modal split in Bengaluru, private vehicles are, in general, assumed to comprise approximately 30% of the total modal share in Bengaluru. Non-motorized transport accounts for approximately a third of total trips in the city, with public and intermediate public transport making up the remainder.

Given the composition of vehicles in the city, it is not surprising that the majority of trips completed using private vehicles are by two-wheelers. While the share of public transport in overall passenger-trips in Bengaluru is hardly abysmal, it is notable that comparisons with earlier studies suggest that the modeshare of public transport in Bengaluru's passenger-trips has stagnated - an unhealthy sign when considering the city's increasing emissions and congestion. The city's mode-share of public transport also compares unfavourably to India's other metros such as Delhi having 43%, Mumbai with 45% and Kolkata with 54%[20]. In this context, it is instructive to briefly examine the existing public transport setup in Bengaluru.

Table 1. Modal split in Bengaluru.

Study	Private Transport		Non-Motorised Transport		Public Transport/Intermediate Public Transport	
	Two-Wheeler	Car	Walk	Cycle	Public Transport	IPT
Wilbur Smith Associates – Government of India (2008)①	17%	8%	26%	7%	35%	7%
Bangalore Mobility Indicators (2011)[19]	25%	6%	32%	3%	27%	7%
WRI India Household Survey (2013)②	28%	2%	30%	1%	35%	4%

① https://casi.sas.upenn.edu/sites/casi.sas.upenn.edu/files/iit/GOI%202008%20Traffic%20Study.pdf

② Unpublished data; study done by WRI authors Srikanth Shastry and Sahana Goswami.

2.1 Bus Services

As Bengaluru depends on its road network for transit, its bus system plays a critical role in public transport. Public bus services in the city are operated by the Bangalore Metropolitan Transport Corporation (BMTC). BMTC is the sole provider of bus-based public transport services in the city, and its operations extend to urban, peri-urban and rural areas within the Bengaluru Metropolitan Region. With an effective fleet of 6,218 buses serving a metropolitan area of 5,130 km^2 [19], the Corporation caters to 5.02 million passenger-trips on a daily basis [21], making it one of the largest city bus operator in the country. The Corporation, along with several private fleet operators, also provides chartered services to major industrial and technology parks as employee shuttles. While not 'public' transport in the strictest sense, these services serve to reduce the volume of vehicles entering and exiting significant white-collar business clusters durin peak hours.

BMTC is among the most innovative city bus operators in the country and has proactively utilised funds under the erstwhile JnNURM scheme to augment its fleet, while also enhancing services by inducting over 700 A/C buses into its fleet. It was the first city bus corporation in India to introduce an Intelligent Transport System (ITS), allowing passengers real-time information on upcoming bus arrivals, apart from providing the control room immediate information about bus operations. In another first in the Indian context, BMTC is scheduled to roll out a smart-card to enable cashless transactions on its services. The Corporation has, however, been criticised for low and erratic frequencies on many bus routes and for charging relatively high fares vis-*à*-vis other city bus operators in the country.

2.2 Metro Services

In 2007, Bengaluru began construction of a metro rail system operated by the Bengaluru Metro Rail Corporation Limited (BMRCL)[2]. Phase I of this metro – a north-south 'green' line and an east-west 'purple' line intersecting at Majestic, one of the city's transport hubs – spans a total of 42.3 km. Initially scheduled to be completed in 2011, the project has been plagued by delays; as of May 2016, the east-west line and the northern portion of the north-south line – 27 km in total [22] – are operational, with a daily ridership of approximately 140,000 [23]. Phase I is now expected to be completed by the beginning of 2017 and the cost has escalated from INR 81.5 billion to INR 138.5 billion [23].

Phase II of the metro – including extensions to the two existing lines, apart from two new metro lines – spans a total of 72 km at an estimated cost of INR 264 billion [24]. While this is scheduled for completion in 2019, the fact that this phase is still at the stage of land acquisition suggests that operations are likely to commence well past 2020. Figure 2 highlights the service coverage of Phase I and II of the metro (indicated in red and orange, respectively) as well as BMTC's routes (indicated in blue).

2.3 Rail Services

Unlike most metropolitan cities in India, Bengaluru lacks significant suburban rail services. While the existing railway network links the city's Majestic transit hub with multiple surrounding townships – not to mention several IT and industrial clusters on the city's periphery[3] – rail services for short-distance commuters are infrequent. As such, the idea of a Commuter Rail System for Bengaluru – using the existing rail network to provide frequent suburban and peri-urban rail services for the city – has gained

[2]The Bangalore Metro project is being implemented by a Special Purpose Vehicle (SPV) called Bangalore Metro Rail Corporation Limited (BMRCL) which is jointly owned by the Government of India and the Government of Karnataka.

[3]Major IT and Industrial Clusters with Convenient Railheads:

Area	Closest Railway Station(s)
Whitefield (IT cluster)	Whitefield, Hoodi
Electronic City (IT cluster)	Heelalige
Chandapura and Attibele (Industrial cluster)	Heelalige
Anekal and Jigani (Industrial clusters)	Anekal Road
Kempegowda International Airport	Doddajala
Kumbalgodu (Industrial cluster)	Hejjala

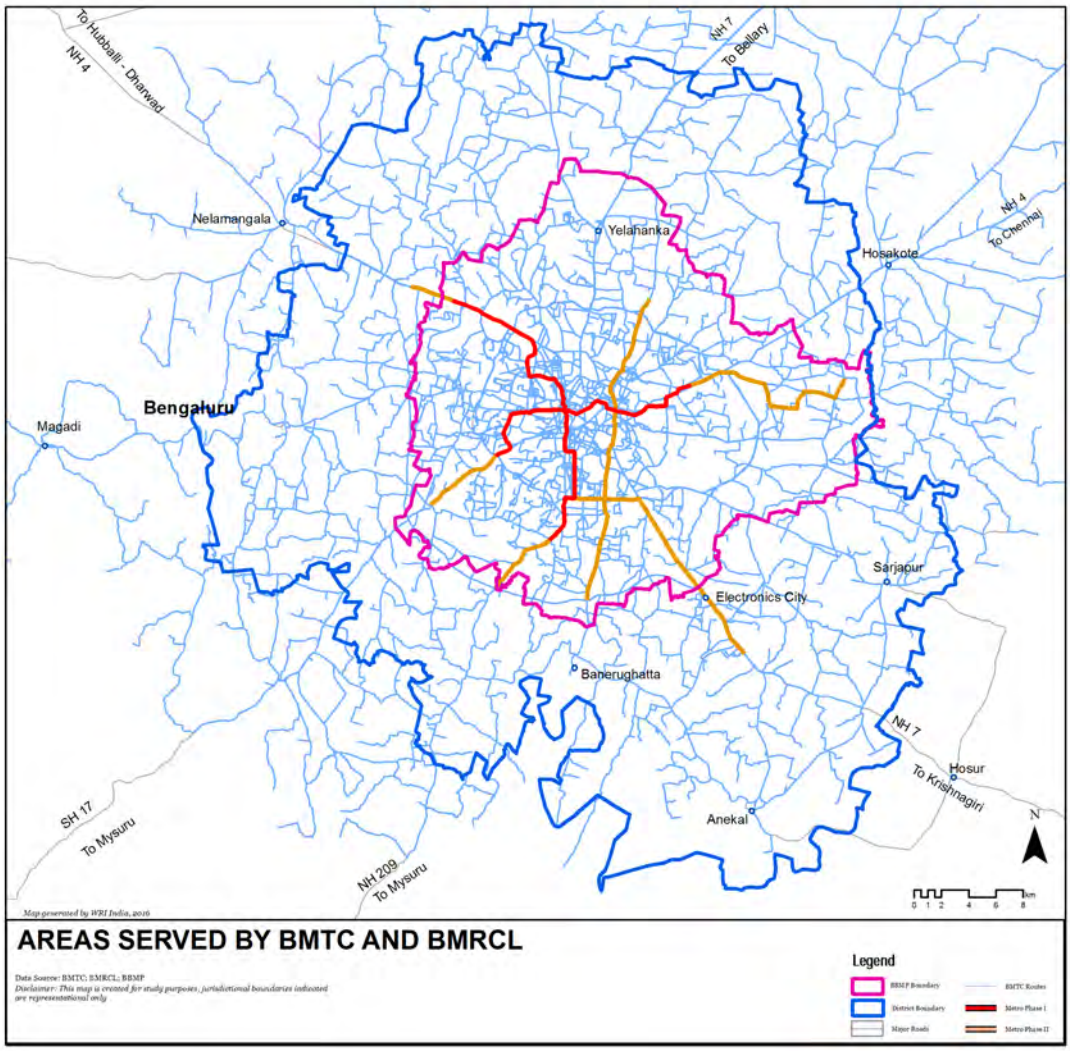

Figure 2. BMRCL and BMTC service coverage.
Map created by the WRI team (Raj Bhagat and Abhishek Sobbana) using data collected from BMTC and BMRCL.

traction over the last five years [25]. However, progress on developing the network for a Commuter Rail (Figure 3) has been negligible since the proposal was mooted.

2.4 Intermediate Public Transport

Bengaluru also boasts of a robust Intermediate Public Transport (IPT) system. This consists primarily of auto-rickshaws and call taxi services. Auto-rickshaws account for the majority of IPT services in Bengaluru. As of March 2016, there were over 160,000 registered auto-rickshaws in Bengaluru [13]. Although they are a vital component of the transport system in Bengaluru, quality of service is generally low due to factors such as poor safety, haggling for fares, and high rates of refusals to ply.

Call taxis operated by companies such as Meru and Mega serve the higher-end of the IPT market. More recently, the aggregator-based taxi model has begun to represent a significant and growing share of transport services in Bengaluru. Aggregators such as Ola and Uber, by virtue of relatively low fares, easy availability, and the convenience of a door-step pickup have managed to gain an estimated 0.5%[4] of total motorised passenger-trips in 2016, primarily passengers previously using auto-rickshaws and regular taxis. In addition to auto-rickshaws and call-taxis, minivanbased IPT services operate in the peri-urban areas of the Bengaluru Metropolitan Region.

3 Transport Scenarios

The evaluation of future transport scenarios for Bengaluru requires an estimation of the city's daily travel demand. Table 2 projects Bengaluru's travel demand – within the boundaries of the city's municipal corporation, the Bruhat

[4] Assuming 40,000 of the city's 65,000 registered taxis are with aggregators, each completing a set of ten trips on a daily basis. The estimated daily motorised passenger demand for 2016 is 8.82 million trips.

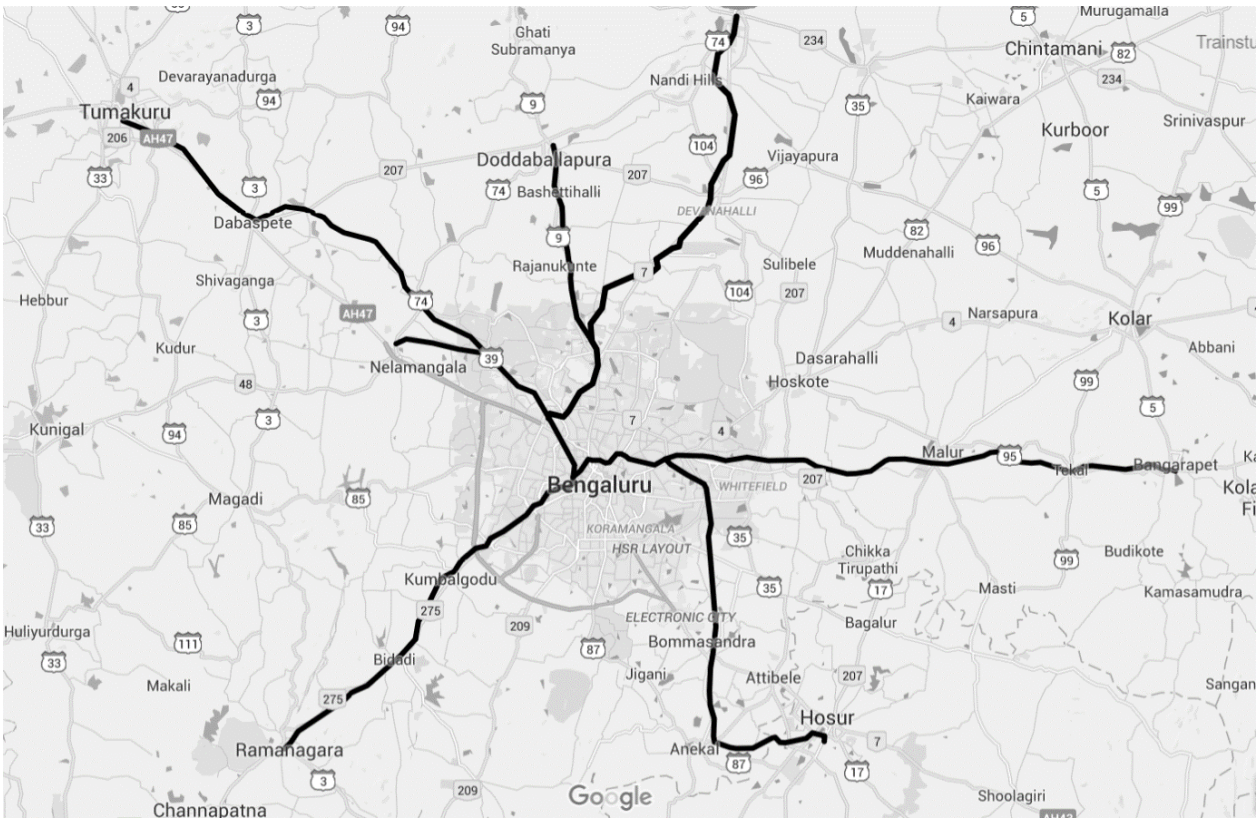

Figure 3. Proposed commuter rail network in Bengaluru, Phases I and II.

Bengaluru Mahanagara Palike (BBMP) – for 2025; this projection is derived from the baseline year of 2011.

Table 2. Modal split in Bengaluru.

Year	Population	Per Capita Trip Rate (Daily)	Total Daily Passenger Trips	Daily Passenger Trips (Motorised)①
2011	8.03 million	1.31[19]	10.52	7.36
2025	11.07 million②	1.40③	15.50	10.85

① Assuming 70% of overall passenger-trips to be motorised, in line with prevailing estimates.

② Projections based on the Revised Structure Plan for Bengaluru 2031, p. 93.

③ Per capita trip rates are observed to increase with increases in city populations. The figure of 1.4 is in line with estimates from WSA (2008) and CSTEP (2011) for a city of 11 million residents.

While the majority of city trips fall within BBMP limits (800 km^2), it is also pertinent to note the growth of population in the Bengaluru Metropolitan Area outside BBMP limits, encompassing eight major industrial clusters[5] and townships that generate significant economic and employment travel demand to Bengaluru city.

With the population of the Bengaluru Metropolitan Area outside BBMP limits projected to touch 4.64 million by 2025, even assuming a conservative Per Capita Trip Rate of 1 in this area and that only 50% of trips originating from these areas involve travel into the BBMP limits, the projected daily tally of motorised passenger trips in Bengaluru for 2025 increases to 13.17 million. Our estimate is marginally higher than modelling based on the Comprehensive Traffic and Transportation Plan (CTTP) of 2011, which assumes a daily demand of 12.72 million motorised passenger-trips for 2025.

Modelling based on the CTTP also indicate that a Business as Usual (BAU) approach to transport in Bengaluru will lead to total saturation of the city's roads by 2025, given the endemic congestion already prevailing on Bengaluru's roads. As the existing Right of Way (RoW) along the majority of the city's roads is insufficient for significant road widening, apart from the fact that roadway capacity expansion rarely serves as a long-term solution to traffic congestion, these estimates recommend that at least 75%–79% of total motorised passenger-trips should be made by public transport and IPT in 2025 to ensure a sustainable flow of traffic on the city's roads. This requires a significant augmentation of public transport capacity; however, solely augmenting capacity in itself is no guarantee of increased ridership, especially in the absence of

[5] These clusters include notable townships and industrial clusters such as (a) Ramanagaram and Channapatna (b) Harohalli, (c) Nelamanagala, (d) Thyamagondlu, (e) Dodballapur, (f) Devanahalli, (g) Hosakote and (h) Hebbagodi and Bommasandra.

service quality improvements that incentivise mode-shifts towards public transport.

4 Approach

Given the current mode-share of public transport in overall passenger-trips in Bengaluru, it is evident that only a proactive approach can enable a scenario where close to 80% of passenger-trips in the city are by public or Intermediate Public Transport in 2025. Our approach consists of three components which are articulated very briefly below:

Sustainable capacity augmentation: Proactive rather than reactive expansion of public transport capacity at a higher rate than anticipated increases in transport demand. This requires a careful evaluation of costs, capacity, transit speeds and the gestation period of different modes of transit capacity augmentation across the city. At present, BMTC buses and the Purple Line of the metro run to its capacity during peak hours, incentivising users to switch to private modes of transport.

Improving operational efficiency: The reliability of public transport is a major component of commuter decisions to switch to, and continue using, mass transit. While frequency increases provided by fleet augmentation are a means to improving transport reliability, increased operational efficiency through rationalised routing systems, better maintenance, and safety policies help further improve transport reliability through increased efficiency.

Improving service quality: Service quality also plays an important role in incentivising public transport utilisation. Above all, public transport must afford a convenient and pleasant commute – convenience in terms of a fast, seamless journey and pleasance in terms of fleet comfort and interaction with staff. This requires a high level of integration across transit modes.

The following section focuses on two macro-level challenges to enhancing public transport facilities in Bengaluru. This is succeeded by an application of our approach to existing and upcoming mass-transit modes in the city, apart from the network as a whole.

5 Challenges

Two major challenges exist to improving public transport as a whole in Bengaluru: lopsided financial investments in public transport and the currently fragmented institutional setup that hinders co-operation and progress across transit agencies within the city.

5.1 Lopsided Financial Investments in Public Transport

As mentioned earlier in this paper, the bulk of public transport demand in Bengaluru is currently met by its expansive bus system operated by the BMTC. Even with newer modes of mass transit – such as the metro – under progress, BMTC is likely to remain the central mode of public transport in the city. As of 2016, BMTC catered to 5.02 million passenger-trips on a daily basis [21], close to double that of the city metro's projected ridership even for 2031. Endemic delays in constructing and opening new metro lines have also resulted in ridership on the metro falling significantly short of projections made in its Detailed Project Report, as seen in Table 3.

Table 3. Metro rail projections and actual ridership.

Year	Population①	DPR Projections – Daily Metro Ridership②	Actual Daily Ridership
2011	8.03 million	1.02 million	0.04 million
2016	8.99 million	1.48 million	0.14 million③
2021	10.06 million (projected)	2.20 million	–
2031	12.60 million (projected)	2.80 million	–

① Population figures are from the Revised Structure Plan for Bengaluru 2031 (page 93), and are only for areas of Bengaluru within the boundaries of the Bruhat Bengaluru Mahanagara Palike (BBMP). These totals will thus be lower than population estimates for the Bengaluru Urban Agglomeration as a whole.

② Data from the report 'Need for Government Support for Public Bus Transport' by CSTEP, p. 18.

③ Daily ridership since the opening of the underground section of the east-west metro corridor on 30 April 2016. (Times of India 2016)

However, in comparison to the upcoming metro project and roadway reengineering works, BMTC receives minimal financial support from the state government. Unlike most city bus operators in the country, it receives no operating subsidy from the government, barring payments towards its heavily-subsidised student passes and a few other categories of discounted passes. BMTC has received a total of INR 5.6 billion since 2007 as assistance from agencies of the state government towards fleet enhancement [26]. However, the state has invested INR85 billion in roadway construction and improvement work over the last two years alone [27,28] and will invest INR 264 billion in Phase II of the Bengaluru Metro [24].

BMTC will not lose relevance even after newer mass-transit modes start operating in the city. There is substantial evidence to show that, both internationally and in India, city bus operators cater to a larger number of passenger-trips even in the presence of an extensive metro rail network. Transport modelling from Delhi, for exam-

ple, estimates that 64% of public transport trips are made by bus even with a 256 km metro network in place[29]. In the context of Bengaluru, BMTC is the only mass-transit mode that can change routes in real time based on passenger demand and serve as a critical last-mile service linking metro, BRT, and rail stations with surrounding residential and commercial areas. Even in a scenario with multiple other modes of mass transit operating, BMTC's service coverage remains unmatched, as Table 4 indicates. In addition, as most upcoming mass-transit projects entail long gestation periods and are unlikely to be fully operationalised within the next five years, Bengaluru's bus system has an especially significant role to play in the interim period – as the only method of rapidly expanding public transport capacity during this period if the government supports it.

Table 4. Transit modes and service coverage.

Transit Mode	Service Coverage
Bus (BMTC)	5,130 km^2 (1,321 road km utilised)[19]
Metro (BMRCL)	114 km (Phase I + Phase II)
Commuter Rail (IR)	161 km (as initially proposed)[25]
BRT	280 km (proposed)[17]

As any enhancement of the city's public transport network depends significantly on BMTC, the lack of meaningful investment in the mainstay of the city's public transport system poses a challenge to overall systemic improvements.

5.2 The Institutional Framework for Public Transport in Bengaluru

Bengaluru's institutional framework for public transport is highly fragmented – different government agencies manage individual aspects of urban transport and seldom co-ordinate among themselves. All urban transport and planning agencies[6] in Bengaluru report to the Urban Development Department (UDD), which is the apex body responsible to approve funding for almost all transportation projects. However, there is little transparency about decisions pertaining to urban transportation projects and their status of funding[30].

The lack of a Unified Metropolitan Transport Authority hampers transport enhancement in multiple ways. In the current setup, different transport agencies often work at cross-purposes and do not frequently apprise each other of major developments under their aegis. There are two major ramifications to this: first, the development of a common mobility ticket or card is usually hindered in the absence of an overseeing authority. This is because agencies are unable to resolve disputes around payment settlement mechanisms or 'telescopic' fares, where an integrated fare is charged for a multimodal journey. Second, as there is no overseeing authority to plan for upcoming transit changes, other transport agencies take time to service any disruption or modification in existing transport services (such as the opening of a new metro line requiring feeder bus services), resulting in reactive rather than proactive transport planning within the city.

To simplify the institutional framework and establish a comprehensive decision-making process, the government of Karnataka created two Unified Metropolitan Transport Authorities[7] in 2007. The Directorate of Urban Land Transport (DULT) oversees different land transport authorities in Karnataka, while the Bangalore Metropolitan Land Transport Authority (BMLTA) is responsible for Bengaluru. Though these institutions were designed to direct and co-ordinate between different land transport agencies, they lack the necessary legal backing and independent control of funds to mobilise projects. As such, transit agencies are not mandated to coordinate with the Unified Metropolitan Transport Authority. This is unfortunate, as a strong Unified Metropolitan Transport Authority is a prerequisite for the smooth implementation of a truly seamless, multimodal public transport in a city. The current convoluted institutional framework is a major challenge in the way of enhancing public transport in the city as each operator functions independently and there is no integration in the approach.

The most successful example of functioning of a Unified Metropolitan Transport Authority is Transport for London (TfL), which co-ordinates between multiple transit agencies operating different modes of transit[8]. Besides London, a number of other cities have begun the transition towards achieving multimodal integration, among which Paris, Singapore, Hong Kong, and New York have also been able to integrate public transport with intermediate

[6] Some major agencies are:

Agency	Responsibility
Bruhat Bengaluru Mahanagara Palike (BBMP)	Upkeep, maintenance and development of local roads
Bangalore Development Authority (BDA)	Planning and execution of city-based development projects
Bengaluru Metropolitan Transport Corporation (BMTC)	Operation of bus services within the Bengaluru Metropolitan Area
Bengaluru Metro Rail Corporation Limited (BMRCL)	Operation and planning of the metro rail project in Bengaluru
Bangalore Metropolitan Regional Development Authority (BMRDA)	Planning and execution of development projects in the 8000 km^2 Greater Bengaluru region
Indian Railways (IR)	Railway operations

[7] Unified Metropolitan Transport Authorities were a requirement for cities to receive funds under the erstwhile JnNURM scheme.

[8] Surface Transport (buses, cycle, taxis and private hire, river services, streets); Rail and Underground (Tube, TfL rail, trams, Emirates Air Line, Dockyard Light Rail, Overground); Crossrail (a joint venture between Transport for London and the Department of Transport to build a new railway line).

public transport. This would not be possible in the absence of a Unified Metropolitan Transport Authority[31].

The following sections of this paper discuss transit-specific approaches to enhance public transport in Bengaluru over the next decade by building capacity as well as augmenting service quality.

6 Transit-Specific Approaches

As mentioned earlier in this paper, our approach to enhancing public transport in Bengaluru consists of three major components: sustainable capacity augmentation, improving operational efficiency, and improving service quality. These aspects are discussed in the forthcoming sections.

6.1 Sustainable Capacity Augmentation

Different areas of a city require different public transit interventions. While choosing a mode of mass transit, it is important to understand its effectiveness in resolving transport issues in the context of the amount of time required to make it operational, its long term implications on the city's changing fabric, and economic feasibility in implementation.

Given Bengaluru's population and projected growth in motorised passenger-trips over the following decade to 13.17 million motorised daily passenger-trips, the city, quite evidently, merits a wide range of masstransit modes for seamless, speedy, and economical public transit. This paper focuses on city buses, BRT, and metro rail, and also briefly touches upon the proposed Commuter Rail System for the city. Given the need to create capacity to cater to 79% of total motorised passenger-trips in the city by 2025, we discuss a Business as Usual (BAU) scenario and an ideal, though not infeasible, scenario.

The Business as Usual scenario looks at BMTC fleet expansion over the previous five years as well as the present speed of construction of the Metro Rail. BMTC's effective fleet augmentation since 2011 is depicted in Figure 4, with an increase of just 369 buses in five years despite assistance from the JnNURM scheme.

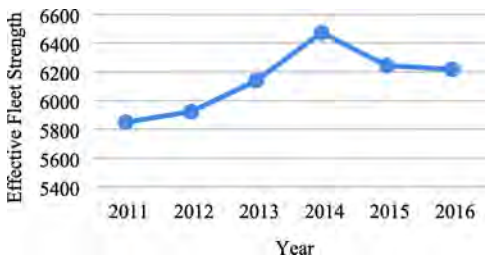

Figure 4. BMTC effective fleet augmentation 2011−2016.

Assuming a similar rate of fleet expansion and taking into account an effective augmentation of 1,000 buses across 2016−2017[32]. BMTC's fleet size is expected to expand by 1,500 buses by 2025, increasing total bus capacity to 8.3 million[9]. At the present rate of construction of the Bengaluru Metro, the metro network will touch 75 km in 2025, with an estimated daily capacity of 1.5 million. With no current push for Bus Rapid Corridors or a Commuter Rail System, public transport capacity will be at the total of 9.8 million − marginally insufficient to cater to the expected demand even at full capacity. More importantly, however, the current piecemeal development of public transport in the city hardly incentivises significant mode-shifts towards public transport, and public transport utilisation is unlikely to increase beyond present levels. Ridership figures from Delhi indicate a daily ridership of around 0.8 million for a metro network of 75 km in length, and assuming BMTC's existing load factor of 74.5%[10] to continue for its augmented fleet, overall bus ridership will increase to approximately 6.2 million, summing up to just 7 million in daily overall public transport ridership.

In terms of capacity augmentation, a desirable scenario would see the existing bus network considerably increasing capacity, the completion of Phase II of the Metro, the operationalisation of feasible Bus Rapid Transit Corridors, and the initiation of a Commuter Rail System in a manner that avoids disturbing the schedules of long-distance trains.

The introduction of rail-based mass-transit systems in the form of an expanded metro network and a functioning Commuter Rail System are good examples of sustainable capacity augmentation. It is, however, important to remember that while investing in capital-intensive rail-based modes of mass transit is inevitable and necessary at the present stage, the city bus system − the mainstay of public transport in Bengaluru − should not remain neglected.

6.1.1 City Bus Capacity

Previous sections in this paper have focused on BMTC's service coverage and the centrality of buses to public transportation in large cities to make the case for increased investment in augmenting city bus services. Added to these points is the fact that significant latent commuter demand exists in the city, demand that the Corporation has been unable to tap due to a lack of buses. BMTC's fleet is dwarfed by the number of company buses operating in the city, many of which transport regular passengers illegally after dropping their employees[33]. In addition to this, over 44,000 maxi-cabs and vans are registered in the city[13], several acting as a parallel public transport system on routes and times underserved by BMTC. The existence

[9]The calculation is based on assumption of: Number of buses * 8 trips per bus * load factor (number of seats and standees)

[10]Data from "State-wise Physical Performance of State Road Transport Undertakings 2015 − Part IV" published by the Ministry of Road Transport and Highways, accessible at http://bit.ly/29vgjAG (Requires a login and password)

of a flourishing, unregulated, and unsafe quasipublic transport system in the city clearly indicates deficiencies in the supply of 'legal' public transport across multiple locations in the city. Inadequate bus frequencies on many routes – especially during peak hours when buses run late due to traffic – add to commuter dissatisfaction, hardly incentivising continued use of bus transport.

There is thus a strong case for BMTC to expand its fleet – to provide safer, more reliable public transport to a large segment of the city's commuting populace as well as to decongest the roads. The Corporation has forecast a need for the city's bus fleet to touch 8,500 by 2018[11]. In an ideal scenario, BMTC's fleet should reach at least 10,000 buses by 2020, thus creating an effective capacity of 10.82 million passenger-trips on a daily basis. Unfortunately, the Corporation's plans of fleet augmentation over the past few years have been hampered by delays and non-delivery of buses from the suppliers. BMTC, however, can augment its fleet more rapidly by tapping underutilised private buses in the city through a gross-cost contractual model, wherein private operators supply and operate buses on routes defined by BMTC, with BMTC collecting fares and providing compensation on a per-kilometre basis to the operators in question.

6.1.2 Bus Rapid Transit Capacity

While augmenting the city's bus fleet is urgently required to enhance Bengaluru's public transport, indefinite augmentation of conventional bus fleets is likely to yield declining returns beyond a certain level. The largest[12] disincentive to switching to conventional buses for users of private vehicles is speed; buses – which move slower than general traffic as they need more room to manoeuvre the city's roads and stop frequently – do not provide a time-efficient solution to commuting within the city. In this context, the CTTP recommended close to 280 km of Bus Rapid Transit (BRT) Corridors for the city; high-frequency services utilising segregated bus ways on high-demand, high-quality roads; bus ways backed with quality stations that enable level boarding; and prepayment of fares. The advantage of BRTs over conventional buses are numerous; they enable average bus speeds to increase to over 30 kmph, and well-branded BRTs with comfortable bus stations offering realtime information on arrivals have proven far more successful in persuading non-bus users to shift to mass transit than conventional bus systems. They are also significantly less capital-intensive than constructing a metro and can be constructed in far shorter lengths of time.

Of the 12 corridors identified by the CTTP for BRT implementation, the pilot is expected to be trialled on the 31.7 km stretch from Silk Board to Hebbal, creating capacity of 0.5 million passenger-trips on a daily basis by conservative estimate[34].

6.1.3 Commuter Rail Capacity

The initial feasibility study on the Commuter Rail System recommended four corridors of such a system; with a distance of 161 km, these corridors are not touching Bengaluru's centrally-located City Station. This was later expanded to a 440-kilometre network criss-crossing the city centre. Given the high levels of rail congestion surrounding City Station, large-scale requirements are needed to re-engineer City Station to handle increased local services, not to mention operational changes required on the eastbound line from City Station to enhance rail capacity in the extended scenario. Considering this in the context of low levels of enthusiasm from both the railways as well as the State Government, it is unlikely that a 440-kilometre Commuter Rail Network is likely to materialise by 2025. As such, the initial 161-kilometre network has been envisaged in our 2025 scenario. As per calculations by RITES – running trainsets of 15 coaches each at a peak frequency of 10 minutes – the total capacity created by a Commuter Rail Network of 161 km is 0.8 million passenger-trips on a daily basis[25].

While the total capacity of public transport (including the metro) will total 14.6 million – higher than the capacity necessary for 2025 – under this scenario, ridership trends are estimated in Table 5.

Table 5. Break-up of estimated ideal ridership by 2025.

Mode of Transport	Estimated Ridership
79% of total daily motorised pas senger-trips	At least 10.4 million
IPT	1 million①
Metro	1 million②
Bus + BRT	8.2 million③
Commuter Rail System	0.6 million④

① Assuming a marginal increase from the baseline scenario.

② Based on Delhi Metro ridership for a similar metro length.

③ Assuming an effective increase of BMTC's fleet to 10,000 buses and operationalization of BRT corridors at a load factor of 70%.

④ Assuming an average daily load factor of 70%.

6.2 Improving Operational Efficiency

Capacity augmentation, though critical in enhancing public transport in a city, needs to be accompanied by improvements in the operational efficiency of public transport to further improve reliability, especially during peak

[11] Unpublished; based on communication by the chief traffic manager to Aloke Mukherjee.

[12] Survey responses from the Detailed Project Report on the proposed BRT corridor from Silk Board to Hebbal prepared by EMBARQ India.

hours. In the context of Bengaluru, the existing bus network provides plenty of scope for increased operational efficiency over two aspects visible to commuters: routing and operational safety.

6.2.1 Routing

BMTC's method of routing buses, while suitable for the city when the Corporation first came into existence, is currently outdated for a city as large as Bengaluru. The Corporation follows a destination-based routing system, where the aim is to connect the city's major hubs (in this case, Kempegowda Bus Station, K.R. Market, and Shivajinagar Bus Station) with most major – and many minor – localities through direct services, apart from attempting to connect major localities in the city with each other, again through direct buses.

While this system of routing works well in small cities with a few major localities, as a city grows – with new important localities forming – the number of direct routes required to service this growth increases exponentially. In Bengaluru's case, this becomes evident when comparing the number of routes in the city (over 2,300) with cities of comparable size and bus fleet strength: London (approximately 700)[13], Shanghai (approximately 1,000)[14], and Seoul (approximately 360)[15]. This results in multiple problems. First, numerous bus routes are closely duplicated by other routes for a majority of the journey, requiring commuters to remember several different route numbers for the same commute. This results in an overcomplicated, intimidating system especially for new users. Second, this renders providing passenger information and designing route maps a highly complicated task due to the multiplicity of routes. Third, the high route-to-bus ratio results in several less-popular routes being served by a single bus, resulting in low bus frequencies on many routes.

Based on an analysis of the existing system and its deficiencies, our research recommends that BMTC move towards a direction-based routing model instead. Rather than aiming to connect each major locality to each other through a direct and often infrequent route, a direction-based model envisages a 'connective grid' of high-frequency buses running throughout the city. In Bengaluru, this has taken the form of the Bengaluru Intra-city Grid (BIG) Bus Network with five different categories of routes[16]. While the number of transits a user makes during an average trip might increase, the higher frequency of buses results in a faster trip on the whole. Besides the 'Trunk', the feeders also need to be strengthened such that the transfer is smooth and the buses do not loose patronage. As bus routes are shorter on average under a direction-based system, it is possible to increase bus frequencies without significant fleet augmentation. BMTC is currently rolling out the new system in phases; when completed, it is expected to make the bus network in Bengaluru vastly more efficient.

6.2.2 Safety and BMTC

While a mode-shift to public transport is likely to improve road safety by reducing the number of vehicles on Bengaluru's roads, BMTC buses can also be made safer. Buses belonging to the Corporation were involved in 306 fatal accidents from 2012 to 2015, resulting in 327 fatalities, approximately 10.9% of the total fatal accidents and fatalities in the city[17]. 17% of the fatalities were passengers (boarding, alighting, and while commuting), almost all of which occurred in non A/C buses. These fatalities were primarily due to passengers falling off while boarding and alighting a moving bus, attributable to driver negligence in not keeping the doors closed while the bus is in motion. Based on this analysis, WRI's research has recommended that an automatic door-closing system be fitted in all buses, preventing the bus from moving when the doors are open.

Over 75% buses involved in fatal accidents were fitted with small non-standard side-view mirrors replacing the original mirrors. The replacements were primarily due to high breakage rate of standard mirrors caused by inappropriate assembly and handling while cleaning and maintenance of the bus. WRI's blind-spot analysis ascertained that drivers were unable to see anything at a height of 1.3 to 3.5 m from the bus front, resulting in frequent collisions with twowheelers attempting to overtake the bus. Based on this analysis, our recommendation is to replace non-standard small mirrors with Automotive Industry Standard (AIS) mirrors. Emphasis on safe and defensive driving training was also recommended for all BMTC drivers based on the assessment of the present training module.

6.3 Improving Service Quality

While capacity is a prerequisite for ridership for any mode of mass-transit, service quality is crucial to attract a larger range of users to the system than just those without access to private transport. In this context, Bengaluru's transport

[13] London: http://data.london.gov.uk/dataset/tfl-bus-stop-locations-androutes.

[14] https://www.travelchinaguide.com/cityguides/shanghai/transportation/town-bus.htm

[15] http://citynet-ap.org/wp-content/uploads/2014/06/Seoul-Public-Transportation-English.pdf

[16] These include 'Trunk' routes on arterial roads, 'City' routes replicating traditional city routes, 'Feeder' routes linking trunk routes with adjoining areas, 'Connect' routes enabling transit between adjacent arterial roads without entering the city centre, and 'Circle' routes operating on the Outer Ring Road.

[17] Unpublished; BMTC accident data was procured from BMTC by Roshan Toshniwal; City data available at http://www.bangaloretrafficpolice.gov.in/index.php?option=com_content&view=article&id=55&btp=55

system requires multi-modal integration – both physical and fare integration – to enable seamless commuting and improved last-mile connectivity options. Focusing on buses, BMTC's commitment to provide real-time bus running information and scrap ageing buses is commendable; however, its fare policy requires a relook.

6.3.1 Multimodal Integration

Current progress to integrate BMTC and the Bengaluru Metro – either through physical or fare integration – has not been promising. In June 2016, it was not possible to perform a multi-modal journey on a single ticket, and a common metro-bus pass introduced earlier was abruptly withdrawn[35]. If a single mobility card for the city cannot be introduced, BMRCL and BMTC should honour each other's smartcards once the latter rolls out its cashless ticketing system. Telescopic ticketing[18] across modes will incentivise commuters to use the most efficient multimodal route to their destinations, optimising ridership across modes.

To ensure the highest levels of utilisation of the metro and proposed Commuter Rail System, it is necessary to ensure sufficient integration of the metro with other modes of transit. This is especially important in the context of last-mile connectivity methods such as feeder buses and Intermediate Public Transport. Feeder routes from metro and rail stations should be designed carefully through a demand assessment study through the collection of mobility data, a review of existing bus routes around the two metro termini, and an evaluation of environmental factors[19] around these two metro stations. While BMTC had earlier introduced 'Metro Feeder' buses, routes introduced were not based on an analysis of last-mile demand from metro stations, with these routes closely replicating existing bus routes. Rather unsurprisingly, these routes failed to gain ridership.

6.3.2 Bus Fares

BMTC's fares are among the most expensive of any bus operator in the country, as Figure 5 comparing five major city bus operators illustrates:

Apart from irrational fare jumps, the current fare structure is problematic in that it avoids round fares for the most part, resulting in frequent change hassles for commuters. Among complaints received by the BMTC, those about conductors not returning change rank among the most frequent, often souring interaction between commuters and the bus system. Equally problematic is the current fare structure that heavily penalises passengers changing

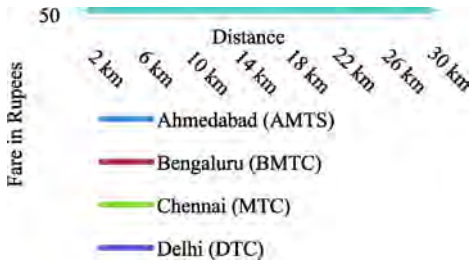

Figure 5. Bus fare comparisons.

buses during a trip – multi-bus journeys can cost up to 65% more than a single-bus journey of equivalent length.

At the outset, BMTC should look at fixing fares in multiples of five rupees to reduce change hassles among commuters, apart from reducing – if not abolishing – transfer penalties with the introduction of their cashless smartcard system. Unfortunately, in the absence of significant financial support from the government, it is unlikely that BMTC will be able to reduce their fares meaningfully in the near future to make them attractive to owners of two-wheelers. This is compounded by relatively high rates of taxation on State Transport Undertakings (STUs) in Karnataka. Data from the Ministry of Road Transport and Highways, 2014, reveals that of 45 STUs surveyed, taxes form a higher proportion of BMTC's cost than 25 other STUs[20]. As the state government does not provide operating subsidies to BMTC, it can consider reducing the rates of motor vehicle taxes paid by the undertaking, allowing it to pass on these benefits to commuters, making public transport fares more competitive to using a two-wheeler.

7 Conclusion

Bengaluru, currently the fastest-growing metropolis in India, is at a decisive point in its history. With most road infrastructure heavily overloaded, city planners can opt for conventional solutions in wider roads and elevated corridors, further incentivising people to use private transport. Alternatively, they can decide to use road capacity more efficiently by encouraging multiple forms of mass transit – a critically necessary approach in the case of Bengaluru. In the context of mass transit in India, the current trend in India is to prioritise capital-intensive rail-based system such as metros. Our research, however, indicates that Bengaluru will remain heavily dependent on bus transit even after the introduction of rail-based mass transit, with 80% of public transit trips still by bus.

[18] This allows passengers to travel across modes of transit on a single, integrated fare.

[19] These include congestion levels, roadway characteristics, road layouts and capacity to plan optimal feeder routes from these stations.

[20] Data from 'State-wise Financial Performance of State Road Transport Undertakings 2015' published by the Ministry of Road Transport and Highways, accessible at http://bit.ly/29kfnAs (Requires a login and password).

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No conflict of interest is reported by the authors.

References

[1] Chandramouli C, 2011, *Census of India 2011: Rural urban distribution of population*. Registrar General and Census Commissioner, India, accessed May 10, 2016, http://censusindia.gov.in/2011-prov-results/paper2/data_files/india/Rural_Urban_2011.pdf

[2] The Energy and Resources Institute, 2014, *Climate proofing Indian cities: A policy perspective*. The Energy and Resources Institute, New Delhi, accessed May 1, 2016, http://www.teriin.org/policybrief/docs/Urban.pdf

[3] United Nations, Department of Economic and Social Affairs, Population Division, 2014, *World urbanization prospects: The 2014 revision, Highlights*. United Nations, New York, accessed May 3, 2016. http://esa.un.org/unpd/wup/Publications/Files/WUP20 14-Highlights.pdf

[4] Beinhocker E D, Farrell D and Zainulbhai A S, 2007, Tracking the growth of India's middle class. *The McKinsey Quarterly*, vol.3(3): 51−61. http://ecell.in/eureka13/resources/tracking%20the%20growth%20of%20indian%20middle%20class.pdf

[5] Datanet India Pvt Ltd. *Total number of registered vehicles in India (1951, 1956 and 1959 to 2013)*, accessed May 10, 2016, http://www.indiastat.com/table/transport/30/registeredvehicles/16443/6121/data.aspx

[6] Bandivadekar A and Bansal G, 2013, *India retrospective fact sheet*. The International Council on Clean Transportation, India, accessed May 7, 2016, http://www.theicct.org/sites/default/files/India%20Retr ospective%20Fact%20Sheet%20Nov2013.pdf

[7] Bose P, 2011, Population boom: At 46.68%, Bangalore tops urban districts, *Business Standard*, accessed May 7, 2016, http://www.business-standard.com/article/economy-policy/population-boom-at-46-68-bangalore-tops-urban-districts-111040700056_1.html

[8] Census of India, 2011, *Provisional population totals: Urban agglomerations/cities having population 1 million and above*. Office of the Registrar General and Census Commissioner, Ministry of Home Affairs, India, accessed May 6, 2016, http://censusindia.gov.in/2011-prov-results/paper2/data_files/india2/Million_Plus_UAs_Cities_2011.pdf

[9] Bangalore Development Authority, 2012, *History*, accessed May 7, 2016, http://www.bdabangalore.org/history.html

[10] Kumar T K A, 2011, *Primary census abstractData highlights, Directorate of Census Operations-Karnataka*, accessed May 10, 2016, http://censuskarnataka.gov.in/presentation-PCA-2011Press%20Release.pdf

[11] *BBMP Restructuring: Expert committee preliminary report*, 2015, Government of Karnataka, Bengaluru.

[12] Praja.in, 2010, *Number of vehicles registered in Bangalore*, accessed May 14, 2016, http://praja.in/en/gyan/number-vehicles-registered-bangalore

[13] Transport Department, Government of Karnataka, India, accessed May 10, 2016, http://rto.kar.nic.in/

[14] Bengaluru City Traffic Police, 2016, *Bangalore Traffic*, accessed May 19, 2016, http://www.bangaloretrafficpolice.gov.in/index.php?option=com_content&view=article&id=45&btp=45.March 31

[15] Aditya Bharadwaj K V, 2014, Average vehicle speed drops to 9.2 kmph in Bangalore, *The Hindu*, accessed May 13, 2016, http://www.thehindu.com/todays-paper/tp-national/tp-tamilnadu/average-vehicle-speed-drops-to-92-kmph-in-bangalore/article6340410.ece

[16] Armonk N Y, 2011, *IBM global commuter pain survey: Traffic congestion down, pain way up*. IBM, New York, accessed May 17, 2016, http://www-03.ibm.com/press/us/en/pressrelease/35359.wss

[17] RITES, 2011, *Comprehensive traffic and transportation plan for Bengaluru*. Karnataka Urban Infrastructure Development and Finance Corporation, Bangalore. http://wricitieshub.org/sites/default/files/Comprehensive Traffic and Transportation Plan for Bangalore.pdf

[18] Aditya Bharadwaj K V, 2015, Traffic mess: Capgemini may exit Bengaluru, *The Hindu*, accessed May 10, 2016, http://www.thehindu.com/todays-paper/traffic-mess-capgemini-may-exit-bengaluru/article7982008.ece

[19] Directorate of Urban Land and Transport and Urban Mass Transit Company Limited, 2011, *Bangalore mobility indicators 2010-11*, accessed May 5, 2016, http://www.urbantransport.kar.gov.in/Bangalore Mobility Indicators (22-12-2011).pdf

[20] National Transport Development Policy Committee, 2013, *Urban Transport*, accessed May 13, 2016, http://planningcommission.nic.in/sectors/NTDPC/voulme3_p2/urban_v3_p2.pdf

[21] Bengaluru Metropolitan Transport Corporation, India, *BMTC at a glance*, accessed May 19, 2016, http://mybmtc.com/bmtc_glance

[22] Nidheesh M K, 2016, Bangalore Metro, *the journey so far*, HT Media Limited, http://www.livemint.com/Politics/jlyG8A4ASB6XzFeYzm8KcL/Bangalore-Metro-the-journey-so-far.html

[23] Bellie T, 2016, *Metro eases traffic on Mysuru Road*, accessed May 19, 2016, http://www.deccanchronicle.com/nation/current-affairs/190516/metro-eases-traffic-on-mysuru-road.html http://epaper.deccanchronicle.com/articledetailpage.aspx?id=5441350

[24] *Bangalore Metro Rail Project Phase 2*, n.d., accessed May 10, 2016, http://bmrc.co.in/pdf/phase2/phase2forweb.pdf

[25] *Implementation of commuter rail system for Bangalore*, n.d., accessed May 19, 2016, http://www.urbantransport.kar.gov.in/Bangalore_CRS_Final_Report.pdf

[26] BMTC, 2016, Request for Loan Subvention for Fleet. Bengaluru, 2 16. http://www.urbantransport.kar.gov.in/Bangalore_CRS_Final_Report.pdf

[27] Government of Karnataka, 2014, *Budget 20142015*, accessed May 13, 2016, http://finance.kar.nic.in/bud2014/bseng14.pdf

[28] Government of Karnataka, 2015, *Budget 20152016*, accessed May 14, 2016, http://finance.kar.nic.in/bud2015/bs2015eng.pdf

[29] Goel R and Tiwari G, 2014, *Promoting low carbon transport in India: Case studies of Metro Rails in India*. United Nations Environmental Programme, http://www.unep.org/transport/lowcarbon/PDFs/CaseStudy_MetroRails.pdf

[30] Vaidyanathan V and King R A, 2011, *The 4th Annual International Conference on Next Generation Infrastructures, Virginia Beach, Virginia, November 1618, 2011: Institutional analysis of urban transportation in Bangalore*, http://www.cstep.in/uploads/default/files/publications/stuff/f752307a5b273a0d2d9988e58e4f93a1.pdf

[31] Mani A, 2014, *On the move: The future of multimodal integration*, accessed May 19, 2016, http://thecityfix.com/blog/on-the-move-future-multimodal-integration-akshay-mani/

[32] Aditya Bharadwaj K V, 2016, Bengaluru gets its share: Rs 5,000 crore special grant for the city. *The Hindu*, accessed May 14, 2016, http://www.thehindu.com/news/cities/bangalore/bengaluru-gets-its-share-rs-5000-crore-special-grant-for-the-city/article8370342.ece

[33] Kidiyoor S, 2015, Illegal transport operators thrive despite RTO drives, *Bangalore Mirror*, accessed May 10, 2016, http://www.bangaloremirror.com/bangalore/others/Illegal-transport-operators-thrive-despite-RTO-drives/articleshow/49248664.cms

[34] Transport Training Institute and Consultancy, *Detailed project report: Non-motorized transit infrastructure facility near proposed PBS locations in Mysore*. Directorate of Urban Land Transport, Bangalore, accessed May 14, 2016, http://www.urbantransport.kar.gov.in/Mysore NMT infrastructure facility.pdf

[35] Kidiyoor S, 2015, BMTC, BMRCL websites mislead passengers on combo passes, *Bangalore Mirror*, accessed May 14, 2016, http://bangaloremirror.indiatimes.com/bangalore/others/BMTC-BMRCL-websites-mislead-passengers-on-combo-passes/articleshow/48024495.cms

RESEARCH ARTICLE

Reimagining the peripheral ring road of Bengaluru as an area development project

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Abstract: Bengaluru City's Peripheral Ring Road (PRR), a project announced back in 2005 has faced several impediments to its implementation largely due to land acquisition hurdles, associated cost overruns and stakeholder dissent. This paper addresses the state of the practice in the way the ring road was imagined, why the project has remained unimplemented in over a decade and the possible alternatives by which it could be better planned and financed. Findings suggest that the crux of the problem could be attributed to a failure in recognising the full potential of a ring road to the city. Envisioned as a mere bypass to 'decongest an already crowded Outer Ring Road (ORR), to prevent long distance private vehicles from entering the city centre' its potential for area development, planned urban expansion and to serve as an ideal tool for land value capture were not recognised. Experiences of other cities which have been more successful in implementing similar projects through the use of alternative means of accessing land for public purposes provides clues to achieve that elusive middle ground between all stakeholders.
Keywords: ring road, serviced land, value capture, readjustment, participation

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1 Bengaluru – Economic Growth Unmatched by Infrastructure Investment

The State of Karnataka aspires to be a 700 billion US$ economy by the year 2035 from its current 120 billion US$ economy[1]. Bengaluru is the economic powerhouse of the State and the fifth most preferred destination worldwide for multinational corporations to set up after Silicon Valley, London, Paris and Singapore. The Bengaluru Metropolitan Region (BMR) contributes to 37% of Karnataka's income (2012−2013) despite an occupation of only 4% of the State's area, and 19% of its population[2]. Public investments in infrastructure are the base of a robust economy. Ample literature indicates the beneficial impacts particularly of road development in terms of productivity, production, market access and even poverty reduction; also access to jobs, education and healthcare all indicating the positive correlation between transport investments and economic outputs. Transport infrastructure in Bengaluru however, has been unable to keep pace with its rampant growth.

The BMR is intercepted by 2 National Expressways, 3 National Highways and 12 state highways connecting major towns and cities within BMR and beyond. The radial road network in the BMR converges into the core and contains centre-periphery traffic, as well as transit traffic that converges at and congests the city centre. The city is plagued with decreasing travel speeds and increasing travel distances.

Bengaluru has been attempting to complete several large ring road projects to improve its city-region connectivity and alleviate traffic congestion. A series of ring roads namely, the Satellite Town Ring Road (STRR), Intermediate Ring Road (IRR), Peripheral Ring Road (PRR) and Town Ring Roads (TRR) have been envisaged. The NICE Corridor[1] implementation was also undertaken of which the southern arc has been constructed[3] (Figure 1).

Several or rather all of these ring road projects are incomplete or have been stalled due to land acquisition hurdles, and cost and time over runs. The STRR for example, proposed in 2006, had its land acquisition cost estimated at Rs. 741 crores in 2007, which increased to Rs. 2,872 crores in 2012[4] and continues to escalate causing the agency to rethink its approach. Projects such as the Bengaluru Metro Rail Project (Namma Metro), which was conceived almost 9 years ago, also faced prolonged delays due to litigation against land acquisition. The PRR which is the focus of this paper and conceived by the Bangalore

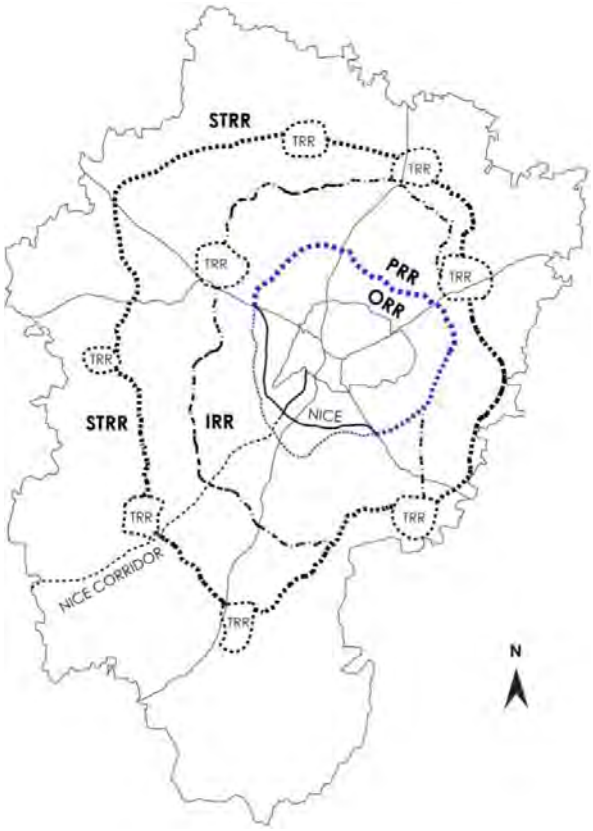

Figure 1. Indicative proposed ring road alignments in Bengaluru Metropolitan Region (BMR).
Source - WRI India
Data Source: BMRDA Revised Structure Plan 2031

Development Authority (BDA) in 2005 too languishes, with the agency stating financial inability to meet the high costs of land acquisition related compensation.

2 Scope, Limitations and Method

This paper is conceived as a practice note and hence it specifically addresses experiences related to the PRR in the context of Bengaluru and any recommendations or lessons presented are narrowly tailored to this particular case. With the PRR stalled indefinitely, a request was made by the Karnataka State Government to address possible ways out of the deadlock. A presentation was made on the same, the content of which has been drawn into this paper. The paper is targeted at public agencies in the city tasked with implementing the PRR, as well as to those tasked with making decisions on its future.

The paper suggests methods and strategies that offer area development opportunities and cost recovery methods through the use of alternative mechanisms rather than the sole use of compulsory acquisition of land for implementing the project. It examines the current approach of developing the ring road as a mere strip of road involving large capital investments for land acquisition and project execution. Data and research is limited to that available in the public domain. This includes accessing government websites such as that of the Bangalore Development Authority which is the implementing agency, journals, research papers, open source maps and various newspaper accounts on the progress of the project. Projects of similar scale and nature from other cities in India are also assessed to understand related aspects of success or failure.

3 PRR – The Long Road to the Project's Deadlock

3.1 Vision, Justification and Project Details

The Bangalore Development Authority (BDA) is the agency that prepares the long range master plan for the city of Bengaluru and is also tasked with implementing large road infrastructure projects such as the city's ambitious PRR. Studies by the BDA indicated that the population of Bengaluru was around 84.25 lakhs (as per census 2011) spread over 821 km^2, and had an annual growth rate of 3.25%. However, vehicular growth was leaping ahead at 10.2% annually. The last constructed ring road for the city known as the Outer Ring Road (ORR) with a length of about 65 km was also built by the BDA. The ORR was constructed as a bypass to the city for commercial vehicles and long distance personal vehicles. Rapid ribbon development led to increased traffic on ORR and its interconnected roads, and solutions such as grade separators were proving insufficient. In order to provide a bypass to the through traffic going across the city, and relieve the congestion of the ORR the need for a second ring road was felt and was envisioned as a 'direct corridor passage'. This second ring road, referred to as the PRR was initially imagined to be a ring around the city with an approximate radius of 17 to 25 km with a total length of 116 km[5].

The BDA's Master Plan for the city (RMP 2015) largely used this proposed PRR alignment as its conurbation limit (Figure 2), with various land uses being assigned inside of it and the outside being predominantly designated as agricultural lands and green belts. Due to an already implemented half loop (51 km length) towards the south of the city by the NICE Corridor project; it was decided to only construct the northern loop of the PRR which would then form a ring with the NICE project. The State government had granted permission to the BDA to take loan assistance from Japan International Cooperation Agency (JICA) to complete the northern loop. The total length of the PRR hence proposed for construction was 65.55 km with a proposed Right of Way (RoW) of 100 m which includes a 12 m wide central median and 9 m service roads on either side[5] (Figure 3 and 4). The land for developing the PRR was to be acquired using provisions of the BDA

Act in conformity with the erstwhile Land Acquisition Act (LAA) of 1894 and subsequently the new Act of 2013. This enabled the authority to enter into agreements with land owners to compulsorily purchase the land. Spread out across 67 villages, the land requirement for this alignment was estimated to be 8.04 km^2 (Table 1). Of this total land, 11% belongs to the government and 89% to private owners. In the 676 land parcels, covering an area of 7.17 km^2, that fall within the proposed corridor, agricultural land constituted 78% of the land use, followed by residential use at 21% and the remaining is commercial or mixed use (Table 2)[5].

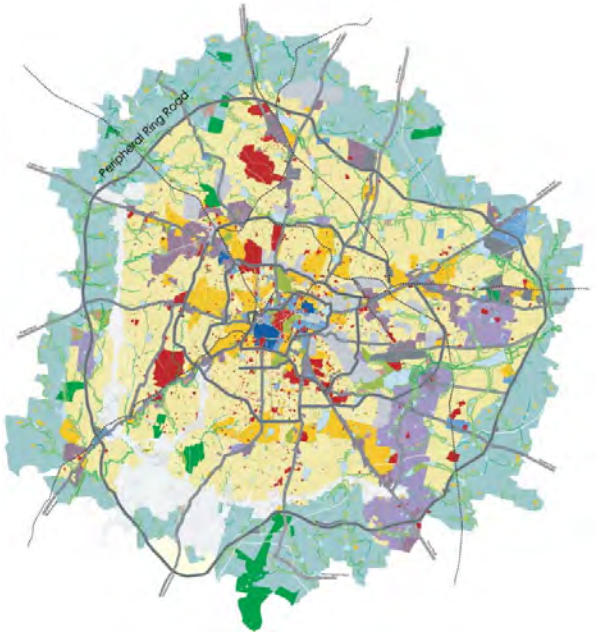

Figure 2. The PRR alignment served broadly as Bengaluru City's conurbation limit.
Source: Bengaluru Revised Master Plan (RMP 2015, Volume 2)

Table 1. Land requirements for the PRR[5].

Particulars	Amount of land	
	km^2	%
Extent of land required for 100 m^2 wide corridor for a length of 65 km	8.04	100
Government land coming under project	0.87	11
Private land required for the project	7.17	89

The project was initially to be implemented through a Build Own Operate Transfer (BOOT) model of PPP, wherein the revenues to the developer would accrue in the form of an annuity payment spaced over the concession period[6]. The identified land was to be supplied by the BDA though this acquisition is yet to be completed and faces numerous court cases pertaining to titles and sharing of benefits. The delay in acquisition of land and its subsequent development has caused discontent among the land owners resulting in cooperation issues. In some places people have boycotted the process altogether[5].

Table 2. Type of affected land parcels[5].

Category of land use	Land parcels			
	Number	%	Completely lost	Partially lost
Residential	143	21.15	18	125
Commercial	3	0.45	1	2
Residential cum commercial	5	0.74	1	4
Agriculture	525	77.66	236	289
Total	676	100.00	256	420

3.2 Implementation Options Attempted and Related Resentment

3.2.1 Compulsory Acquisition under the BDA Act using provisions of LAA, 1894

As the project was conceived more than a decade ago (Figure 5), the BDA initially chose the provisions of the erstwhile Land Acquisition Act (LAA) 1894 which relates to the use of eminent domain. The acquisition process faced litigations and protests from the land owning farmers, since the compensation offered was much lower than the market value of land and the post development value of land was not considered in evaluating compensation. These protests and litigations severely hampered the project's delivery. The root of the problem, as per the BDA[5], lay in the challenges associated with identification of project affected families/persons. Challenges included wrongful listing of both affected and unaffected farmers, majority land owners were absentees not residing in the project area and their whereabouts were not available/known in the villages etc.

3.2.2 Method of Transferable Development Rights

To solve the challenges associated with compulsory land acquisition as stated earlier, the BDA, in 2011, proposed to compensate the property/land owners through transferable development rights (TDR), where development rights were granted as a nonmonetary compensation for the land surrendered. The BDA has in the past used the provisions of TDR for implementation of road projects and other master plan proposals within the city of Bengaluru with varying degrees of success. The BDA intended to use TDR by artificially lowering the Floor Area Ratio (FAR) of the core city to 1. This, the BDA believed, would create a lucrative market for TDR in the city, as additional development rights in excess of what is permitted had to be purchased. The BDA has so far failed to convince the land losing farmers to opt for TDR as a mode of compensation[7].

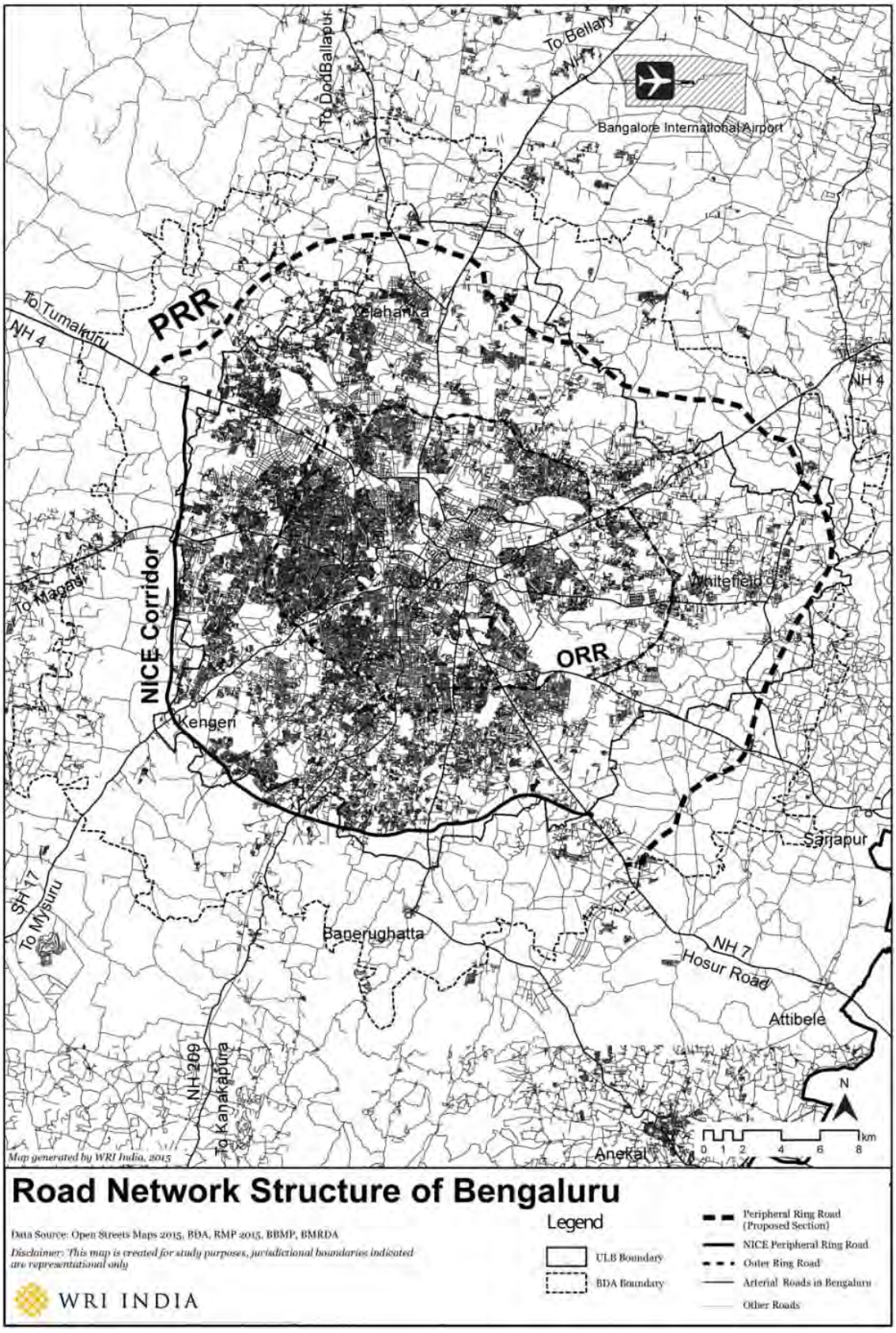

Figure 3. Road Network Structure of Bengaluru.

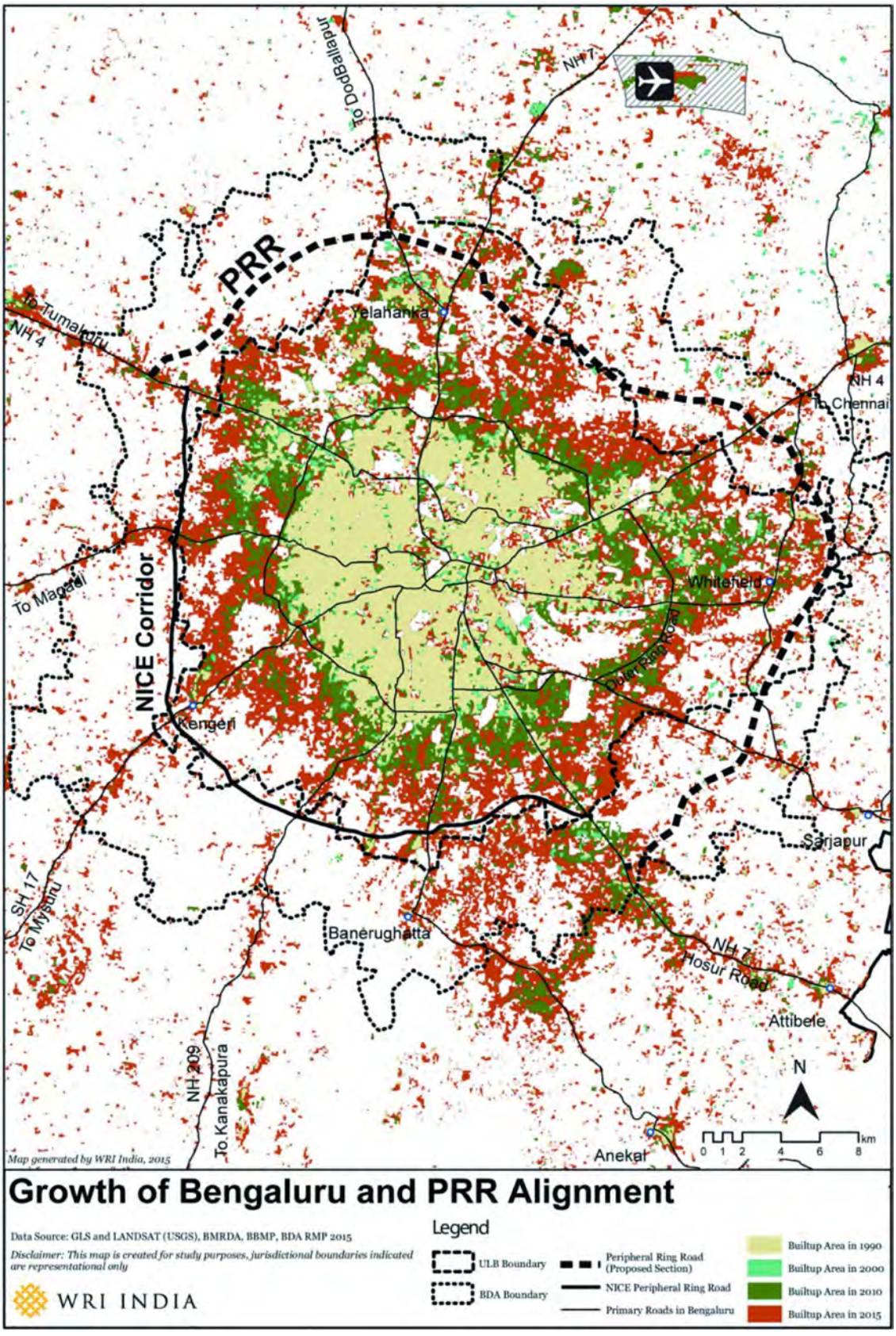

Figure 4. Growth of Bengaluru and proposed PRR Alignment.

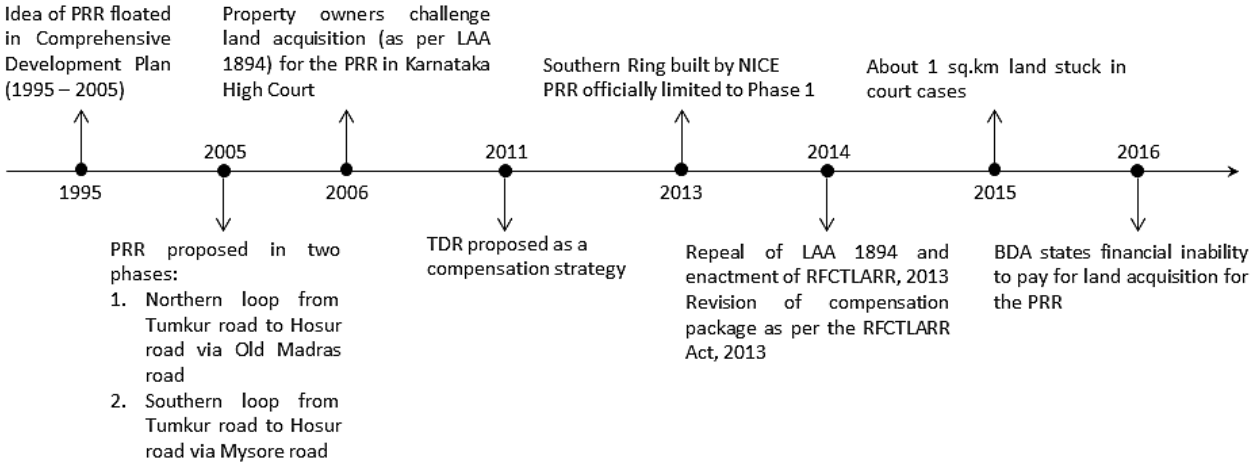

Figure 5. Milestones in the PRR project.
Source: WRI India, data source (5) and other secondary sources

3.2.3 Revised Compensation Strategy as per the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (RFCTLARR) Act, 2013

Compulsory acquisition of land as per the erstwhile-LAA of 1894 had become the subject of much criticism across India. To overcome such challenges and widespread resentment, the Ministry of Rural Development repealed this British era Act of 1894 and replaced it with the RFCTLARR, 2013. The BDA hence, had to relook at their compensation strategy in this new light, following which in April 2015; a Resettlement Action Plan (RAP) for the PRR was proposed which offered an enhanced compensation package. This included market rate compensation, TDR, rehabilitation and resettlement benefits, developed land as compensation etc.

The total cost of acquisition which includes compensation and rehabilitation benefits now amounts to Rs 8,100 crore, while the former cost under the previous 1894 Act was Rs 1,930 crore[8]. The BDA had also tied up with JICA to provide project implementation assistance via a loan which amounted to an additional Rs 4,000 crore[9]. The State Government and the Central Road Ministry too, have made commitments to partially fund the land acquisition cost for the project. The BDA however has stated its inability to pay out this higher compensation amount and the PRR remains unimplemented after a decade of its conceptualisation.

3.2.4 Perception of the Project Affected People

A Resettlement Action Plan (RAP), completed in 2015, surveyed the affected area and drew up a profile of the PAPs which is summarised in Table 3 below.

The RAP indicates that the key issues of the project affected people included fears that land beyond the scope of the road was being acquired, they demanded further information on Transferable Development Rights (TDR), and expressed dissatisfaction over the fact that they were unable to either transact or build on their own land for over 10 years delaying marriages of their children etc. Their demands included additional compensation for delay of the project, unwillingness to pay toll once the road was built, jobs for small farmers who lose their livelihood and market rate compensations for their land.

Table 3. Profile of the Project Affected People (PAPs)[5].

1	Number of villages affected	47
2	Number of households affected	647
3	Total PAPs	3995
4	Proportion (%) of PAPs in the productive working age group (16-50 years)	62
4.1	Proportion (%) of PAPs in the 16-30 years age group	35
4.2	Proportion (%) of PAPs in the 31-50 years age group	27
5	Literacy rate (%) among the PAPs	84
6.1	Proportion (%) of PAPs engaged in agriculture	60
6.2	Proportion (%) of PAPs employed in the private sector	12
6.3	Proportion (%) of self-employedPAPs	7

The RAP suggests that the understanding about the project was very low amongst affected people. 68% of the affected households were not even aware of the construction of the PRR. 64% of people preferred cash compensation for their lands at market rates while 30% preferred to opt for a BDA developed house-site at a 40:60 ratio. They had a limited understanding of the benefits of the road to the city, but importantly 91% of the people responded that they either could not say or do not know where to go as a choice of relocation. 13% said that they would like to construct a house with the cash compensation received.

3.2.5 Partial Thrust Towards an Area Development Approach

More recent development in 2016 have seen decisions taken to acquire the land for a total width of 100 m, out of which 25 m would be used for commercial us with increased development rights. This 25 m width commercial zone would serve as two-thirds of the compensation package for land losers and the remaining one-third would be paid as cash compensation[10]. Karnataka State Government proceedings and circulars of May 2016 indicate a partial move towards an area development approach with a 1 km impact area being declared on either side of the PRR where mixed uses and higher FAR will be allowed. The mixed uses and additional FAR (up to 1.25) is expected to influence the landowning farmers/developers to pay up a betterment fee for development of land. Betterment levies, premium FAR and commercial sites auctioning are together expected to bring total revenue of about 10,000 crores. There is no mention however about any other area development measures that will be taken up such as the provision of feeder road networks, connectivity to the PRR, water supply, sewerage, education and health facilities, open spaces etc. that would encourage landowners to pay up these betterment levies.

4 Assessment of the Current Approach to Building the PRR

4.1 No Lessons Learnt from the ORR Experience: Incomplete Road Network and Hierarchy

The rapid ribbon development along the ORR and beyond has led to increased traffic at all major intersections and midblock sections, and this was the mainjustification for the requirement of an additional ring, i.e. the PRR[15]. A closer look spatially at stretches along the ORR (Figure 6) reveals a very low density of road networks connecting up to it as compared to any well-developed and planned area within the city which has a dense interconnected networks of streets, whether or not a clear hierarchy is present.

The ORR (especially the eastern arc) became the preferred destination for IT companies that took up large parcels of land along it. However, land parcels beyond this first layer of plots abutting the ORR have very low connectivity to this major road investment. While this is an underutilisation of a major road investment, it also results in poor traffic management as all vehicles have to travel longer distances and come onto this main arterial due to very few options to take alternate routes or make any left and right turn choices. Pedestrian movement also becomes extremely challenging due to unwalkable block sizes and the impenetrable first layer of plots.

Bengaluru's large portfolio of IT and ITES business houses, located along the ORR have formed an organisation called the Outer Ring Road Companies Association (ORRCA); however one of their largest concerns today, quite predictably, is traffic congestion.

The Indian Road Congress (IRC) in its standards for Urban Roads for example gives a clear classification of roads which are 'Arterial, Sub Arterial, Collector and Local Streets'. The PRR as per this classification would be considered as an arterial as its primary function would be 'through traffic usually on a continuous route'. The other hierarchies are largely missing around the ORR, thereby not allowing any 'lower level of traffic mobility for collection and distribution purposes', and 'entrances to business and residences'. The PRR, if implemented through the same approach, is also expected to suffer the same consequences.

4.2 Land Parcels Around the PRR will Remain Unplanned and Unserviced

Envisioned as a 'direct corridor passage' that does not complete missing road networks or set a road hierarchy in place, results in land parcels of the area not being transitioned in a planned manner from a rural to an urban purpose. Village revenue parcels are often oddly shaped for urban use and need to be brought into a more regular or rectangular shape to allow for internal road connectivity and infrastructure and amenity provision.

4.3 Market Dominated Area Development and Speculation Expected

With no clear plan in place for the area, intermediaries and private developers will tend to capture all the land value increase benefits. Demand for land along the PRR is set to escalate when a large infrastructure project like the PRR is identified and constructed. As in the case of the ORR, there is a growing preference for households and IT firms to shift to the suburbs for large housing and campus style developments[11]. Large isolated gated communities are common features in the city's peripheries which cordon off large parcels of land through negotiated purchase from owners and become islands of excellence that do not contribute to the public realm. While the actual land requirement for the project itself may not always be significant, demand for land in the surrounding areas goes up sharply because of purchases by land speculators[12].

4.4 Non Participation of Land Owners in Projects Decisions and Future of the Area

As land owners are typically only served legal notices for land acquisition, it is evident from the RAP surveys that

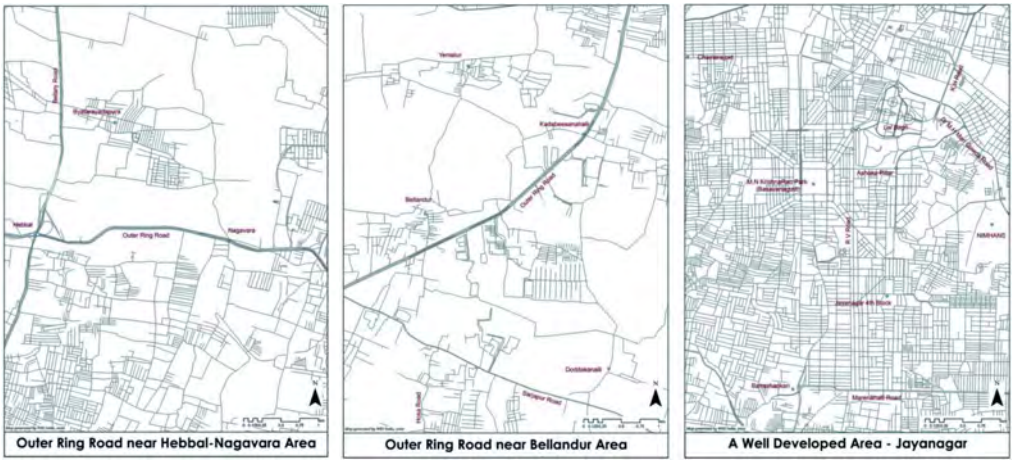

Figure 6. Road density and block size comparison of ORR and a well-developed area in Bengaluru.
Source – Generated by WRI India, Data Source: Open Streets Maps 2016

68% of the affected households were not even aware of the construction of the PRR a decade after it was announced. 91% of the people were unsure of what would be their choice of relocation. Lack of communication with project affected people continues to be a critical gap with low acceptance levels and resistance to the project with many pursuing their legal options against the acquisition.

4.5 Post-development Benefits do not Accrue to Land Owners, Increasing Dissent

Landowners who sell their land for such road projects receive a one-time compensation which is currently estimated on the basis of the market value that is prevalent prior to development. Once a large infrastructure investment such as the PRR is implemented, the value of the land is expected to greatly escalate though the original owners will not receive any of the benefits. Speculators and fortunate landowners who still have parcels abutting the proposed ring road make a disproportionately better financial gain out of such projects.

4.6 TDR as a misplaced Incentive along the PRR

29 wards within Bengaluru city are witnessing declining population growth rates between census years 2001 and 2011. These are areas in the city centre that have the highest levels of municipal services and public transport access including metro rail and buses. With an FAR of 1.75 typically being consumed on an average here, artificially lowering this to 1 FAR, in the hope of make TDR a tradable commodity is counterproductive. The city has no real geographical constraints to growth and the urban spatial footprint of the city is growing at the rate of 594 ft^2 per minute within the BDA jurisdiction. 78% of the PRR alignment today runs through agriculture land. Hence, the only real effect would be that the city centre will be disincentivised from redevelopment instead of being encouraged to increase the affordability and supply of building stock. Doubling of FAR (upto FAR 2 along the PRR) is counterproductive and will cause an unsustainable 'donut' effect where the city centre empties out and 'unserviced' peripheries become the destinations for housing and jobs. TDRs should be awarded in areas where normal FARs could be exceeded such as dynamic growth nodes. Sending and receiving zones are also critical while awarding TDR.

5 Reimagining the PRR through Alternative Approaches to Access and Plan Land

Challenges in land acquisition are not new in India and as many as 414 highway projects are embroiled in equity crunch, and land acquisition hurdles[13]. The Union Minister for Road Transport, Highways and Shipping in 2015, stated that delayed land acquisition and environmental clearances have stalled more than 270 projects across the country[14]. It is observed that such large scale projects aimed at leveraging the potential of cities as growth engines in developing countries throws up multiple challenges such as displacing local population and livelihoods, fuelling land speculations, reorienting employment patterns and increasing environmental health risks[15].

The older 1894 Land Acquisition Act faced opposition from the land owners on grounds of inequity and inadequate compensation; the newer 2013 Act however, faced opposition from urban agencies and investors for being prohibitive in terms of the cost of acquisition, having cumbersome procedures and a long delivery time. The Vice Chairman of NitiAayogin a presentation in Novem-

ber 2014 for example, stated that land acquisition under the new law would take a minimum of five years without even considering the typical delays, protests and court challenges; and that the monetary compensation as per the new act was higher than almost anywhere else in the world.

States and cities all over India are faced with limited financial capacities and sky rocketing land values, but many are able to implement large scale urban projects such as special investment regions, greenfield capital cities, city ring roads and public amenities. They are able to do so using alternative mechanisms to access land which does not necessarily use the compulsory land acquisition method. These alternative mechanisms employ methods of land readjustment, land pooling, leveraging resources of the private sector, land value capture and non-monetary compensation such as the grant of development rights, built up area and other incentives. This is possible because land acquisition and requisition is identified in the Constitution of India as a 'Concurrent List' subject. Hence both the Centre and the States have the power to legislate on the subject, with a condition that the State cannot bring out a legislation which is inconsistent with the Central legislation.

Ahmedabad in Gujarat for example successfully completed its ring road (76 km length) in record time using the Town Planning Scheme (a method of land readjustment) and Surat also has managed a similar feat. The Dholera Special Investment Region (DSIR) in Gujarat for instance is a greenfield industrial city planned and located approximately 100 km south of Ahmedabad. Out of the 920 km^2 of the DSIR, the total developable area is about 580 km^2 which is being developed through six Town Planning (TP) Schemes[16]. The greenfield capital of Andhra Pradesh, Amravati, used a method of land pooling to access 133.55 km^2 of land, again in record time. Not to be left behind the private sector partnered with the State Government of Haryana to implement large developments through a Joint Development model. While the above are mechanisms for green field situations, in Maharashtra, the land locked city of Mumbai has been innovating since the 1990s in redevelopment and amenity provision using the mechanism of Cluster Redevelopment Schemes.

Karnataka State however has not experimented with alternative mechanisms of accessing land and has largely relied on compulsory acquisition of land using eminent domain powers. This is another reason that an area development approach has been lacking in Bengaluru as it continues to lack any legislation related to local area planning. As the PRR has large stretches of greenfield agricultural land, and some stretches of developed and built upon land, four mechanisms used in India which could prove directly useful to access land in both these conditions and provide a planned area development are summarised as follows: The TP Scheme Mechanism (Gujarat); The Land Pooling Scheme (Andhra Pradesh); The Joint Development Model (Haryana) and The Cluster Redevelopment Scheme (Maharashtra).

5.1 The Town Planning Scheme Mechanism (Gujarat)

Planning and Area Development: The Town Planning Scheme (TPS) was originally introduced through the Bombay Town Planning Act of 1915, and is the first known State led alternative to access land for public purposes in India. It is extensively used in Gujarat and to a lesser extent in Andhra Pradesh, Maharashtra and Kerala. It is a micro level plan that follows the land readjustment and pooling method and is typically guided by a Development Plan (DP) prepared as per the provisions of Gujarat Town Planning and Urban Development (GTPUD) Act 1976. This 'partners in development' model brings together a group of land owners who pool their land/plots for development. The GTPUD Act allows up to 35% of land to be taken for roads, social amenities and housing accommodation for socially and economically backward classes[17]. The Act further allows 15% of the land to be kept by the authority for sale for residential, commercial or industrial use, and the remaining land is returned as reconstituted final plots to the landowners. TPS, being an area development scheme enables holistic development of the area earmarked in the Development Plan. Road networks, which range from the main arterials to the collector and feeder road at neighbourhood level get implemented through the scheme. Plots for amenities such as schools, dispensaries, parks and recreational spaces as designated in the scheme is implemented in the process.

Box 1: Implementation of Sardar Patel Ring Road in Ahmedabad, using T P Schemes

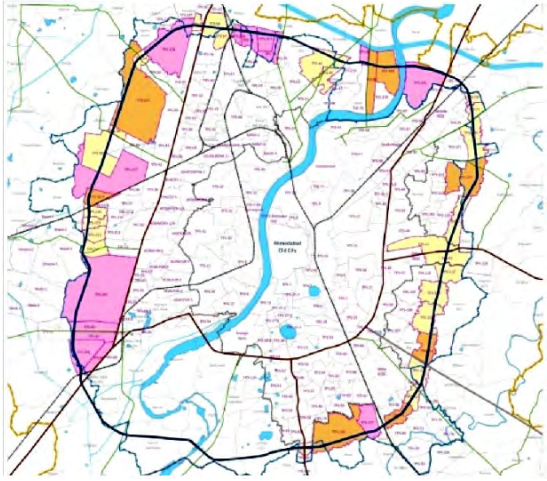

Figure 7. Sardar Patel Ring Road, Ahmedabad[37].

Highlights:

- Sardar Patel Ring Road is 76 km long and 60 m wide. The 47 TP Schemes proposed along this alignment took approximately 4 years to implement.
- Work completed between 2002 and 2006.
- Project cost: Rs 230 crore.
- Approximately a 1 km wide belt along the ring road was reorganised to create the road.
- More than 60% of land was returned to owners close to or overlapping with their original plots. Land owners also reap benefits of appreciation in land value as a result of the ring road and the use of TPS.
- Minimal development rights provided in the zoning codes as predominantly rural at the time in late 1990s.
- The then Municipal Commissioner of Ahmedabad Urban Development Authority (AUDA), Surendra Patel chose not to acquire land using the conventional approach under eminent domain, and opted instead to use Town Planning Scheme in which the owners voluntarily surrendered up to forty per cent of their property in the expectation that improvements made by the authorities would increase the price of his truncated property.

Most of the land owning farmers agreed to the scheme, after being explained the benefits. While substantial amount of the land in the area has changed hands after the implementation of the TPS, many original owners have retained their lands. Additionally, the original owners were able to reap the benefits of the land value appreciation that happened as a result of the Ring Road construction as well as implementation of the TPS.

Source: Box in [35]

Box 2: Proposed T P Schemes to be taken up in Bengaluru

In Bengaluru two projects, namely the STRR and the Bidadi Township (proposed township to the south-west of Bengaluru), have received a push towards development after nearly a decade through the use of T P Scheme. An article in the Hindu states that amendments would be made in the enabling law (Karnataka Town and Country Planning Act, 1961) to reduce the time framework of the T P Scheme legislation as well as issue a monthly pension to the contributing landowners. Land owners unwilling to participate in the TPS would be paid cash compensation. The cash compensation package will be calculated based on the extent and value of land taken over for the project (18). In the Bidadi Scheme, the State will hand over developed land, which includes 836 m^2 of residential plots and about 167 to 250 m^2 of commercial plots per 4,000 m^2 within a 5 km radius of the township to those giving lands for the project. In addition, they will be given annuity while the landless families will be given pension for ten years. In the STRR Scheme, the Authority will take up land pooling and develop the stretch up to 1 km on both sides of the proposed STRR. Of this, it will return 60% of the developed land to landowners and use 30% to develop roads and social infrastructure. The remaining 10% will be sold at market price to develop the road. The timeframe expected to plan and execute the STRR is 3 to 5 years [19].

Financing: Financing strategy for TPS is built on the principle that the benefits of urban infrastructure investments are capitalized through land value capture. Cost of the scheme is partially or wholly financed through the contributions levied by the authority on the landowners for the infrastructure provisions and through the sale or mortgaging of plots obtained through the scheme by the authority. During the draft scheme stage, along with the tabulation of ownership details and plot details, increments in the land value is calculated taking into account the locational advantage as well as disadvantages of the plot. This increment in land value is a result of government intervention through providing infrastructure facilities and hence the landowners are entitled to pay a percentage of the increment as betterment levy. Betterment levy is calculated as the difference between 50% of the increment in land value and the compensation to be paid by the authority for land appropriated.

Advantages and Disadvantages: TP scheme is a win-win proposition for both the government and the landowner, as both the government and landowners share the post development benefits. The government authority executing the scheme, strives to ensure that owners receive reconstituted plots at the original location itself. While TP scheme is known for its robust and comprehensive approach to development, in some cases it has faced administrative and procedural delays that hamper the timely implementation of the scheme [20]. With powers vested in the State government to approve and sanction the stages of TPS, the process has become fairly centralised and time consuming. The non-inclusion of the landless PAPs, who may be dependent on the land taken up for the scheme for their livelihood is also a drawback of the TP scheme.

5.2 The Land Pooling Scheme (Amravati)

Planning and Area Development: The Land Pooling Scheme (LPS) was introduced for the development of the capital city Amravati through the Andhra Pradesh Land Pooling Scheme Rules, 2015. Several States such as Punjab, Haryana and the Magarpatta township of Maharashtra and most recently Delhi have explored land pooling schemes for accessing land for developmental works. It is typically a master plan guided process, wherein areas for public purpose reservations are delineated. In this mechanism, land parcels owned by individuals or a group of owners are legally consolidated by transfer of ownership rights to the Authority, which later transfers the ownership of a part of the land back to the original land owners. Landowners voluntarily surrendering land for the scheme, get reconstituted developed land based on the type of land and its ownership status. For instance for every acre of land surrendered by landowners possessing a patta, they in return get 25% of land in case of dry land and 27% in case of wet land. Whereas in case of assigned land, the landowner get 19% of land in case of dry land and 21% in case of wet land. Regular shaped plots with infrastructure services are ensured to the landowners through the LP Scheme. Sector level roads, internal road networks, infrastructure/services (including water supply lines, power supply, rain water harvesting, sewage treatment facilities, water treatment facilities, etc. falling in the share of the land guaranteed to the land owners are developed through LPS [21].

Financing: Similar to the TPS, the cost of developing infrastructure facilities, amenities and trunk infrastructure incurred in the LP scheme is to be recovered by using the land which will be retained by the authority. The Andhra Pradesh Capital Region Development Authority Act, 2014 under the provisions of which the LPS scheme is prepared permits developer entities to undertake LPS, in which case the cost of the scheme would be borne by the developer entity. LPS of Amravati has factored in skill development programmes and monetary benefits for the landless families such as one time agriculture loan waver and interest free loans to poor families for self-employment. A capital region social security fund is created to provide pensions of 2,500 rupees per month per family for a period of ten years to all landless families [21]. For the maintenance of the common infrastructure and services such as roads, street lighting, solid waste management, sewerage treatment facility, water supply, parks and play grounds and other amenities, the reconstituted plot/landowners are charged with usage, consumption and maintenance charges.

Advantages and Disadvantages: In addition to offering developed land, monetary benefits in the form of annuity payments are paid out to the land losing farmers. It fares better than the TP scheme in aspects such as rehabilitation strategies for the landless project affected families and it also seeks the consent from interested parties or landowners to participate in the scheme. While the LP scheme has a simpler process that is described systematically in the Act, the grievance redressal mechanisms are vaguely described. There is a no restriction imposed on the type of land to be taken for LP scheme, and fertile agriculture land has been assembled for the capital city development in Amravati.

5.3 The Joint Development Model (Haryana)

Planning and Area Development: The Haryana Development and Regulation of Urban Areas (HDRUA) Act, 1975, legally permitted private participation in the supply of serviced urban land by designating certain planned areas for private land assembly. While this mechanism is commonly termed as Joint Development Model of Haryana, variations of public private partnership models of land assembly are used in Uttar Pradesh, Gujarat and Tamil Nadu. In the Joint Development Model, private developers acquire and assemble land through market price negotiations from landowners and then apply for a licence to develop the land into residential, commercial or industrial colonies in conformity with the land use plan. The mechanism ensures that adequate educational, health, recreational and cultural amenities as per the norms and standards provided in the development plan of the area is provided by the owner/private developer. Additionally the private developer has to reserve land for roads, open spaces and such common facilities, which varies from a minimum of 20% of the gross land area, in case of low density eco-friendly colony to 45% in case of plotted or group housing colony development [22]. In the process, the infrastructure amenities for the colonies are built by the private developers, who make profitable gains through sale of plots in the open market. The external trunk infrastructure amenities are to be provided by the government authorities.

Financing: The developer deposits infrastructure development charges, which are to be used for stimulating socio-economic growth and the development of major infrastructure projects in Haryana. The HDRUA Act stipulates that the private developer, making a net profit (through sale and lease of plots or built up area in open market) above 15% after the completion of the project period, has to deposit the surplus amount in the State government treasury or spend this money for further facilities. The private developer makes profit through sale of plots/flats in the open market. Being a land development model, the supporting legislation does not have any provision for arriving at the land value and compensation offered to the original owners of the land. Cost of developing the internal infrastructure in the colonies will be borne by the

private developer. Trunk infrastructure facilities which are to be developed by the government authority are partially funded through the external development charges which the developer has to pay.

To ensure affordable housing, the colonizer has to sell 25% of plot in case of plotted colony development on a no profit no loss basis at a price determined by the director of the authority. Secondly, the colonizer has to reserve 15% of the total developed residential plots/proposed to be development for allotment to economically weaker sections (EWS) in case of development of a group housing and 20% in case of plotted colony development. Around 8,000 plots for EWS were developed in Gurgaon using this model [23]. In order to ensure the upkeep and maintenance of the group housing colony, for a period of 5 years from the period of completion, the authority keeps 1/5th of the bank guarantee amount unreleased. The act states that the colonizer has to deposit 30% of the amount collected from the plot-holders within a period of 10 days of its realisation in a separate account which will be released only on satisfactory completion of internal infrastructure amenities.

Advantages & Disadvantages: In Joint Development Model, by engaging the resources of private developers in urban development, the financial burden of developing infrastructure amenities in the layout are transferred from the authority to the private developers. Guided by the profit motives, private developers built layouts with infrastructure amenities within the stipulated time framework. However with the intention of maximizing profits motives private developers tend to build their colonies at locations only where they could assemble land from the market through negotiations with local landowners [24]. Landowners do not receive any post development benefits. While there are provisions in the Act and rules to ensure the execution of the development works by the private developers, there are no clauses in the Act to ensure the implementation of external development works by the authority.

5.4 The Cluster Redevelopment Scheme (Maharashtra)

Planning and Area Development: The Cluster Redevelopment Scheme (CRS) was introduced for the redevelopment of dilapidated and old buildings in the city through an amendment in the Development Control Regulations in 2009. Clusters for redevelopment are chosen as per the Development Plan or an Urban Renewal Plan. Under this scheme, cluster of buildings that are eligible as per the norms set by Maharashtra Housing and Area Development Authority (MHADA) having a minimum area of 4,000 m^2 are redeveloped and handed over to eligible tenants either by a private developer or a government agency [25]. The promoter or developer of the CRS redevelops cluster of old and dilapidated of buildings that are eligible as per the criteria set by the authority, with the consent of 70% of the tenants as well as the landlord. The promoter of the scheme pools land belonging to various categories of land holders including public land through:

i) Purchase of land belonging to state government or MCGM or MHADA or agency under state government;

ii) Exchange of such land with a suitable land of equivalent value as per land rates in the Annual Statement of Rates (ASR);

iii) Procurement of development rights over such land;

iv) Transfer of all land included in the CRS to a legal entity;

v) Acquisition of land, provided that promoter purchases rights over at least 70% of the land comprised in the URC and there are dangerous buildings on the balance land contained in the CRS.

Through the CRS, redeveloped areas are provided with better housing and public amenities such as open spaces and wider road networks are developed. High power committee appointed for the CRS ensures that the reservations made in the Development Plan get implemented through the scheme. To ensure the development of reservation mandated in the DP, the promoter has to hand over 60% of the zonal FSI under reservation or Built Up Area (BUA) of the amenity to the authority free of cost and free of FSI. The promoter has to hand over BUA equivalent to 30% of zonal FSI, in case of development of reservations of Rehabilitation & Resettlement under URS, free of cost and free of FSI in addition to rehabilitation of existing tenements or users.

Financing: The promoter has to pay development charges which is charged as per the provisions of the Town Planning Act as well as a surcharge which is referred as the infrastructure charge to the Municipal Corporation of Greater Mumbai (MCGM). The promoter gets incentive FSI which is based on the ratio of Cost of land included in the scheme as per ASR and the construction cost in Rs/m^2 applicable in the same area as per ASR [27]. CRS get an FSI of 4 or sum total of the Rehabilitation FSI + Incentive FSI, whichever is more. The incentive FSI that the promoter gets cross subsidises the cost involved in constructing and handing over the rehabilitation tenements free of cost to the eligible tenants. Each eligible tenant get carpet area equivalent to the area occupied by such tenant the old building and also 'additional area' for residential/residential cum commercial tenement based on the size of the URC. Each eligible slum dweller get a carpet area of 25 m^2 in the scheme. The promoter is entitled to create a corpus fund, which is a minimum of 50,000 per tenement or as directed by the High Power Committee (HPC), which is used for the mainentenance of the rehabilitation buildings for a period of 10 years.

Advantages & Disadvantages: The scheme facilitates rehabilitation of eligible tenants in better housing facili-

ties as well as development of public amenities such as open spaces and wider road networks on land which otherwise remain non-accessible for public purposes. The mechanism ensures that consent is obtained prior to proceeding with CRS and also mandates a feasibility study to assess its impacts in advance. Mechanisms to prevent malpractices while obtaining the consent are not clear, as there is a possibility that the consent might be obtained through coercion. Though the scheme requires consent of the tenants prior to the initiation of the process, there is no scope for tenants to participate in the planning and implementation of the scheme.

6 Lessons for the PRR from the use of Alternative Mechanisms to Access Land

Different Indian cities have, with an aim to provide seamless traffic movement and prevent through traffic from entering the core city, constructed ring roads with varied degrees of success. One of the most successful examples as discussed was using of the T P Scheme in Ahmedabad as it not only resulted in road development but also area development and was completed in just 4 years[28]. Surat also similarly completed its ring road and is using T P Schemes for area development. However, cities that opted for Land Acquisition to implement ring roads have faced cost and time escalations, often remaining incomplete till date. Hyderabad embarked on a ring road of length 158 km in 2006 (Bengaluruis said to have been modelled on this) and required about 24.5 km^2 of land[29]. The road is being built in phases at a cost of about Rs 6,696 crore since 2007 and is expected to reach completion by 2017. The Hyderabad Growth Corridor Ltd (HGCL), a special purpose vehicle formed to build the road has faced cost overruns to an extent of 15% to 20%. JICA is providing phased funding of Rs 3,558 crore for a stretch of 71.30 km[29]. Jaipur similarly opted for compulsory land acquisition for its 125 km ring road using the erstwhile LAA 1894 through a PPP model and has only completed land acquisition of the southern arc of its ring road[30].

Key lessons for the PRR include:

6.1 Utilise Various Alternative Mechanisms in the form of a Hybrid Model

A reassessment of the project needs to be undertaken to understand the current status of land acquisition (including government land) to see how much land is yet to be acquired. This yet to be acquired land could be categorised into fully developed, semi developed and agricultural lands and the choice of appropriate alternative mechanism could be applied. Land pooling and readjustment models (like the TPS) could be utilised in the agricultural land stretches of the road alignment. Difficult stretches could be accessed using the resources of the private sector using the JDM model allowing market price negotiations between the landowner and the private developer with pre-determined incentives that the government will provide. Lastly, the CRS approach could be explored for densely built up areas (residential, commercial and mixed use areas) ensuring rehabilitation and reconstruction of homes and businesses that have been set up. The project could be phased accordingly. However, while considering these mechanisms, it is important to contextualise these mechanisms taking into account the local conditions, the development objectives and shortcomings of the current land delivery system. For instance, consensus building to ensure participatory land development process could be incorporated into the alternative mechanism chosen to minimise the opposition from the landowning farmers.

6.2 Master Plan to Incorporate Area Development Approach

Bengaluru's City Master Plan is currently under revision and is a legally enabled process by which the resulting plan is a statutory one which has to be followed by all. While the courts have given a go ahead for land acquisition for the 100 m right of way of the PRR itself, it does not permit further acquisition related to the project unless and until the PRR is implemented. This is where the full potential of a master plan can be realised where strategies of land readjustment and land pooling such as the T P Scheme or the Land Pooling Scheme could be utilised to ensure planned and serviced land as a Phase 2 of the PRR. Local area planning could also be introduced as a micro level plan to the macro level master plan to enable area development. This will also give the BDA ample opportunities to factor in cost recovery mechanisms.

6.3 A Dynamic Leader and Efficient Project Management are Key to Drive Project Success

The presence of a visible and dynamic official will play a pivotal role in the execution of the project determining the success and timely completion of such projects. This has been seen in the Ahmedabad Ring Road project as well as in Amravati Capital City Development. A credible face explaining the projects benefits, convincing people, and thereby winning their confidence and trust is imperative. Backing such a leader should be a robust project management and delivery team that assesses risks, factors in operation and maintenance costs and chooses appropriate delivery mechanisms based on a wide array of issues such as regulatory status, land owner priorities and degree of risk.

6.4 Land Value Capture for Land Owners and Government Agency Alike

The unearned increment resulting from the rise in land values and change in use of land from public investment or decisions or due to the general growth of the community must be subject to appropriate recapture by public agencies[31]. Land readjustment and pooling ensure that post development benefits such as land value increments and the developed land with services are shared between the government agencies as well as with the landowners. While government agencies get land for the envisaged development free of cost, the landowners benefit from the rise in value of the land they possess. This approach to accessing land is less prone to resentment from the landowners, as they are not left out in the process of land development. JDM uses infrastructure development charges for service delivery, which gets transferred to the end user. CRS leverages the built up land for a social cause (that is affordable housing for EWS) as a tool for capturing the benefits of redevelopment. The land based fiscal tools have to be essentially seen as benefit tax used for financing capital investment (or also to service debt when required), but certainly not for general administrative or O & M expenditure[32].

6.5 Project Legacy: Planned, Financed and Serviced Urban Expansion

The legacy of the ORR should serve as a reminder that the PRR must not take the same route. While BDA managed to develop a few layouts with fair connectivity to the ORR, it was not to scale and most sections today have poor access. The PRR should have broader benefits that percolate beyond the linear corridor through creating planned developments with interlinked street networks. Area development schemes such as LPS, TPS and JDM ensure that planned developments happen in the urban periphery. CRS does the same in an already built upon context. These areas benefit through planned services such as road networks, water supply, sewerage and electricity as well as social and recreational amenities. Private developments in the urban expansion areas are to be regulated through such area development schemes that are guided by a macro level development plan.

6.6 Getting Land Owners, Government Agencies and the Private Sector on a Single Platform

Government coffers do not get strained to build the road or develop the area, when they opt for alternative mechanisms to access land. The burden of upfront payment of cash compensation as in compulsory acquisition is eliminated. In addition to this benefit, government agencies have options to use land as a fiscal tool to finance further infrastructure developments.

From the point of view of land owners, the leading causes for resentment typically includes displacement, insufficient compensation, urgency clauses misappropriated, absence of a space for communication between the impacted community and the project implementers for transparent negotiations, and the absence of a choice in moving into a transformed common future associated with the process leading to their displacement[33]. Mechanisms such as TPS, LPS and CRS ensure that many of the above concerns are addressed. Provisions for landless labourers will need to be an additional factor to be addressed as some of these State led mechanisms do not have provisions for the same. The impact of land acquisition on the landless farmers could be reduced, if a percentage of land acquired is reserved for affordable housing and auctioned at subsided prices to eligible landless project affected families.

Private developers too who are large players in the land market have ample opportunity to engage with government agencies using models such as JDM and CRS. The government too needs to hone its skills in engaging in public private partnerships in a structured and defined manner to not only leverage the resources of the private sector but to also prevent any unethical practices or information asymmetry.

7 Way Forward – Reaching the Elusive Middle Ground Between all Stakeholders

Infrastructure has emerged as a dominant source of demand for land, and it is widely believed that the growth momentum of the Indian economy in recent years cannot be sustained unless infrastructure bottlenecks are swiftly and adequately removed[12]. While considering mega scale projects, more efforts need to be put into the early phases of planning which include a broad, open reconnaissance stage where various potential solutions for the road development are studied and discussed together with the local stakeholders[32].

After over a decade of facing implementation hurdles, the PRR needs to realistically assess the current ground conditions and employ multiple solutions to promote holistic development of the PRR influence area as well. Lessons from the ORR experience too should serve as a guidance to not repeat old mistakes of conceiving it as a mere strip of road on ground. The phase I of the PRR, which involves just the construction of the road (75 m ROW + 25 m commercial development) will continue to face challenges as levying betterment charges without area development will be difficult. However phase II of

PRR needs to be reimagined as a catalyst to plan and finance serviced urban expansion. By employing an area development approach in the impact area of PRR in the phase II, spatial development could be integrated with transport development increasing efficiency and accessibility of movement to a better planned and sustainable city form.

Land value capture is an opportunity not to be missed by government agencies as there is only limited revenue that can be recovered from development charges and change of land use fees post project implementation. Private developers and market forces should be managed and embraced through structured partnerships especially in situations where the govern-ment coffers are heavily strained. Participation and buy in of the people is a critical way forward if any large projects have to be moved forward and such affected persons must benefit from post development gains.

Karnataka State and hence Bengaluru City has traditionally relied on using the compulsory land acquisition method as enabled by the National Land Acquisition Act (1894 and more recently the 2013 Act) via the Karnataka Town and Country Planning Act (KTCP), 1961. An important piece of legislation that is lying dormant within the KTCP Act is the Town Planning Schemes legislation which has never been used in Bengaluru since independence. It is heartening to note that agencies such as the Bangalore Metropolitan Region Development Authority (BMRDA) are exploring the idea of alternative mechanism such as TPS and LPS for the STRR and the Bidadi Township. The Directorate of Town and Country Planning (DTCP) too has in the recent past taken up measures to amend the TPS legislation to make it more applicable for current day needs. While challenges abound such as the BDA being unable to charge a toll on the road as per its Act, and having limited experience in leveraging private sector partnerships, it is time to do a rethink on the future of infrastructure projects for the city and to find viable alternate solutions.

Rather than displacing many and benefitting a few, projects like the PRR should have a long term comprehensive vision of road and area development because it will have a lock in period of over a hundred years. The lessons learnt from the use of alternative mechanisms to access land would go a long way in reaching that middle ground between land owners, government agencies and the private sector. The legacy of the PRR should move beyond requiring another ring road to decongest traffic within 5 years of when it gets implemented.

As a next step to this practice note, the authors are undertaking an on ground exercise to assess the financial feasibility of using alternate mechanisms to access and plan land. This will assess existing land values in the area, post project implementation escalation in land value, area development charges and on ground complexities and cost recovery options with respect to public or private investment in infrastructure provision etc.

References

[1] Chief Minister, GoK, 2016, *Chief Minister's Speech at the Inaugural of Invest Karnataka-2016 Investor's meet at Bengaluru Palace*, Department of Information and Public Relations, Government of Karnataka, Benguluru.

[2] Directorate of Economics and Statistics, 2014, *State and District Domestic Product of Karnataka 2014-15*, Government of Karnataka, viewed October 12, 2016. http://des.kar.nic.in/docs/sip/State%20and%20District%20Domestic%20Product%20of%20Kar%2014-15.pdf

[3] BMRDA, 2011, *Bangalore Metropolitan Regions: Revised Structure Plan 2031*, viewed June 28, 2016.

[4] Deccan Herald, 2012, *NHAI, PWD to build Satellite Town Ring Road for Bangalore*, viewed June 29, 2016. http://www.deccanherald.com/content/266799/nhai-pwd-build-satellite-town.html

[5] Centre for Management and Social Research, 2015, *Peripheral Ring Road Project: Final Revised Draft Resettlement Action Plan*. Bengaluru Development Authority, Urban Development Department, Government of Karnataka, viewed June 30, 2016. https://www.jica.go.jp/english/our_work/social_environmental/id/asia/south/india/c8h0vm000090s0d1-att/c8h0vm00009pqvzw.pdf

[6] CRISIL Infrastructure Advisory, 2012, *Development of Peripheral Ring: Pre-feasibility Report*, Bangalore Development Authority, viewed June 29, 2016. http://www.iddkarnataka.gov.in/docs/41.peripheral.pdf

[7] Bharadwaj K V, 2015, *Last Ditch Effort to Save Peripheral Ring Road*, The Hindu, viewed July 1, 2016. http://www.thehindu.com/news/cities/bangalore/lastditch effort-to-save-peripheral-ring-road/article7463465.ece

[8] Government of Karnataka, 2016, *Karnataka State Proceedings: Regarding the Phase I Planning of Peripheral Ring Road, Bangalore, Karnataka*, viewed October 17, 2016.

[9] Kidiyoor S, 2016, *BDA Finally Moves to Build the PRR*, Bangalore Mirror, viewed July 4, 2016. http://www.bangaloremirror.com/bangalore/civic/BDAfinally-moves-to-build-the-PRR/articleshow/50524055.cms

[10] Bharadwaj K V, 2016, *Impasse over peripheral ring road project continues*. Bangalore: The Hindu, viewed October 19, 2016. http://www.thehindu.com/news/cities/bangalore/Impasse-over-peripheral-ring-road-project-continues/article14465260.ece

[11] Sridhar K S, 2004, *Cities with Suburbs: Evidence from India*, National Institute of Public Finance and Policy. http://www.nipfp.org.in/media/medialibrary/2013/04/wp04_nipfp_023.pdf

[12] Datta S, Mahajan V and Singha A K, 2009, Land for Infrastructure Development: Livelihoods and Fair Compensation, in *India Infrastructure Report: Land – A Critical Resource for Infrastructure*, Oxford University Press, 111-122.

[13] India today, 2016, *Equity crunch, land acquisition delay 414 highway projects*, viewed April 12, 2016. http://indiatoday.intoday.in/story/equity-crunch-land-acquisition-delay-414-highway-projects/1/605340.html

[14] Economic Times, 2015, *Delay in land acquisition holding up 270 projects: Nitin Gadkar*, viewed July 12, 2016. https://economictimes.indiatimes.com/news/politics-and-nation/delay-in-land-acquisition-holding-up-270-projects-nitin-gadkari/articleshow/47121249.cms?from=mdr

[15] Kennedy L, Robbins G, Scott D, *et al*., 2011, The Politics of Large-Scale Economic and Infrastructure Projects in Fast-Growing Cities of the South. *Literature Review*, Chance 2 Sustain.

[16] Panchal K, Salgaonkar J, Vyas D P, *et al*., 2016, *Scaling up Land Readjustment for Urban and Industrial Development through the Town Planning Scheme in Dholera, Gujarat, India*. 2016 World Bank Conference on Land and Poverty, World Bank, Washington DC.

[17] *Gujarat Town Planning and Urban Development Act*, 1976, Government of Gujarat.

[18] Bharadwaj K V,2016, *Rush to Build*, The Hindu, viewed July 9, 2016. http://www.thehindu.com/news/cities/bangalore/rush-to-build/article8116994.ece.

[19] Deccan H, 2015, *Bidadi Township and Satellite Town Ring Road get Government Nod, Deccan Herald*, viewed July 13, 2016. http://www.deccanherald.com/content/520453/bidadi-town ship-satellite-town-ring.html

[20] Deuskar C, 2011, A better way to grow: land readjustment through town planning schemes in Ahmedabad. *Master in City Planning Thesis*, Masachusetts Institute of Technology, Masachusetts, 103−108.

[21] Municipal Administration & Urban Development (M2) Department, Govt of Andhra Pradesh, 2015, *The Andhra Pradesh Capital City Land Pooling Scheme (Formulation and Implementation)* Rules, viewed August 3, 2016.

[22] The Govemor of Haryana, 1975, *The Haryana Development and Regulation of Urban Areas Act 1975*, Haryana Government Gazette (Extraordinary), viewed September 4, 2016. https://archive.india.gov.in/allimpfrms/allacts/1907.pdf

[23] Rao P S N, 2012, *Peri-Urban Land Development in Metropolitan Cities: Issues and Concerns*, Meeting of the Working Group of AsiaPacific Ministerial Conference on Housing and Human Settlements (APMCHUD) on 'Urban and Rural Planning and Management', A Report. Ministry of Housing & Urban Poverty Alleviation, Government of India, New Delhi, 134−135.

[24] Souro D J, 2006, *Development Mechanism in Spatial Integration of Cities*. 42nd ISoCaRP (International Society of City and Regional Planners) Congress, Yildiz Technical University.

[25] Municipal Corporation of Greater Mumbai, 2016, *Draft Development Control Regulations, Draft Development Plan-2034, Greater Mumbai*. MCGM, Government of Maharashtra, Mumbai.

[26] Mehta C, *View on Cluster Redevelopment*.

[27] Urban Development Department, Maharashtra, 1991, *Development Control Regulations for Greater Mumbai -1991*, Mumbai.

[28] Ballaney S, 2012, *Supply of Land for Development: Land Readjustment Experience in Gujarat, India*, UN-Habitat.

[29] Mahalekshmi B V, 2015, *A smart road for the commuter*, Financial Express, viewed May 23, 2016. http://www.financialexpress.com/economy/a-smart-road-for-the-commuter/136335/

[30] Jaipur Development Authority, 2014, *Master Development Plan 2025, Jaipur Region -Volume 2*. Jaipur Development Authority.

[31] United Nations, 1976, *Report of Habitat: United Nations Conference on Human Settlements*. United Nations, Vancouver.

[32] Phatak V K, 2013, *Land Based Fiscal Tools and Practices for Generating Additional Financial Resources*, Ministry of Urban Development, Government of India & The World Bank.

[33] Bapat J, 2009, Resettlement entitlements: moral economy of land rights and beyond, in *India Infrastructure Report 2009: Land − A critical resource for infrastructure*, Oxford University, New Delhi, 97−102.

[34] Lenferink S, Tillema T and Arts J, 2008, *The potential of a life-cycle approach for improving road infrastructure planning in the Netherlands*. Colloquium Vervoersplanologisch Speurwerk, Santpoort. https://www.cvs-congres.nl/cvspdfdocs/cvs08_68.pdf

[35] Ballaney S and Patel B, 2009, Using the 'evelopment Planning own Planning Scheme': Mechanism to Appropriate Land and Build Urban Infrastructure, in *India Infrastructure Report 2009: Land − A Critical Resource for Infrastructure*, Oxford University, New Delhi, 190−204.

[36] Law Commission of India, 1958, *Report on the Law of Acquisition and Requisitioning of Land*, Ministry of Law, New Delhi.

[37] Gautam I P, 2012, *Land Use and Urban Transport*. ICRIER. http://icrier.org/pdf/IP_Gautam_GOG_IPG_Program.pdf

[38] Jain A K, 2012, *Towards a Hybrid Land Policy for Inclusive Development*. Meeting of the Working Group of AsiaPacific Ministerial Conference On Housing and Human Settlements (APMCHUD) on 'Urban and Rural Planning and Management', A Report, Ministry of Housing & Urban Poverty Alleviation, Government of India, Delhi, 166−167.

RESEARCH ARTICLE

Making water flow in Bengaluru: planning for the resilience of water supply in a semi-arid city

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Abstract: The south Indian city of Bengaluru (formerly Bangalore) has a long history of human occupation. Today as one of the fastest growing cities in the world, Bengaluru is unusual in the fact that it is an old city, located at a distance from perennial sources of fresh water. While in the precolonial past, it depended upon an interconnected system of rainwater harvesting via lakes and wells, today it relies on water that is pumped from a river at a distance of over 100 km.

This paper traces the evolution of Bengaluru's water supply infrastructure from the precolonial past into the present day. We posit that the shift of the city's dependence on water from local to distant sources, with the advent of technology and the introduction of centralized piped water, has weakened local residents' and policy makers' awareness of the importance of conservation of local ecosystems. The resulting degradation and conversion of the city's water bodies has reduced the resilience of Bengaluru to flooding and drought, especially affecting the poorest and most vulnerable of its residents. The disruption of the links between water and other forms of commons, including grazing lands, fishing areas and wooded groves, has further fragmented the once-organic connection between the city and its ecosystems, with widespread construction on wetlands leading to flooding and water scarcity in different seasons. In an era of increasing climate change, cities in semi-arid environments such as Bengaluru will be hit by problems of water scarcity. We stress the need to develop an integrated perspective that considers the importance of local ecosystems as commons for increased urban resilience.

Keywords: lakes, wells, resilience, urban infrastructure

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1 Introduction

Urbanization is taking place at increasingly rapid rates of progression, leading to largescale transformations in land use and land cover across the world[1]. The rapid growth of cities has led to a host of environmental challenges, of which water scarcity is one of the most apparent and widespread[2].

Challenges of water availability and access are especially pronounced in the context of developing countries such as India, given the high population density and inequity in access to resources[3]. Cities in India today face frequent challenges of droughts leading to frequent conditions of water scarcity[4]. Water therefore becomes a highly contested resource, creating massive conflicts and disputes both locally as well as regionally over its management and appropriation[5]. An example of one such conflict is the ongoing Cauvery Water Dispute between the south Indian states of Karnataka and Tamil Nadu over the waters of the river Cauvery[5]. In such cases, while states and bureaucracies are engaged in legal battles over water, the most affected are marginalized communities for whom water represents lives and livelihoods[6]. At the same time, with increased focus on meeting the demands of their rapidly increasing demographics, cities have over time forgotten traditional methods of water storage, harvesting, and recharge[7]. Many traditional water storage and harvesting structures across the country thus have been dismantled, built over, or degraded. Examples include the massive, ornate stepwells (*baolis*) scattered throughout north and central India, the tanks dotting the south, and open wells across the country[7]. They are unable to perform their role in enhancing the water security of the landscape of which they were once an integral part[7]. Fur-

thermore, the social capital of communities once centred on water harvesting systems and other forms of associated commons such as grazing lands and wooded groves has been disrupted, affecting the lifestyles of communities dependent upon them[8].

This paper is focused on the city of Bengaluru (formerly Bangalore), in the south Indian state of Karnataka. Known famously as the Garden City of India, and internationally known for its Information Technology industry, Bengaluru is located in a semi-arid region, distant from large rivers, and faces frequent challenges of acute water shortage[9]. Yet, it has also been a city with a long history of settlement[10,11]. How did the city survive and grow in a water-scarce landscape, and what lessons can we learn from its past that may be relevant for its resilience today? Through a narrative of changes in the history of water supply in Bengaluru from its precolonial past to the present day, we examine these questions.

2 Methods

We conducted detailed analysis of archival records and historical maps from the Karnataka State Archives in Bengaluru, the Divisional Archives in Mysuru, the Mythic Society of India in Bengaluru, and the British Library in London. We also conducted field research on the current uses of commons, with semi-structured interviews of commons users to understand recent changes in access and usage.

Drawing on old maps, we examined changes in lakes in the older parts of Bengaluru from the late 19th century to current times. The "Map of Bangalore Cantonment and its Environs for the Year 1884−1885" was referenced from the Mythic Society of India, Bengaluru. The "Bangalore Guide Map for the year 1935−1936", published by the Survey of India in 1935, was obtained from the Indian Institute of World Culture, Bengaluru. $1:25,000$ scale topographic maps dating to the 1970s were obtained from the Survey of India's Bengaluru Office. All maps were scanned, georeferenced to Google Earth images, and then digitised to look at changes in the number and extent of lakes.

Field research was conducted around 21 lakes around the city, some of which are no longer extant over three years, *i.e.*, from 2012 to 2015. The lakes were chosen using a process of stratified sampling across gradients of size. They were distributed across the city and ranged from those located within its core to those situated in its peripheral peri-urban zones. Figure 1 shows the location of each of these study sites as located within the current administrative boundaries of the city. At each lake, we recorded the social and ecological uses through a combination of field observations, archival literature, and interviews with resource users. The archival material we used for the study was obtained from the holdings of the Karnataka State Archives in Bengaluru, the Divisional Archives in Mysuru, and the British Library in London. The material analysed covered the period between the late 18th century (about 1799 CE onwards) and the year 1935. These files consisted of government records of use, regulation, and conflicts surrounding water bodies within the city.

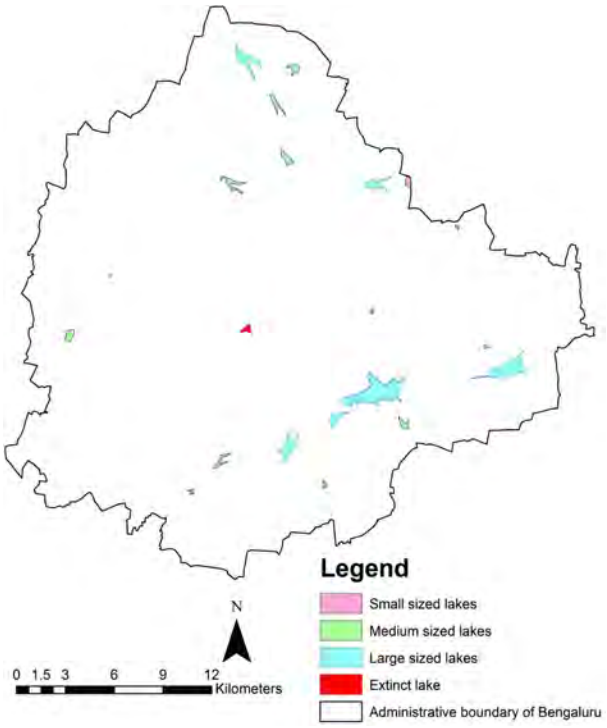

Figure 1. Map showing the study sites within administrative boundary of Bengaluru.

They also detailed various schemes − proposed and implemented − to provide water for Bengaluru. Additional historical information was obtained by consulting secondary sources of information in the form of old school magazines and records of speeches made by former ministers of the colonial city.

The former were obtained through internet-based searches, while the latter from the collections of the Mythic Society, Bengaluru. We also conducted oral history interviews with communities living around each lake to understand changes they perceived in their relations with the water bodies over time. A description of each of these 21 lakes is provided in Table 1.

A total of 129 such interviews were conducted around the study sites to arrive at the results we present here. As the focus of our study was the history of use and change around water bodies, we conducted interviews with elderly members of communities living around the lake selected through a process of snowball sampling where one

Table 1. Characteristics of study area.

Name of lake	Area (Acres)	Size*	Degree of urbanity	Level of pollution	Governance of lake	Managing Authority**
Pillappanakatte	3.48	S	Low	High	Public	Unknown
Thubarahalli lake	8.46	S	Medium	Medium	Public	BDA
Bhattarahalli lake	8.91	S	Medium	Medium	Public	BDA
Kelaginakere lake	10.01	S	Low	Medium	Leased	BBMP
Doddakallasandra lake	13.30	S	Low	Medium	Public	BDA
Nyaayanayakanahalli	18.82	S	Low	High	Public	BDA
Rampura lake	42.24	S	Medium	High	Public	BDA
Sawl *kere*	50.35	M	High	Low	Public	BBMP
Sarakki lake	52.84	M	High	High	Public	BDA
Kogilu lake	60.05	M	Low	Low	Public	BBMP
Jakkur lake	61.87	M	Medium	Low	Public	BDA
Mallathalli lake	67.56	M	Low	Medium	Public	BDA
Rachenahalli lake	76.43	M	Medium	Medium	Public	BDA
Hebbal lake	89.09	M	High	Medium	Private	LDA
Madivala lake	99.40	L	High	Medium	Public	FD
Kalkere lake	117.22	L	Medium	High	Public	BBMP
Agara lake	193.70	L	High	Medium	Private	LDA
Yelahanka lake	196.66	L	High	Medium	Public	BBMP
Varthur lake	376.57	L	High	High	Public	BDA
Bellandur lake	829.02	L	High	High	Public	BDA
Sampangi lake	NA***	NA	High	NA	Converted into built space	Department of Youth Services and Sports, Karnataka

*S = Small sized lakes; M = Medium sized lakes; and L = Large sized lakes
*LDA = Lake Development Authority; BDA = Bangalore Development Authority; BBMP = Bruhat Bengaluru Mahanagara Palike; and FD = Forest Department
** NA = Not applicable as lake has been converted into a built space

interviewee would direct us to the next. During these interviews, we asked the interviewees what they remembered of the inception and use of the lakes, changes perceived in the quality and utility of the resource as well as perceived causes for these changes. We also examined how communities perceived themselves as having been affected by landscape transformations around each lake. At each study site, our interviews were supplemented with field observations made through field visits conducted over two seasons (pre-monsoon and post-monsoon). Adopting this mixed-methods approach, we were able to trace out the various provisioning and cultural dependencies communities have formed around lakes in the city of Bengaluru.

3 Results

Figure 2 shows the changes in the distribution of traditional water bodies (lakes) within the area covered by the older parts of Bengaluru city (colonial Bengaluru) between the years 1885 and 2014. It shows that the number of lakes has drastically reduced in the intervening years.

Epigraphic inscriptions discovered around the city reveal that the landscape surrounding present day Bengaluru was ruled from about the 6th Century AD by a succession of dynasties including the Gangas, Cholas, Pallavas, Hoysalas and the Vijayanagaras[11]. These dynasties placed great economic, spiritual, and cultural importance on exploiting the undulating terrain to harvest rainwater from seasonal rivulets and streams in the form of networked cascading reservoirs – tanks or lakes – to capture and provide rainwater to local communities[12].

Great importance was attached to their management and upkeep, with inscriptions listing a number of curses aimed at discouraging potential violators[10]. Lakes were connected in networks along topographic gradients, with water flowing from upstream lakes to those located downstream at lower elevations, via storm water channels (locally known as *kaluves*)[12]. A semiarid landscape covered by thorny scrub was thus transformed into a fertile irrigated landscape with paddy fields, fruit, and flowering orchards, large herds of cattle, and thriving village

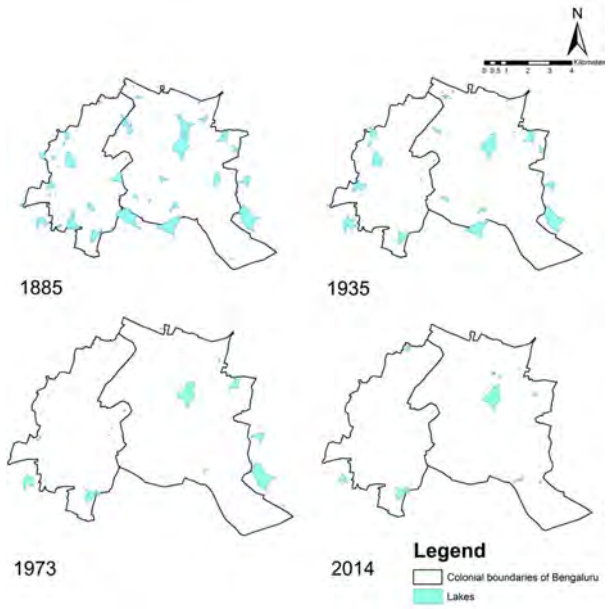

Figure 2. Changes in the distribution of lakes within the colonial boundaries of Bengaluru between the years 1885 and 2014.

settlements, by the design of interconnected rainwater harvesting systems.

The market town of Bengaluru was founded in 1536 AD by a local chieftain Kempe Gowda[10]. Kempe Gowda and his successors are credited with the construction of a number of new lakes across the city, some of which still survive to the present day. To supplement the water in lakes, a number of smaller tanks – *kalyanis* – and massive open wells were constructed, which connected to the shallow ground water table recharged by the lakes on the surface[10]. These water bodies were managed as commons and community life revolved around them[8].

Each lake was connected to one or more local areas that jointly undertook the responsibility of its maintenance and upkeep. Rules governed the access, appropriation, and management of these resources bearing in mind the various dependencies associated with the water body as well as the number of dependents[12]. Both archival as well as oral histories have shown that water from the lake was used for various purposes – irrigation, brick making, laundering, fishing, domestic needs, and drinking. Grass and green leafy vegetables growing on the banks of the lake were harvested for use as fodder and food respectively[8]. Our interviewees recall that certain plants, chief among which was called the *Onagane soppu (Alternanthera sessilis)* were particularly harvested as a nutritional supplement in times of drought. They also recalled that the banks of the lake provided a space for livestock grazing and the dung so left behind was collected both for fuel and manure. In the case of the Hebbal lake particularly, interviewees remembered the intense competition with which local women would reach the lake in order to collect cow dung. Some of the collected resource was used to meet subsistence needs, while the rest contributed to increasing the income generated by the family. Irrigation too was regulated around the lake by means of manual sluice gates operated by specific members of the community (the *neerganti* or the village waterman) who also monitored levels of water in the lake[12,13].

Lakes were further associated with a number of other commons integral to the lifestyles of village communities. Wooded groves or *gundathopes* planted with fruit trees were situated in close proximity to lakes and they provided shade and shelter both to nomadic tribes as well as the livestock herders of the village associated with the water body[3,8,14]. Water is held sacred in many communities and therefore cemeteries or burial grounds for both humans and livestock were situated close to lakes. Our field studies have documented the continued presence of some or all of these structures in the immediate vicinity of the extant lakes we have studied. *Gomalas* or grazing commons were also part of the commons associated with water bodies[13]. The strong ties communities built around their water resources were further reflected in the cultural traditions that revolved around water bodies, many of which continue into the present day[3,15]. These traditions included various forms of worship of female deities associated with water bodies[3], rituals related to flooding and overflow cycles of the water body such as the *Gange Pooje* (a tradition where numerous oil lamps were lit and set afloat on the lake during its first overflow of the year)[16], and festivals such as the Karaga[15].

In 1799 AD, after the defeat of the ruler Tipu Sultan, the city of Bengaluru passed into the hands of the British[10,17]. At this point in time, lakes and wells still formed the primary source of water for the population, and agriculture was one of the primary occupations[18]. Thus, narratives of the time describe how advancing armies were deterred or slowed down by the presence of vast flooded marshlands and paddy fields in their path[15]. The British regiments established the Cantonment in 1807 AD, to the east of the then existing city limits. From 1831, the British established direct rule over Bengaluru until 1881, when they signed an agreement of Rendition with the Wodeyar rulers of the Mysore State[16]. The city was then divided into two zones – the British governed Cantonment and the native city or the *Pete*, managed under the jurisdiction of the Mysore state.

Lakes and open wells continued to meet the water needs of this increased population, with the Cantonment and *Pete* sharing resources from certain lakes dotting the cityscape[18]. Yet, it was also around this time that sewerage systems of the city directed their contents into some of the city lakes (which were not used for the supply of water), heralding an era where lakes began to be contaminated in different forms[19]. In 1830 AD, with a view to

improving the water supply of the city, various lakes began to see restoration attempts to rectify damages caused due to prolonged conditions of war[20]. Between 1873 and 1882, new tanks such as the Millers tanks and the Sankey tank were constructed to augment existing water supply following conditions of drought and famine in the preceding years[21]. The Mysore Gazetteer of 1897 records an impressive number of 2,388 government tanks, 16,725 wells and 254 canals present within the District of Bangalore[18]. Yet, this supply of water was insufficient for the city, which experienced a number of successive years of drought towards the late 1880s. The city started looking beyond its local boundaries to meet its water needs. The year 1895 AD saw the introduction of piped water from the Hesarghatta reservoir (artificially created by damming the river Arkavathi), about 13 miles to the northwest of the city[18,20]. Three additional lakes – the Kakol, Byate and the Yellemallappachetty – were further created in the outskirts of the city[3].

The introduction of piped water to the city from a distant reservoir heralded a new era in how lakes within the city began to be perceived and used. Lakes now (keeping with the dominant colonial ethic of recreation and aesthetics) began to be seen as picturesque spaces for recreation, exercise, and nature appreciation[16]. Uses of the water body that were perceived to spoil the beauty of the landscape were prohibited. Examples include the extraction of mud from the lake for purposes of brick making and the excavation of wells around the water body[22]. In the case of Sampangi Lake, for instance, our interviewees remembered that uses such as grazing cattle on the banks of the lake, washing clothes and collecting fodder grass began to be regulated by uniformed guards stationed around the water body[16].

Our research into the social ecological history of the Sampangi Lake has revealed that the deepening of the lake to provide additional water to agriculturists began to be seen as a potential threat to the low-lying bungalows and establishments that had sprung up around it by the year 1904 AD[16]. While such activities sparked protests among the farmers and horticulturists[16], they also saw people gradually distancing themselves from both the maintenance of the water body as well as their dependencies on it. Interviewees recalled that migration of resource-dependent communities became widespread, and such areas began to be repurposed in creating newer settlements either to house the landless poor or the urban middle classes[16]. The lake began to become more polluted with the constant inflow of sewage. Its seasonality was lost and it became a perennial pool of sewage, whose only value now lay in fishing and extraction of fodder. Consequently, cultural traditions associated with the water body too began to dwindle, with many water-based traditions becoming mere memories. Significant portions of the lake were drained and used in many ways such as for compensatory efforts, or for use as polo grounds[16]. Lakes, in general, also began to be perceived as breeding spaces for mosquitoes[23]. While these changes were occurring, the most affected individuals included those whose livelihoods depended upon the water body such as the farmer, the fisherman, and the pastoralist[16]. These people were deprived of a formerly important resource, further enhancing their ongoing disconnect from lakes. Interviewees around the Sampangi lake recalled that many horticulturists migrated away from the resource, leaving behind space for newer settlers to occupy. These new settlements however did not share the same utilitarian or cultural connect with the water body as their predecessors, further influencing the decline of the social-ecological system.

The years 1925 and 1926 saw the failure of two consecutive monsoons, plunging the city into conditions of severe drought[22]. This necessitated augmenting the existing water infrastructure, resulting in the construction of the Thippegondanahalli reservoir in the outskirts of the city[17]. Lakes and wells within the city fell into further disuse with many water bodies drying and in some cases (such as the Sampangi) being used as playgrounds or as spaces to conduct cattle fairs, and carnivals[16,24]. In other parts of the state, lakes began to be seen as spaces within which to develop public amenities such as stadiums and bus terminals – a trend which began to be repeated within Bengaluru as well[22]. Existing lakes were either converted into residential and resettlement sites, or public amenities such as sports stadiums, forever destroying the deeply ecological character of these resources.

This trend of converting water bodies into built spaces continued well after India gained independence in 1947. Lakes were either seen as aesthetic adornments to the landscapes or as barren spaces suited to meeting the housing needs of a growing city[25]. Water supply continued to be sourced from the Thippegondanahalli and Hesarghatta reservoirs until about the year 1969[26]. With the formation of the Bangalore Water Supply and Sewerage Board (BWSSB) in 1964 and the inception of the Cauvery Water Supply Scheme in the year 1969 (currently ongoing in several stages), Bengaluru shifted its entire water dependency upon the river Cauvery, located at a distance of over 100 km from the city, at a lower elevation[26]. A number of lakes were further drained as part of efforts aimed at malaria eradication, and converted into malls, bus stands, and stadiums[27–29]. In some of these places today, there exists a collective memory of the lake having been part of the landscape (examples include the Sampangi Lake, and the Koramangala Lake). However, in others, we found it immensely challenging to find interviewees who recalled the presence of the water body, or remember its name (examples include field interviews conducted around Neelasandra and Byappanahalli regions of Bengaluru).

By about 1985, local residents, particularly in and

around the heart of the city (Bellandur, Varthur and Agara lakes, to name a few) recall that their lakes had become nothing more than sewerage collection units. They had become extremely polluted not just with the entry of sewage into their depths but also industrial and chemically laden agricultural runoff (such as around the Yelahanka Lake). Lakes no longer met the drinking water needs of communities dependent upon them, except in some cases (such as Kalkere Lake) where wandering pastoralists consume the heavily polluted water even today. Domestic uses such as bathing and washing vessels also ceased around most of these lakes[30]. Pastoralism, brick making, and commercial laundering of clothes are examples of traditional livelihoods that have persisted into the present day, albeit in small pockets of the urban landscape. Connectivity between lakes was lost due to encroachments and building over of the channels that connected various lakes. In addition, the seasonality of lakes was lost because of the perennial inflow of sewage into the lakes. Both these activities led to the stagnation and further pollution of the once flowing water in these lakes. In such places, older residents are able to point out specific locations where former channels leading into and out of the lakes used to flow, as well as those of the village groves and grazing commons. In the case of the Bhattarahalli Lake, residents have even resorted to using legal instruments to reclaim some of their urban commons, though with little success.

Uses of lakes that were dependent upon the seasonality of lakes too halted. Rapid urbanization that took place around most lakes within the urban and periurban landscapes of the city further reduced agricultural dependency upon lakes[30]. The polluted status of lakes, especially from about 2000 to mid-2014 has discouraged fishing around some of these lakes. Interviews we conducted around some of these lakes (Rampura Lake, Bellandur Lake, and Pillappanakatte) reveal a sense of loss within former fishing communities when they spot fishes (some of them weighing over 7 kilograms) swimming within the murky depths, but are unable to harvest them to supplement their regular incomes.

Around this point in time, responsibility for the maintenance and upkeep of lakes rested entirely upon the state. Furthermore, around the early 2000s, certain lakes within the study area underwent differing processes of enclosure such as leasing out for maintenance (Kelaginakere), creation of public parks with paid entry (Madivala Lake) and Public Private Partnerships (PPPs) (Hebbal and Agara lakes). Such undertakings have reduced the more utilitarian and spiritual dependencies built around the water bodies. At the same time, they actively encourage middle-class and bourgeois notions of aesthetics and recreation, unwittingly excluding a significant population of ecosystem users from the resource. Another way in which resource dependents have been alienated are the restrictions on timing, patrolling by home guards and active discouragement of traditional activities introduced after state led or community led rejuvenation in many lakes. Interviewees recall that these changes imposed restrictions upon traditional users in the form of gated entry, fences, and levy of entry charges and the boom of middle to upper middle class real estate around them. Along with these restrictions, development of the enclosed lakes has proceeded with strong emphasis on building the aesthetic and recreational value of the water body.

These dominant perceptions favouring aesthetics and recreational value for water bodies have inherently distanced traditional livelihoods such as brick making and pastoralism, which were seen to be against that ethic. Villagers around each of these lakes reported a strong disconnect from the water body, so much so that formerly integral cultural practices around the water body were also discontinued. In addition, people hesitate to go near the lake or its perimeter, while expressing a feeling of being powerless to effect any change. Also, in the case of certain lakes, informal, unmanned entry points are used by some traditional users to derive certain provisioning ecosystem services (such as fodder grass), though with a high risk of eviction from the premises.

This trend of distancing long-term village residents from their lakes has continued into the present day. While leasing out of lakes and PPPs has been discontinued mostly due to citizen led protests against these practices[31], newer forms of enclosure continue to omit traditional users from accessing benefits from these water bodies. Due to the high levels of pollution, many lakes in the study area (examples include Rampura, Bellandur, and Varthur lakes) were covered by froth from detergents used by city residents. In these lakes, pastoralism and the collection of fodder grass from lakes has been adversely impacted.

In the last decade, great attention has been paid to the condition of lakes within the city, especially with focus on their aesthetic potential. Further, at the level of legislations too, action has been taken to clear lakes of encroachments and unauthorized construction around water bodies. Keeping with this larger climate of attention to water bodies, the city has seen the rise of many localized lake protection groups comprising of middle to upper middle class urban residents living around lakes. At the other end of the spectrum are state led rejuvenation efforts which seek to divert sewage away from lakes, and develop them into aesthetically appealing lung spaces for the city. Through interactions between these two groups, certain lakes (such as Kogilu, Sawlkere, and Rachenahalli lakes) have been earmarked for rejuvenation and subsequent maintenance. Building upon the ethic of enclosure, these lakes too have had treatments ranging from draining polluted water, dredging, and diversion of sewage. They have also been landscaped to include parks and jogging tracks, while being fenced and patrolled by home guards.

Restrictions are strictly imposed with respect to access into the water body except in the case of tender based fishing activities. Traditional occupations such as commercial laundering and grazing cattle are prohibited especially within the fenced perimeter of the lake. However, in some lakes, respondents are permitted to enter the lake (within the restrictions imposed on timing) and harvest fodder grass.

Our studies indicate that lakes closer to the urban centres have already distanced their traditional communities for the most part, while those in peri-urban regions are progressing steadily towards doing so. Increasing real estate around lakes, coupled with further losses in connectivity, and the gating of lakes has further widened the gap between communities and the formerly important resource.

4 Discussion

This paper demonstrates changes in the waterscape of the city of Bengaluru, both at the level of providing water to a city as well as the strong interpersonal relationships that people build with a source of water. It shows how as the city grew and expanded, it looked to ever-distant sources of water. In doing so, the connection to local sources of water was disrupted. Consequently, the perception and use of water bodies as local commons, on which people depended for subsistence, livelihoods, worship and recreation was altered. Lakes became considered as areas to be preserved for biodiversity, aesthetics, and recreation[3]. They have consequently evolved and transformed into their contemporary identities concomitant with changes in how they became used and imagined. Through the introduction and establishment of centralized piped water supply systems and the rapid pace of urbanization and migrations both into and out of the city, these spaces have come to be perceived through different lenses than what they were originally meant to be.

While lakes then began to be seen in these terms, benefiting only certain sections of the society (for whom aesthetics and recreation assumed great significance), it also affected the lives of the urban marginalized whose livelihoods depended upon the water body. This created a distancing of such communities from the resource, leading to neglect in its use and subsequent maintenance. Their vulnerability to development and urbanization increased, while at the same time reducing the city's capacity to deal with potential conditions of drought and flooding during extreme weather events.

5 Conclusion

While this study focuses on lakes in the city of Bengaluru, insights provided by this study are relevant to other urban ecosystem resources in cities across the globe, when the local link between maintenance and use is disrupted. In documenting the complexity of this change and its implications for the present day, this study also underscores the importance of understanding the historical changes in the use of and governance of urban commons. It is clear that there is continued prioritization of certain forms of ecosystems uses from historical times into present day planning and policy mechanisms. Therefore, it becomes imperative that present day mechanisms of ecosystem governance should necessarily be guided by knowledge of how exclusionary regimes have operated in the past and how events of long ago have shaped and moulded the landscape of the present[16].

The appropriation of and exclusion from urban commons highlighted in this study is supported by examples from other cities of India as well[32–35]. We argue that, given the diverse threats to continued and equitable distribution benefits from the urban commons, there needs to be increased policy attention to dealing with contemporary management regimes that exacerbate exclusion. Democratic governance of urban commons has to be socially just, inclusive, and must take close cognizance of the diverse uses and values among all residents of the city.

On a broader level, lakes and associated water bodies (wells, stepwells and smaller *kalyanis* or tanks) have been integral to maintaining the water security of the city for centuries. Today, the city relies upon water sourced from distant rivers and reservoirs to meet its needs, while a potential local source of water has become polluted, dried up or been removed due to the pressures of urbanization[3]. At the same time, some studies have forecasted that the city is likely to run out of water in the coming decades[36]. Given these grim prospects, we need to better understand the processes of change and the factors we need to consider in order to reverse the process[3]. A city's innate resilience lies in its ability to absorb changes without losing its integrity in form or function[37]. It depends upon the capacity of the system to retain, adapt, and strengthen its inherent strengths, while at the same time providing an opportunity for reorganization and memory[38,39]. The availability of water is an important element integral to enhancing the resilience of any cityscape. Bengaluru, with its extreme dependence on water from the distant Cauvery, is ill prepared to deal with adverse changes in water availability because of excessive use, and depletion in availability. Yet, as our research has shown, traditional water bodies such as lakes continue to remain dynamic spaces that are integral to supporting a wide variety of lives and livelihoods. Making Bengaluru resilient to water risks will require preserving both the ecological and social importance of the resource. Encouraging the diverse and inclusive utilitarian uses of such resources (thereby creating value for the resource), will help encourage the retention of value associated with the remainder of the city's lakes, wells, and wetland systems along with other

distant sources of water. The current trend of unintentionally alienating communities from formerly integral resources places into question the feasibility of community led stewardship of these resources – an important step towards enhancing ecosystem resilience. In other words, fostering local collective participation towards sustaining and protecting both ecological and social values of a resource can go a long way in enhancing the resilience of the system[38]. While the city has witnessed numerous movements towards collective management of its water bodies (particularly its lakes)[40], these efforts have mostly been spearheaded by the middle and upper classes of the society, for whom the lake ecosystem represents mostly an aesthetic and recreational resource. Including marginalized communities for whom water bodies represent more utilitarian benefits thus poses a potential challenge and has received limited success (barring a few examples such as Kaikondrahalli and Jakkur lakes)[41,42]. In this context, adaptive management[43] of urban commons that involves incorporating local knowledge into policy and planning, and fostering collaborations between citizens and administrators has contributed to resilience building in other cities of the global South[44,45]. The decentralised governance structure for Indian cities has the potential to foster adaptive management, but this is not happening at present to the extent required.

On one hand, restoring the former waterscape of the city of Bengaluru to provide a means to supplement its water resources remains unlikely owing to challenges in the form or rising populations, geographical spread, and massive changes in land use. On the other hand, it is imperative that surviving water bodies be focused upon in terms of ecosystem rejuvenation and promoting inclusivity in its access and appropriation. Such measures can only be feasible if the physical and cultural dependencies formed around the resource are thoroughly researched and understood. To do so would require historically and contextually sound understanding of the landscape coupled with massive effort in reconceptualising the space as being more inclusive and equitable. This requires long-term engagement with local residents around lakes, working with a diverse array of stakeholders from different sections of society with differing conceptions of, and dependencies on lakes, to understand how they envision the future development and restoration of these lakes, and towards what goals. Such a collective envisioning would be the first step in a process of reclaiming collective rights to the city[46], and redefining lakes as urban commons thus enabling stewarding efforts to sustain these lake landscapes over the long term. This in parallel can support ecosystem functions such as groundwater recharge thereby enhancing water security and eventual resilience of the cityscape.

Author Contributions

HU, SM and HN conceived and designed the research, analysed the archival datasets and wrote the paper; HU conducted the field work and prepared the maps.

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References

[1] United Nations Department of Social and Economic Affairs, 2014, *World Urbanization Prospects, the 2014 revision*, viewed September 15, 2016, www.esa.un.org/unpd/wup

[2] McDonald R I, Green P, Balk D, *et al*., 2011, Urban growth, climate change, and freshwater availability, Proceed-ings of the National Academy of Sciences, vol.108(15): 6312–6317. https://doi.org/10.1073/pnas.1011615108

[3] Nagendra H, 2016, *Nature in the city: Bengaluru in the past, present, and future*, Oxford University Press, New Delhi. https://doi.org/10.1093/acprof:oso/9780199465927.001.0001

[4] Parikh J, Sandal G and Jindal P, 2016, Climate resilient cities: Vulnerability profiling of twenty Indian cities, in *Development in India*, Springer India, 351–365. https://doi.org/10.1007/978-81-322-2541-6_16

[5] Saleth RM, 2016, Water rights and entitlements in India, In *Indian water policy at the crossroads: Resources, technology and reforms*, Springer International Publishing, 179–207. https://doi.org/10.1007/978-3-319-25184-4_10

[6] Wolf TA, Kramer A, Carius A, *et al*., 2005, Managing water conflict and cooperation, In *State of the world 2005: Redefining global security*, The Worldwatch Institute, 80–95.

[7] Agarwal A and Narain S, 1997, *Dying wisdom: Rise fall and potential of India's traditional water harvesting systems*, Center for Science and Environment, New Delhi.

[8] Unnikrishnan H, Mundoli S, Manjunatha B, *et al*., 2016, Down the drain: The tragedy of the disappearing urban commons of Bengaluru, *South Asian Water Studies (SAWAS)*, vol.5(3): 7−11.

[9] Sudhira HS, Ramachandra TV and Subrahmanya MHB, 2007, Bangalore, *Cities*, vol.24(5): 379−390. http://dx.doi.org/10.1016/j.cities.2007.04.003

[10] Rice BL, 1905, *Epigraphia Carnatica volume IX: Inscriptions in the Bangalore district*, Mysore Government Central Press, Bangalore.

[11] Annaswamy TV, 2003, *Bengaluru to Bangalore: Urban history of Bangalore from the pre-historic period to the end of the 18th Century*, Vengadam Press, Bangalore.

[12] Dikshit GS, Kuppuswamy GR and Mohan SK, 1993, *Tank irrigation in Karnataka*. Gandhi Sahitya Sangha, Bangalore.

[13] Hegde R, 2002, *Kere neeravari nirvaahane charitrika adhyayana* (in Kannada), Publication Division, Prasaranga, Hampi.

[14] Ramesh SC (ed), 2005, *Alemaarigala sthithigathi* (in Kannada), Prasaranga Kannada University, Hampi.

[15] Srinivas S, 2004, *Landscapes of urban memory: The sacred and the civic in India's high tech city*, Orient Longman, Hyderabad.

[16] Unnikrishnan H, Manjunatha B and Nagendra H, 2016, Contested urban commons: Mapping the transition of a lake to a sports stadium in Bangalore, *International Journal of the Commons*, vol.10(1): 265−293. https://doi.org/10.18352/ijc.616

[17] Hasan MF, 1970, *Bangalore through the centuries: A historical narrative of Bangalore*, 1st ed, Historical Publications, Bangalore.

[18] Rice BL, 1897, *Mysore: A gazetteer compiled for government, revised edition, volume IIMysore by districts*, Archibald Constable and Company, Westminster.

[19] Ellis CH, 1865, *Report on the station, barracks, and hospitals of Bangalore*, Adelphi Press, Madras.

[20] Singh RL, 1964, *Bangalore: An urban survey (first edition)*, Tara Publications, Varanashi.

[21] File Number 354 of 1909, Municipal, *Important papers connected with draining a portion of the Sampige Tank*, Karnataka State Archives, Bengaluru.

[22] Government Press, 1949, *Speeches by Amin-ul-Mulk Sir Mirza. M. Ismail, K.C.I.E., O.B.E., Dewan of Mysore, volume III (February 1936December 1938)*, Karnataka State Archives, Bengaluru.

[23] Ross R, 1896, *Report on cholera, general sanitation, and the sanitary department and regulations in the C&M Station of Bangalore*, Residency Press, Bangalore.

[24] The Cottonian, 1946, *Annual magazine of Bishop Cotton Boys High School, Vol. XXXVI (nos. 1 and 2)*, C.L.S. Press, Bangalore.

[25] Government Press, 1954, *Report of the Bangalore Development Committee*.

[26] Subramanian DK, 1985, Bangalore city's water supply: A study and analysis. In *Essays on Bangalore volumes 14*, Karnataka State Council for Science and Technology, Bangalore.

[27] BBMP (Bruhat Bengaluru Mahanagara Palike), 2010, *Namma Bengaluru Nisarga: An action plan for development of lakes in BBMP's jurisdiction*, BBMP, Bangalore.

[28] Thippaiah P, 2009, *Vanishing lakes: A study of Bangalore city*, Social and Economic Change monographs, no. 17, Institute for Social and Economic Change, Bangalore.

[29] Rao TR, 1985, *Mosquito control in Bangalore city: Some observations*, Council for Science and Technology, Bangalore.

[30] D'Souza R and Nagendra H, 2011, Changes in public commons as a consequence of urbanization: The Agara lake in Bangalore, India, *Journal of Environmental Management*, vol.47(5): 840−850. https://doi.org/10.1007/s00267-011-9658-8

[31] Public Interest Litigation (WP No. 817/2008), 2008, filed by Environment Support group and Leo Saldanha against privatization of lakes in Bangalore, viewed September 17, 2016, http://www.esgindia.org/projects/events/campaign-against-lake-privatisation-bang.html

[32] Baviskar A, 2011, What the eye does not see: The Yamuna in the imagination of Delhi, *Economic and Political Weekly*, vol.46(50): 45−53.

[33] Sundaresan J, 2011, Planning as commoning: Transformation of a Bangalore lake, *Economic and Political Weekly*, vol.46(50): 71−79.

[34] Parthasarathy D, 2011, Hunters, gatherers and foragers in a metropolis: Commonising the private and public in Mumbai, *Economic and Political Weekly*, vol.46(50): 54−63.

[35] Vij S and Narain V, 2016, Land, water & power: The demise of common property resources in periurban Gurgaon, India, *Land Use Policy*, vol.50: 59−66.

[36] Sudhir, 2013, Will Bangalore have to be evacuated by 2023? In *Firstpost*, 13 April, viewed September 17, 2016, http://www.firstpost.com/india/will-bangalore-have-to-be-evacuated-by-2023-697649.html

[37] Liechenko MR, 2011, Climate change and urban resilience, *Current Opinion in Environmental Sustainability*, vol.3: 164−168. http://dx.doi.org/10.1016/j.cosust.2010.12.014

[38] Folke C, Carpenter S, Elmqvist T, *et al*., 2002, Resilience and sustainable development: Building adaptive capacity in a world of transformations, *Ambio*, vol.31(5): 437−440.

[39] Ernstson H, van der Leeuw ES, Redman LC, *et al*., 2010, Urban transitions: On urban resilience and human dominated ecosystems, *Ambio*, vol.39(8): 531−545.

[40] Enqvist J, Tengo M and Boonstra WJ, 2016, Against the current: Rewiring rigidity trap dynamics in urban water governance through civic engagement, *Sustainability Science*, vol.11(6): 919−933.

[41] Nagendra H and Ostrom E, 2014, Applying the social-ecological system framework to the diagnosis of urban lake commons in Bangalore, India, *Ecology and Society*, vol.19(2): 67.

[42] Nagendra H, 2016, Restoration of the Kaikondrahalli lake in Bangalore: Forging a new urban commons, *Kalpavriksh*,

Pune, India.

[43] Folke C, Carpenter S, Elmqvist T, *et al*., 2002, Resilience and sustainable development: Building adaptive capacity in a world of transformations. *Ambio*, vol.31(5): 437−440.

[44] Berney R, 2010, Learning from Bogota: How municipal experts transformed public space, *Journal of Urban Design*, vol.15(4): 539−558.

[45] Colding J, Barthel S, Bendt P, *et al*., 2013, Urban green commons: Insights on urban common property systems. *Global Environmental Change*, vol.23(5): 1039−1051.

[46] Lefebvre H, 1991, *The Production of Space* (Translated by Nicholson Smith D), Blackwell Publishing.

PERSPECTIVE

Strategies to harness Bengaluru's solar potential

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Abstract: Solar energy is a key component of cities' climate mitigation and energy security plans, due to its ease of installation & operation and drastic decline in costs. In Bengaluru, residential, commercial and industrial (C & I) consumers contributed to around 85% of the electricity consumption and resultant emissions during 2014 and 2015. What are the options for these consumers within the ambit of current policies to procure solar power? Are changes required in these policies to scale up the adoption of solar power? WRI India has explored both off-site and on-site procurement of solar energy.

On-site procurement

In 2013, net-metering which allows export of excess power to the grid was not available in Bengaluru. This, in addition to expensive electricity storage options meant that the complete potential of an on-site solar plant could not be realized.

WRII has found that net-metering regulations for rooftop solar projects in Karnataka, introduced in November 2014, were met with moderate success among C & I consumers. The adoption among residential consumers was slow due to information gaps about financial parameters, net-metering procedures and credible installers.

On May 2, 2016 gross metering scheme is introduced for both categories of consumers. WRII intends to look into the effectiveness of the new scheme.

Off-site solar procurement

Grid-connected solar power projects in Karnataka, commissioned before 31 March 2018, were exempted from payment of wheeling, banking charges and cross subsidy surcharge for the first 10 years for sale to 3rd party customers.

Since the typical payback period for a utility scale solar project is around 7 years, this order provided long term clarity for investors, solar project developers and consumers. For certain categories of consumers (commercial), the exemption meant that solar energy became more viable.

However, challenges in procuring land and bottlenecks in power evacuation, may delay the large scale deployment of solar projects to the latter half of 2016.

Keywords: Bengaluru, solar, on-site, off-site, roof-top, policy, residential, commercial, industrial

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1 Introduction: Solar Cities

Cities contribute to 70%[1] of the world's emissions, and rightly they are a key focus area for climate mitigation activities. On an average electricity consumption accounts for 75% of these emissions[2]. Renewable energy is a reliable way of reducing electricity related emissions while boosting economic output. Within the gamut of renewable energy sources, solar power is scaling up rapidly across the world, due to its ease of installation & operation and drastic decline in costs. Hence cities across the world are actively considering solar power in their climate mitigation and energy security plans.

However, cities are complex entities with various stakeholders who need to be engaged to bring in any systemic change. In particular businesses, residents and utilities define the electricity consumption patterns of any city. Each of these groups have fundamentally different outlook towards electricity and hence the strategies to engage them during the solarization process should be different.

Bengaluru, with an estimated population of 9.5 million[3] in 2016, is the fourth largest metropolis in India. It is an economic powerhouse and contributed ~2.3% to India's GDP as of during the financial year 2012−2013[4–6]. As a result, the city's electricity footprint is huge and is largely powered by thermal energy. In addition, Karnataka/Bengaluru has ambitious solar power targets to diversify its electricity supply mix and also to align with India's climate change mitigation plans.

Table 1. Circles and Zones in Districts served by BESCOM[7].

	Districts	BESCOM Circles		BESCOM Zones
1	Bangalore Urban	Bangalore East	Bangalore West	Bangalore Metropolitan Zone (BMAZ)
		Bangalore North	Bangalore South	
2	Bangalore Rural	Bangalore Rural		Bangalore Rural Area Zone (BRAZ)
3	Kolar	Kolar		
4	Chikka Ballapura			
5	Ramnagara	Ramnagara		
6	Tumkur	Tumkur		Chitradurga Area Zone (CTZ)
7	Davenagare	Davenagare		
8	Chitradurga			

2 Bengaluru's Electricity Consumption: A Snapshot

Bangalore Electricity Supply Company (BESCOM) is the utility that serves the 8 districts in and around Bengaluru. BESCOM serves these districts through the following three administrative zones and 9 circles (Table 1).

For the purpose of this paper, we will refer to all the circles in Bangalore urban and rural districts as Bengaluru city. Electricity consumption across various categories of consumers in Bengaluru city during FY 2014 (Apr 2013 − Mar 2014) and FY 2015 (Apr 2014 − Mar 2015) is as follows:

2.1 Bengaluru's Electricity Supply and Deficit

BESCOM's total energy requirement has grown from 21,909 MU during FY 2011 to 28,256 during FY 2016 at a CAGR of 5.22%[8]. Since hydro power is BESCOM's second largest source of power supply, any shortfall in annual precipitation affects it badly. As recently as September 2015, BESCOM faced a peak demand deficit of ∼800 MW[9].

The state of Karnataka is trying to fill this deficit in BESCOM and other state utilities through a combination of 1) Demand Side Management (DSM) and 2) supply augmentation with more renewable energy. As of June, 2016[10] the state has successfully exploited 13.4% (134 MW) of biomass, 27.9% (838.5 MW) of small hydro, 20.8% (2,918 MW) of wind and 63.4% (1,267 MW) of cogeneration resources by the end of 2015. In contrast the state has exploited only 0.7% (174 MW) of its solar potential[11].

To further diversify its energy mix, the state has turned its focus to solar power with the Karnataka Solar policy (2014−2021). This policy set a target of 1.6 GW of utility scale solar projects and 0.4 GW of rooftop solar projects by 2021[12]. As per the latest national target of 60 GW of utility scale solar projects and 40 GW of rooftop solar projects by 2022, the rooftop solar target for Karnataka

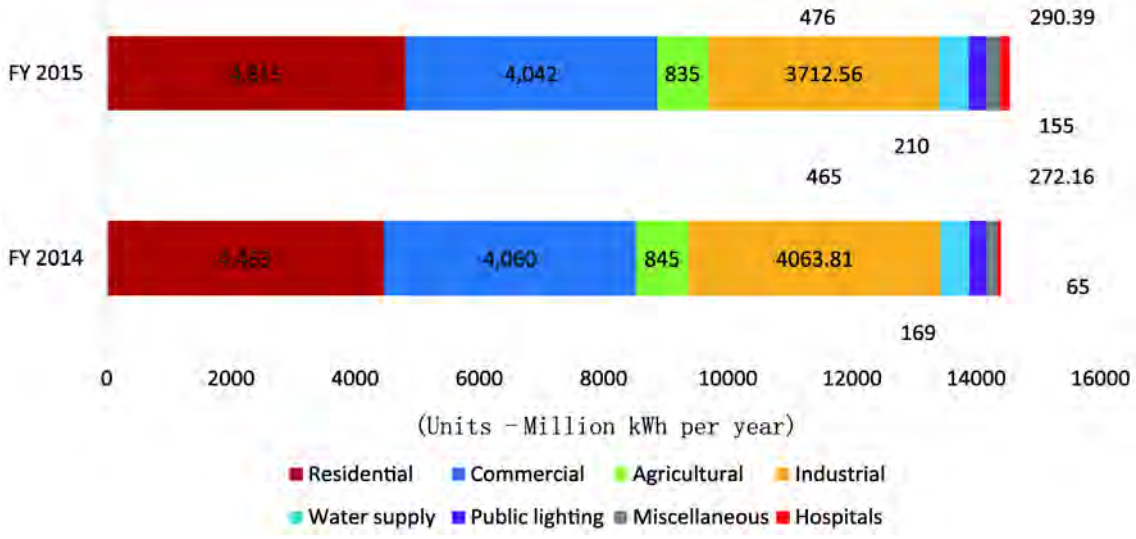

Figure 1. Category wise electricity consumption Bangalore Urban and Rural Circles[7].

is revised to 2,300 MW by 2022[13]. The estimated utility scale solar target for Karnataka will be close to 4,371 MW by 2022[14].

Of this, BESCOM's estimated targets, based on its share (48%[6]) of electricity within Karnataka, will be 1,104 MW of rooftop solar PV and 2,098 MW of utility scale solar PV respectively by 2022. In contrast the current installed rooftop solar PV and utility scale solar PV capacity in BESCOM area is 9.5 MW[15] and 174 MW[16] respectively.

To achieve the targets and fill the energy deficit, it is important for BESCOM to devise suitable strategies to engage with its stakeholders.

WRI India, in its bid to support Bengaluru scale up solar power, has devised some strategies to engage with each of the utility's stakeholders. This paper tries to capture how these strategies are designed and lessons learned from the work done based on such strategies.

2.2 Choice of Consumer Groups to Engage

Within Bengaluru city, commercial, industrial and residential consumers collectively have consumed more than 85%[8] of BESCOM's electricity consistently over the last 3 years. This makes for a strong case to engage with these stakeholders to scale up the deployment of solar across Bengaluru.

2.3 Existing Policy Framework for Solar Power Procurement as of 2014

In India, only consumers connected at >1 MW are eligible for procuring power through the grid, from sources other than the state utilities. This mechanism is called Open Access. Residential consumers, except apartment complexes connected at >1 MW, are not eligible for (solar) power procurement through Open Access mechanism[17].

2.3.1 On-site Solar Procurement by Commercial and Industrial Consumers

On-site solar PV projects connected behind the utility meter on consumer premises are not governed by any regulations. Businesses could either invest in a rooftop solar installation by themselves or sign a Power Purchase Agreement (PPA) with a third-party investor/developer. In both the cases the investors could make use of the Accelerated Depreciation benefit that helps write off 80%[18] of the asset value in the first year of the project.

Net-metering that allows for exporting excess power generation (especially because of no demand during weekend) to BESCOM was not allowed before 2014. As a result, on-site solar PV project sizing had to be done according to the base minimum load on weekends – and this limited the scale of deployment. At INR 8.40/kWh[19], rooftop solar was still expensive compared to the ∼ INR 5.75−7.25/kWh[20] for grid tariff of C & I consumers at that time. It was still not perceived as a reliable technology by the large buyers.

Because of the above reasons, only progressive companies went ahead for rooftop solar either on pilot basis or as part of corporate sustainability efforts.

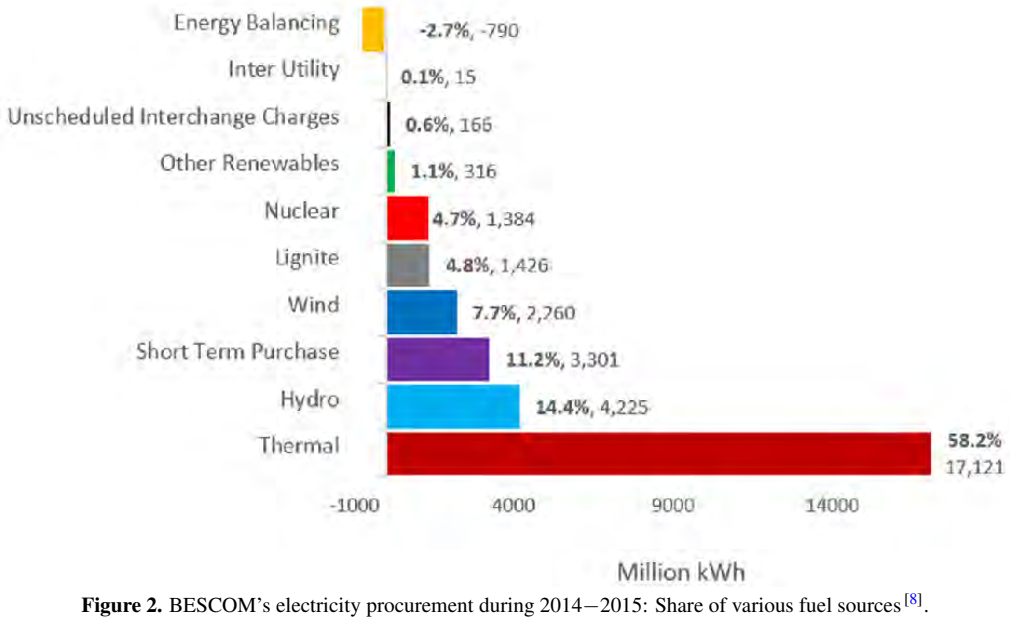

Figure 2. BESCOM's electricity procurement during 2014−2015: Share of various fuel sources[8].

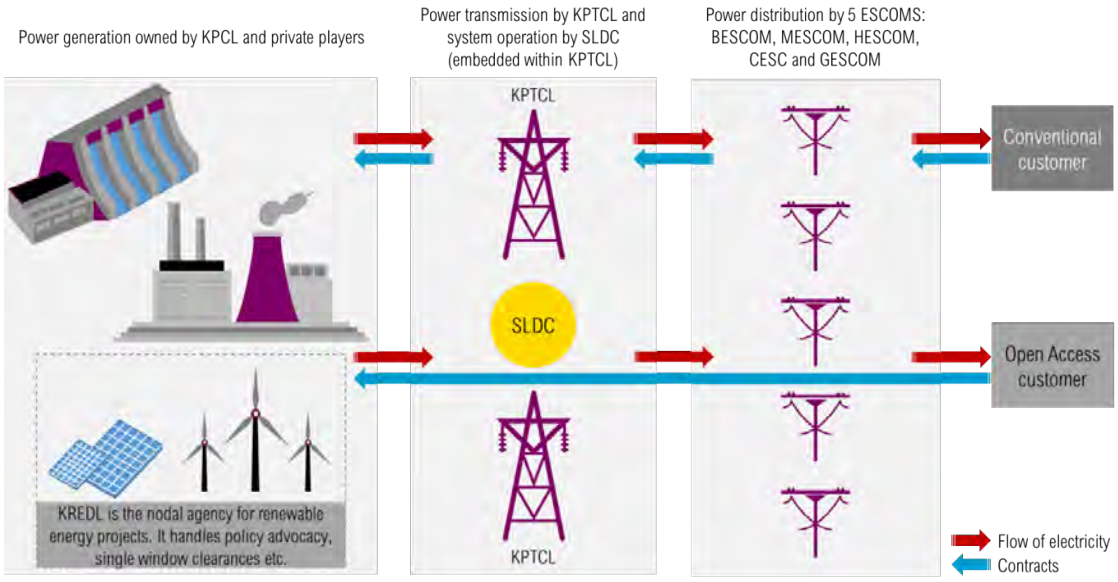

Figure 3. Open Access Mechanism.

2.3.2 Off-site Solar Procurement by Commercial and Industrial Consumers

Businesses could either invest in an off-site solar installation by themselves or sign a Power Purchase Agreement (PPA) with a third-party investor/developer. In both the cases the investors could make use of the Accelerated Depreciation benefit that helps write off 80% of the asset value in the first year of the project. Grid usage charges and Cross Subsidy Surcharges (CSS) are to be paid to the relevant transmission and distribution utilities. Grid usage charges include transmission charges, banking charges, reactive charges etc., whereas CSS is meant to offset the utility's loss of income from these high paying consumers.

2.3.3 Deployment of Roof-top Solar in the Residential Sector

Residential roof-top solar projects that are connected behind the utility meter are not governed by any regulations. Tax benefits are not available for residential solar projects. Limited capital subsidies are available on first come first serve basis from the central and state governments. Net-metering that allows for exporting excess power generation to the utility (BESCOM) was not allowed before 2014. As was the case in C & I consumers, project sizing has to be done according to the base minimum load on weekends – and this limited the scale of deployment. At INR 8.4/kWh solar power was still expensive and still not perceived as a priority by the residential consumers. Because of the above reasons, only environmentally conscious High Net-worth Individuals (HNI) went ahead with rooftop solar projects.

3 Bengaluru Electricity Consumers' Characterization and Engagement Strategies

Each category of Bengaluru's electricity consumers represents a diverse set of needs, preferences, purchasing parity and behavioral patterns. Understanding these factors can go a long way in devising the strategies to help them get on to the solar bandwagon. Hence we have used SWOT analysis to characterize each of the consumer group below.

Testing the engagement strategies

In line with the strategies devised for both sets of consumer groups, WRI India has worked on scaling up solar power through the following 3 activities in Bengaluru:

- Collaborative Solar PV Procurement Project
- Policy advocacy on grid usage charges for utility scale solar projects and
- Identifying the barriers to the BESCOM's net-metering policy for residential rooftop solar projects

The lessons that we learned in each of these activities are summarized below.

3.1 Collaborative Solar PV Procurement Project

WRI India and Confederation of Indian Industry (CII) through the Green Power Market Development Group (GPMDG) initiative attempted to aggregate energy demand from six corporate buyers in Bengaluru – Coca

Commercial and industrial consumers	
Strength	**Weakness**
• Ability to pay for costly power, if needed. HT[1] commercial and industrial consumers are already paying in the range of INR 7.85 – 8.35 /kWh and INR 6.20 – 6.75/kWh respectively, as energy charges to BESCOM[21]. • Ability to invest in capital intensive projects. Some of the early movers have already invested in wind mills and rooftop solar projects. • Sustainability is part of the core business principles of large corporates. • The sheer volume of their energy requirement brings in benefits of economies of scale.	• Typically, require payback times of 3–5 years for investments • Complicated decision making process that involves several levels of approvals • Even more tricky in case of MNC with Indian operations • Information gaps and lack of internal capabilities, as electricity is not the core business
Opportunity	**Threat**
• Solar energy costs are falling rapidly. They are already cheaper than the tariff commercial consumers pay to the grid[22]. • A contract for solar power can lock in the energy costs for ~25 years. • Renewable energy offers an opportunity to reduce the carbon foot print and contribute towards achieving the sustainability goals of the business.	• Grid tariffs are rising continuously. BESCOM's commercial and industrial tariffs have risen at 6.09% and 4.46% on an average between FY 2011 – FY 2015[20]. • Regulatory framework and customer preferences do not favor businesses with large carbon footprint. Renewable Purchase Obligations (RPOs) mandate consumers with self-owned thermal power plants or 3rd party thermal power purchase contracts, to procure a certain percentage of the power from renewables. Non-compliance with RPO attracts penalties[23].
Engagement strategy	
• Use cost hedging and sustainability benefits of renewables as a lever to engage. • Fill-in information gaps about costs, government policies and business models to convince the top management, through direct engagement or by creating peer-to-peer networks. • Aggregate demand, wherever possible, to achieve economies of scale. • Use the power of their network to engage with policy makers about long-term policy stability.	

Residential consumers	
Strength	**Weakness**
• A typical individual house has enough roof space to generate at least ~70% power from installation of rooftop solar plant. • Significant proportion of individual houses already have inverters that can be used to store energy from rooftop solar plant.	• Multi-storied residential complexes have very small ratio of roof space to floor space. Hence such roofs have competing uses. • Cannot invest upfront in rooftop solar projects. • Information gaps and lack of internal capabilities, as electricity is not the core concern.
Opportunity	**Threat**
• Rooftop Solar energy costs are falling rapidly. It can help residential consumers offset the costly power from the top most consumption slab. • A contract for solar power can lock in the energy costs for ~25 years.	Grid tariffs are rising continuously. Reliability concerns in case of frequent load shedding especially during summers.
Engagement strategy	
• Unlike the commercial and industrial consumers, engaging with select residential consumers cannot yield a critical mass of projects that can go on to create a systemic impact. • Policy advocacy can have wide reaching impacts on the residential sector.	

Cola, Infosys, IBM, Cognizant, Philips and Bangalore International Exhibition Center (BIEC). The aim was to combine their rooftop solar procurement into one bid to achieve economies of scale and reduce transaction costs per project. This larger combined project size made this opportunity more attractive for project developers and financiers. Our hope was to demonstrate a new aggregated procurement model that could be replicated across India to accelerate the deployment of rooftop solar power. GP-MDG called this aggregated procurement model as the Collab Solar project.

CII helped in convening the buyers. WRI India helped the buyers in preliminary site assessments, tender documentation, and evaluation of the proposals from vendors etc. During the final negotiations the process slowed down because of the possibility of anti-dumping duty being contemplated on imported solar equipment. Because of this, the vendors wouldn't commit to a specific price. Therefore the project was called off. Following are some of the important lessons[24] that we learned during the Collab Solar project:

- The Aggregation model works best with companies within a small geographic area such as an industrial or business park level.
- Aggregating across a group of buyers with a collective minimum renewable energy demand of $8-10$ million kWh/year ($\sim 5-6$ MW in project size) will negate the risk of project failure from any one individual buyer pulling out of the initiative.
- The creditworthiness of the buyers helps to mitigate the financial risks to project developers and can reduce the cost of project financing. Usually large companies which consume at least 1 million kWh

per annum tend to fall under this category and they can act as the anchor buyers.

- Aggregating demand based on the preference of the procurement business model is critical to be able to select the right vendors. For example, commercial buyers in our bundle paid a higher tariff to the grid and hence preferred a Power Purchase Agreement (PPA) with a solar power vendor to save on their bills. Industrial buyers in our group paid a lower tariff to the grid and preferred to invest in the renewable energy plant directly to make use of the capital tax benefit.
- Buyers need to become more comfortable with providing roof top data in order to get accurate proposals. Buyers we worked with were typically wary of disclosing rooftop data to the solar power vendors because of perceived security/confidentiality concerns. Design of solar power plants is highly location specific and needs to be optimised to maximise the return on investments. Better design leads to lower costs and more value to the buyers. Making buyers more comfortable with signing Non-Disclosure Agreements (NDAs) with the supplier to provide this information will improve the data collection process.
- Net-metering schemes which allow for excess rooftop solar power to be sold to the utilities will improve the economics of on-site solar. However, at the time of this pilot, Bengaluru did not have such a scheme in place. Thus the systems at individual sites had to be sized to the minimum load as there was no compensation for power sold to the grid. We used electricity demand on a typical weekend as a reference to quantify the minimum demand of a buyer. Sizing systems to the minimum load resulted in a smaller transaction size, as neither the vendor nor the buyers wanted to pay for the excess generation during the weekends.
- Early engagement with building owners/property management companies is needed. Several of the participants were in a leased space and found that in order to install a rooftop solar system on their premises, a tripartite commercial agreement between the buyer, vendor and the landlords was needed. Some building owners expressed interest in supporting a solar purchase, but others did not.
- Multi-National Companies (MNCs) who prefer to invest their own capital in a rooftop solar plant need to change their corporate charter to permit their entry into power generation business. While some companies in the collaborative solar project were willing to invest the time engaging relevant stakeholders to make this change to their corporate charters, most of them preferred a PPA as this does not require a change to their corporate charters. Companies need to check on the feasibility of changing their charters before making a final decision between a captive purchase model (using their own capital) and a PPA model (using operating budgets).

This experience will inform the design of the next iteration of demand aggregation projects to be handled by GPMDG across industrial or business parks in Karnataka, Tamil Nadu and other states. The idea is to make demand aggregation a well-established business model to be taken up by the market forces.

3.2 Policy Advocacy on Grid Usage Charges for Utility Scale Solar Projects

Large C & I consumers typically procure renewable energy from the grid through a Power Purchase Agreement (PPA) with third-party sellers or by investing in their own plants (captive projects). In both these cases they have to pay the grid usage charges to the utility, with an exception of waiver of Cross Subsidy Surcharges for captive projects. The Karnataka Electricity Regulatory Commission (KERC) had revised these charges multiple times in the past decade, leading to a great deal of uncertainty for developers & investors. Since the pay back for investment in a solar plant in India is between $8-10$ years, and is dependent on the grid usage charges as well, banks were unwilling to finance long term power purchase contracts in the absence of this policy certainty.

On 31st July 2014, KERC organized a public hearing meeting to decide on a draft regulation that fixed the grid usage charges for utility scale grid connected solar projects for only 5 years. The representation made by the GPMDG sought clarity and long term certainty on the solar tariff policy – especially in the light of a proposed national anti-dumping duty on imported solar equipment at that time. GPMDG was the only group at these meetings representing the large energy buyers who would be impacted by the decision.

On 18 August 2014, the Karnataka Electricity Regulatory Commission (KERC) passed order[25] number S/03/01 called '*Wheeling Charges, Banking Charges & Cross Subsidy Surcharge for Solar Power Generators*', whereby all solar power generators in the state who achieved Commercial Operation Date (COD) before 31 March 2018 were exempted from payment of grid usage charges (wheeling and banking charges) and cross subsidy surcharge[2] for a period of ten years from the date of commissioning.

This landmark order provided long term clarity for solar project developers and consumers. For C & I consumers, this exemption meant that solar energy became more viable while planning their energy mix.

From KERC's perspective, the main drivers for passing this order was the low rate of growth of solar en-

ergy installations in Karnataka and the prevalent trend of a reducing solar tariff seen against rising utility tariffs. The Commission hoped that this measure would facilitate greater and rapid growth of solar energy through third party open access and captive routes.

Without the timely intervention of the GPMDG, this policy would have likely been weaker as the earlier policy that was proposed provided certainty for 5 years, and after the GPMDG intervention, certainty was provided for 10 years.

The importance of this order can be gauged from the fact that the Bangalore International Airport Limited (BIAL) went ahead with its planned procurement of 12 MW through the open access route. It is expected that many other buyers would take advantage of this order.

3.3 Identifying the Barriers to the BESCOM's Net-metering Policy for Residential Rooftop Solar Projects

Net-metering is an arrangement through which solar PV system owners are credited for electricity that they export to the grid. In November 2014, BESCOM introduced a net-metering program after the Government of Karnataka's Solar Policy 2014−2021, and the Karnataka State Regulatory Commission's 2013 tariff order[26]. Under BESCOM's net-metering tariff, owners of rooftop solar PV systems are paid a promotional rate of 9.56 INR per kWh for net excess generation provided to the grid on a monthly basis. As of March 2016, over 5.6 MW of grid-connected rooftop solar PV systems on 262 rooftops had been connected[27]. But, while Bengaluru is making progress in capacity addition, the pace of rooftop solar PV system adoption will need to accelerate if Karnataka is to meet its solar goals.

To better understand the current barriers to BESCOM's net-metering program, WRI India interviewed a small set of local industry experts, project developers, and customers who have installed or want to install a rooftop solar PV system. The interviews shed light on what may or may not be working successfully to date with BESCOM's net-metering program, and what may or may not be discouraging potential prosumers from participating in the future.

Based on the interviews, we identified six barriers that appear to be preventing a wider scale-up of rooftop solar PV in Bengaluru:

- **Poor understanding of PV performance, cost, and payback**
  For example, 3 out of 12 residential prosumers interviewed did not know how much energy their rooftop solar PV system should produce annually (in kWh) and two more were unsure. Current residential prosumers without battery backup quoted a wide range of prices, from 70 to 135 INR per watt, depending on the installer and system requirements. While actual quotes from project developers varied less significantly, they still varied by roughly 20 percent, from 83 to 120 INR per watt.
- **Confusion on net-metering specifications**
  Consumers were not sure about being able to use hybrid inverters that allow them to use stored solar power during nights or power outages. They were also confused about contractual terms with the installer, tenure of contract with BESCOM, rate at which their regular grid consumption will be charged, and permissible size of the solar installation etc.
- **Uncertainty in project developer selection and interaction**
  Potential prosumers are often reliant on project developers for information about the net-metering program. However, the information that project developers provide is not always correct, and no mechanisms are in place to monitor the accuracy or quality of their services. Misinformation and the high number of project developers may undermine consumer trust and hinder current and future program adoption.
- **Limited reach and appeal of the net-metering program**
  BESCOM's net-metering program is attractive and attainable to only a small, relatively wealthy, and motivated segment of the population, limiting its potential reach and growth.
- **Limited effect of the promotional net-metering rate**
  Investing in a rooftop solar PV system that provides a household's annual energy demand and does not take advantage of the promotional 9.56 INR rate yields a return comparable to putting money into a savings account.
- **Limited institutional capacity of the program administrator**
  Bengaluru's net-metering program is relatively new and is experiencing growing pains. As more consumers join the program, BESCOM's institutional capapcity will need to be strengthened in order to overcome challenges such as long wait times for interconnection appointments and confusion with meter-reading processes. Many of these limitations are acknowledged by BESCOM; the utility recognizes that it is learning as it gains more experience with the program.

Drawing on insights and suggestions from local industry experts, project developers, and customers, as well as the literature we reviewed, we offer initial recommendations[27] for how program administrators and others can address these barriers:

- To address limited understanding among prosumers, program administrators can increase publicity and frequency of newspaper advertisements, and provide more detail on rooftop solar PV technology through lengthier articles or television reports. They can also facilitate information exchange through open knowledge-sharing platforms, and provide detailed information about realistic system costs and payback periods.
- To address a lack of clarity on net-metering program specifications and processes, program administrators can facilitate information exchange about net-metering program application, installation, and interconnection processes and specifications through online platforms or frequent prosumer gatherings. They can also develop concise program guidelines that specify each process in a step-by-step, easy-to-follow format, as well as expected timelines. These guidelines should include clear, up-to-date information about what is and is not allowed under the net-metering program.
- To improve prosumer trust in project developers, program administrators can offer an open certification process for developers, and an accessible and up-to-date list of certified developers to prosumers. Furthermore, program administrators can offer training and education programs for project developers, specifically about BESCOM's net-metering program specifications. These trainings will be useful for ensuring that project developers pass along the correct information to customers.
- To expand the limited reach and appeal of the net-metering program, program administrators can undertake market research to understand why the program appeals to some population segments more than others, and to identify how the program can be redesigned to reach a larger share of the population. Administrators can better promote the benefits of solar PV by highlighting community champions and stories of successful systems. Government agencies can also better promote current subsidy and loan programs, and create stronger and simpler financial incentives to lower the upfront cost of rooftop solar PV systems and attract interest from a broader range of residential customers.
- To maximize the effectiveness of current incentives provided under the net-metering program, program administrators should research the effectiveness of the promotional rate in attracting program adoption among the current prosumer demographic and large potential prosumer demographics. If the promotional rate is found to be effective, program administrators should more clearly and explicitly promote its economic benefits. If the rate is found ineffective, the funds supporting it can be redirected elsewhere.
- To strengthen institutional capacity, program administrators can introduce short-term solutions, such as streamlining approval procedures, as well as longer-term solutions, such as creating a "one window" unit that manages the entire net-metering process and provide specialized training sessions for employees.

In the meantime, the KERC has announced the gross metering option for C & I consumers and residential consumers from May 2016. On opting for this scheme, consumers have to sell all the electricity that their panels generate to the grid. There is no way of meeting one's own consumption through solar and exporting the excess, if any. The reception of this scheme, among the relevant consumer categories, has so far been slow and will be better gauged after an year.

BESCOM (along with the other ESCOMs in the state) needs to rapidly update its communication channels with the new information and ensure that the recommendations suggested by WRI India in case of net metering are followed with suitable modifications for gross metering.

4 Conclusion

Long-term stability in policies (for e.g. regarding grid usage charges for off-site projects) may facilitate adoption of solar power by C & I consumers. Net-metering schemes help them to exploit their rooftop solar PV potential to the fullest, by monetizing excess power generated. Making the new gross-metering scheme succeed for all categories of consumers must be a priority for BESCOM. Towards this WRI India has identified a few steps that could have potentially made the net metering scheme a success. We believe the same steps could be adopted to popularize solar installations under the gross metering scheme and contribute to increased solar installations in the city.

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References

[1] John C, Peter P, Jon C, *et al*., 2016, *Leadership by US Cities: Innovation in Climate Action*, Innovation Network for Communities; Bloomberg Philanthropies, viewed May 15, 2016. http://www.bloomberg.org/content/uploads/sites/2/2016/03/Innovation-in-Climate-Action.pdf

[2] CDP, 2015, *Can cities quit fossil fuels?*, viewed May 15, 2015, https://www.cdp.net/en-US/Pages/events/2015/cities/infographic-narrative.aspx

[3] Ramachandra T V and Aithal B H, 2016, Bengaluru's reality: Towards unlivable status with unplanned urban trajectory, *Current Science*, vol.110(12): 2207−2208. http://dx.doi.org/10.3141/2193-15

[4] Directorate of Economics and Statistics, Bangalore, *State and District Domestic Product of Karnataka 2014−15*, viewed November 11, 2016, http://des.kar.nic.in/docs/sip/State%20and%20District%20Domestic%20Product%20of%20Kar%2014-15.pdf

[5] The Times of India, *Karnataka contribution to India's GDP has increased*, viewed November 11, 2016, http://timesofindia.indiatimes.com/city/bengaluru/Karnataka-contribution-to-Indias-GDP-has-increased/articleshow/51466196.cms

[6] The Economic and Statistical Organization, Punjab, *State Wise Data*, viewed November 8, 2016, http://www.esopb.gov.in/static/PDF/GSDP/Statewise-Data/state%20wise%20data.pdf

[7] BESCOM, 2015, *MYT for 4th control period (FY19-FY21)*, viewed May 15, 2016, http://bescom.org/wp-content/uploads/2015/09/Chapter6-_Load_forecast-4th-control-period-1.docx

[8] BESCOM, 2015, *13th annual report of BESCOM for the financial year 2014−15*, viewed May 15, 2016, http://bescom.org/wp-content/uploads/2015/11/Annual-Report-2014-15.compressed.pdf

[9] Deccan Herald, *Widening power deficit causing longer outages*, viewed May 15, 2016, http://www.deccanherald.com/content/504022/widening power-deficit-causing-longer.html

[10] KREDL, *RE cumulative report*, viewed August 8, 2016, http://kredlinfo.in/General/RE%20cumulative%20report.pdf

[11] Deepak K and Ashok T, 2015, *Assessing the Impact of Karnataka Electric Regulatory Commission's Open Access Order for Solar Power Generators in Karnataka*, WRI India, viewed May 15, 2016, http://www.wri.org/publication/assessing-the-impact-of-kerc-order

[12] Government of Karnataka, *Solar Policy 2014−2021*, viewed May 15, 2016, http://www.gokenergy.gov.in/documents/Solar%20Policy%20English.pdf

[13] Government of Karnataka, *Solar Policy 2014−2021* (revised), viewed August 8, 2016, http://mnre.gov.in/file-manager/UserFiles/Grid-Connected-Solar-Rooftop-policy/Karnataka_Solar_Policy_2014-2021.pdf

[14] KERC, *Determination of tariff and other norms for Solar Rooftop and Small Photovoltaic Power Plants*, viewed August 08, 2016, https://www.karnataka.gov.in/kerc/Downloads/COURTORDERS-2016/TARIFF_FY-17/Solar_Tariff_2016/Solar_Rooftop_Photovoltaic_Tariff-ORDER-dated-02.05.2016.pdf

[15] Aruna Kumarankandath, *Karnataka launches gross metering for solar rooftop*, Down To Earth, viewed August 8, 2016 http://www.downtoearth.org.in/blog/kerc-introduces-grossmetering-for-solar-rooftop-along-with-tariffs-54122

[16] KREDL, *RE progress report*, viewed August 8, 2016, http://kredlinfo.in/General/RE%20cumulative%20report.pdf

[17] KERC, *Karnataka Electricity Regulatory Commission (Terms and Conditions for Open Access) Regulations, 2004*, viewed on July 23, 2016, https://www.karnataka.gov.in/kerc/Regulations/Regulations/openaccessregulation/finalopenaccess2004.pdf

[18] KPMG 2016, Union Budget 2016: Energy and Natural Resources, viewed on July 23, 2016, https://www.kpmg.com/IN/en/services/Tax/unionbudget2016/Documents/ENR.pdf

[19] KERC, *Determination of Tariff for grid interactive solar power plants including rooftop and small solar Photo voltaic power plants*, viewed on August 8, 2016, http://www.karnataka.gov.in/kerc/Downloads/COURT-ORDERS-2013/Final_Order-09.10.2013.pdf

[20] KERC, *Retail Supply Tariff approved by K.E.R.C. in Tariff Order for the year 2013−14 For BESCOM*, viewed on August 8, 2016, http://www.karnataka.gov.in/kerc/Downloads/COURT-ORDERS-2013/Tariff_Order_2013/TAG_ENGLISH_BESCOM.pdf

[21] BESCOM, 2015, *Tariff booklet 2015−16*, viewed on May 15, 2016, http://www.bescom.org/wpcontent/uploads/2015/03/Tariffbooklet-2015-16.docx

[22] Ashok T and Deepak K, 2016, *Corporate Renewable Energy (RE) Procurement Guide: Why and how?*, WRI India, viewed on May 23, 2016, http://www.slideshare.net/sachiaggarwal/corporate-renewable-energy-procurement-why-and-how

[23] Deepak K, 2015, *India's Supreme Court Reinforces Re-*

newable Energy Targets for Industry, World Resources Institute, viewed on May 15, 2016, http://www.wri.org/blog/2015/06/india%E2%80%99s-supreme-court-reinforces-renewable-energy-targets-industry

[24] Ashok T and Deepak K, 2015, *Aggregating Demand for Corporate Rooftop Solar Installations: Lessons from the Collaborative Solar PV Procurement Project*, WRI India, viewed on May 15, 2016, http://www.wri.org/publication/aggregating-demand-forcorporate-rooftop-solar-installations

[25] KERC 2014, *Wheeling charges, Banking charges & Cross Subsidy Surcharge for Solar Power Generators*, viewed May 15, 2016, http://www.karnataka.gov.in/kerc/Downloads/COURT-ORDERS-2014/Final_WB_CSS-18-08-2014.pdf

[26] KERC, 2013, *Determination of Tariff for grid interactive solar power plants including rooftop and small solar Photo voltaic power plants*, viewed May 15, 2016, http://kredlinfo.in/general/Final_Order-09.10.2013.pdf

[27] Sarah M and Joshua R, 2016, *Prosumers in Bengaluru: Lessons for scaling rooftop solar PV*, World Resources Institute, viewed May 15, 2016, http://www.wri.org/publication/prosumers-in-bengalarulessons-and-barriers

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Journal article (online) with one to three authors
Jackson D, Firtko A and Edenborough M, 2007, Personal resilience as a strategy for surviving and thriving in the face of workplace adversity: A literature review. *Journal of Advanced Nursing*, vol.60(1): 1–9. http://dx.doi.org/10.1111/j.1365-2648.2007.04412.x.

Journal article (online) with more than three authors
Hargreave M, Jensen A, Nielsen T S S, *et al*. 2015, Maternal use of fertility drugs and risk of cancer in children—A nationwide population-based cohort study in Denmark. *International Journal of Cancer*, vol.136(8): 1931–1939. http://dx.doi.org/10.1002/ijc.29235.

Book

Book with one to three authors
Schneider Z, Whitehead D and Elliott D 2007, *Nursing and Midwifery Research: Methods and Appraisal for Evidence-based Practice*, 3rd edn, Elsevier Australia, Marrickville, NSW.

Book with more than three authors
Davis M, Charles L, Curry M J, *et al*. 2003, *Challenging Spatial Norms*, Routledge, London.

Chapter or article in book
Knowles M S 1986, Independent study, in *Using Learning Contracts*, Jossey-Bass, San Francisco, 89–96.

Others

Proceedings of meetings and symposiums, conference papers
Chang S S, Liaw L and Ruppenhofer J, (eds) 2000, *Proceedings of the twenty-fifth annual meeting of the Berkeley Linguistics Society, February 12–15, 1999: General session and parasession on loan word phenomena*. Berkeley Linguistics Society, Berkeley.

Conference proceedings (from electronic database)
Bukowski R M, 2009, Prognostic factors for survival in metastatic renal cell carcinoma: update 2008, Innovations and challenges in renal cancer: Proceedings of the third Cambridge Conference, *Cancer*, vol.115(10): 2273, viewed May 19, 2009, Academic OneFile database.

Online document with author names

Este J, Warren C, Connor L, *et al*. 2008, *Life in the clickstream: The future of journalism*, Media Entertainment and Arts Alliance, viewed May 27, 2009, http://www.alliance.org.au/documents/foj_report_final.pdf

Online document without author name

Developing an argument, n.d., viewed March 30, 2009, http://web.princeton.edu/sites/writing/Writing_Center/WCWritingResources.htm

Thesis/Dissertation

Gale L, 2000, *The relationship between leadership and employee empowerment for successful total quality management*, thesis, University of Western Sydney, viewed March 31, 2009, Australasian Digital Thesis database.

Standards

Standards Australia Online 2006, *Glass in buildings: Selection and installation, AS 1288-2006*, amended January 31, 2008, viewed May 19, 2009, SAI Global database.

Government report

National Commission of Audit 1996, *Report to the Commonwealth Government*, Australian Government Publishing Service, Canberra.

Government report (online)

Department of Health and Ageing 2008, *Ageing and aged care in Australia*, viewed November 10, 2008, http://www.health.gov.au/internet/main/publishing.nsf/Content/ageing

Patent

Rencher W F, 1995, Bioadhesive pharmaceutical carrier. US Patent 5462749 A.

No author

Guide to agricultural meteorological practices 1981, 2nd edn, Secretariat of the World Meteorological Organization, Geneva.

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