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JNNURM

An Opportunity for Sustainable Urbanisation

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JNNURM: An Opportunity for Sustainable Urbanisation

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Table of Contents

List of Tables

List of Figures

List of Boxes

Abbreviations Used

AUWSP	Accelerated Urban Water Supply Scheme
BSUP	Basic Services for Urban Poor
CBO	Community Based Organisation
CDP	City Development Plan
CGWB	Central Ground Water Board
CPCB	Central Pollution Control Board
CPHEEO	Centre of Public Health and Engineering Organisation
CSE	Centre for Science and Environment
CSP	City Sanitation Plan
DPR	Detailed Project Report
EIUSP	Environmental Improvements of Urban Slums Programme
EWS	Economically Weaker Section
FOP	Financial Operating Plan
GDP	Gross Domestic Product
GIS	Geographical Information Systems
GoI	Government of India
HPEC	High Powered Expert Committee
IDSMT	Integrated Development of Small and Medium Towns
IHP	International Hydrological Programme
IHSDP	Integrated Housing and Slum Development Programme
ILCS	Integrated Low Cost Sanitation
IT	Information Technology
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
LIG	Low Income Group
LPCD	Litres Per Capita Per Day
M&E	Monitoring and Evaluation

MDGs	Millennium Development Goals
MGI	McKinsey Global Institute
MLD	Million Litres Daily
MNP	Minimum Needs Programme
MoF	Ministry of Finance
MoRTH	Ministry of Road Transport and Highways
MoHUPA	Ministry of Housing and Urban Poverty Alleviation
MoUD	Ministry of Urban Development
MoUEPA	Ministry of Urban Employment and Poverty Alleviation
MRTS	Mass Rapid Transit System
MSW	Municipal Solid Waste
NCU	National Commission on Urbanisation
NGO	Non-Governmental Organisation
NIJNNURM	New and Improved Jawaharlal Nehru National Urban Renewal Mission
NIUA	National Institute of Urban Affairs
NSDP	National Slum Development Programme
NUSP	National Urban Sanitation Policy
NUTP	National Urban Transport Policy
O&M	Operations and Maintenance
PPP	Public Private Partnership
RAY	Rajiv Awas Yojana
RWH	Rain Water Harvesting
SLBs	Service Level Benchmarks
SLNA	State Level Nodal Agency
SPV	Special Purpose Vehicle
SWOT	Strengths Weaknesses Opportunities Threats
UA	Urban Agglomeration
UBSP	Urban Basic Services Programme

UFW	Unaccounted for Water
UIDSSMT	Urban Infrastructure Development Scheme for Small and Medium Towns
UIG	Urban Infrastructure and Governance
ULB	Urban Local Body
ULCRA	Urban Land Ceiling and Regulatory Act
UNEP	United Nations Environmental Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UN-HABITAT	United Nations Habitat Programme
UNICEF	United Nations Children's Fund
VAMBAY	Valmiki Ambedkar Awas Yojana
WSP	Water and Sanitation Programme
WTE	Waste to Energy

1 Study Objectives and Methodology

As the world rapidly urbanises, it is imperative to move cities towards greater sustainability if we are to meet the environmental challenge. Urban infrastructures: their design, planning, construction and maintenance are the key to achieving urban sustainability, and in India, these are fundamentally shaped through public programmes. This current study seeks to analyse the sustainability of JNNURM, one of the largest flagship urban programmes of Independent India.

1.1 Objectives

The aim of the study was to undertake an analysis of sustainability of JNNURM, the largest chunk of public sector funding yet to be channelled into urban India. The focus of this study is on the Urban Infrastructure and Governance (UIG) sub-mission of JNNURM, which primarily focuses on infrastructure. The study sought to ask two key questions of JNNURM:

a. To what extent have considerations of environmental sustainability been incorporated within (explicitly or implicitly) in vision and programme design of JNNURM?

b. To what extent and how were the sustainability goals, as outlined in the vision and programme design, taken into considerations by the cities?

The second question has two parts to it: examination of a select set of City Development Plans (CDP) to assess whether and to what extent concerns of sustainability have been taken into account during the planning process. Second, this involved examining in a specific location, through a primary study, whether these concerns have been taken to the implementation stage. As stated in the proposal, it is understood that it would be difficult to arrive at concrete findings unless field work has been carried out in more cities. Hence the objective of this study was to develop and pilot a methodology for the fieldwork, in the hope that with further funding a larger comparative study could be carried out.

The results of the study based on the review of the programme, the CDPs and fieldwork illustrate how issues of environmental sustainability have been integrated into JNNURM at different levels. Based on these findings, the study has put forward a set of draft recommendations that can ensure that investments in next phase of JNNURM or other similar programmes can be directed towards urban sustainability.

1.2 Rationale

Global consumption of resources is concentrated in cities with 75% of global energy and material flows consumed by cities in the year 2005 (UN-HABITAT, 2006). This rapid urbanization is also often at the expense of valuable ecosystems and lands for satisfying urban demands. Serious environmental, social, and economic problems are expected if current and future urban areas

continue with the same resource consumption practices without taking into consideration future needs (Daly, 1997; Millennium Ecosystem Assessment, 2005). The criticality of cities in achieving the sustainability agenda has been highlighted in the past few years. The issue has been explored by a range of international agencies in their studies and reports that seek to draw the connections between urbanisation and environmental impacts.

Asian cities, including those in India, are and will be undergoing major transitions during the first half of the 21st century. By 2030, India will become 40% urbanised with about 590 million people living in urban areas (MGI, 2010). This poses a concern as well as an opportunity for sustainable development in India.

Urban Infrastructure are, perhaps the most critical component of sustainability in urban areas. Urban infrastructure not only direct resource flows in urban areas in specific ways, but also constrain choices and lock behaviour patterns of urban citizens (Swilling et al. 2012). The prevalent infrastructure systems are derivatives of the industrial age, which are based upon specific technical paradigms that may not necessarily taken environmental factors into consideration. Most conventional infrastructure systems are "end of pipe" solutions.

While various urban infrastructure systems and general principles to make these systems more sustainable have been studied, insufficient attention has been paid to reconfiguring existing infrastructures onto a more sustainable path. Most cities in the global South also face the challenge of growing urban populations on one hand, and infrastructure and service deficit on the other. However, this infrastructure deficit could also serve as an opportunity, if cities can leapfrog to some sustainable systems of infrastructure and service delivery.

While the need for urban sustainability gets articulated in various policy circles, it is the Jawaharlal Nehru National Urban Renewal Mission (JNNURM) and its possible successor that are shaping urban growth at the present moment. Hence, this is an opportune juncture in India to examine various means by which urban infrastructure systems can be put onto a sustainable track.

The Jawaharlal Nehru National Urban Renewal Mission (JNNURM), launched in December 2005, is a flagship project of the Government of India. The objective of the project was to lead "a reforms driven, accelerated development of Indian cities, with a particular focus on urban infrastructure" (MoUD and MoUEPA, 2005a). The Mission comprises of two sub-missions: Urban Infrastructure and Governance (UIG), and Basic Services for the Urban Poor (BSUP). The main thrust of the UIG is on financing major infrastructure projects relating to water supply, sewerage, drainage, solid waste management, road network, urban transport and redevelopment of inner (old) city areas.

While the JNNURM does not have an explicit environmental sustainability focus, it has been and will continue to be the primary line of government funding in urban India and thus presents the maximum opportunity for promoting environmentally sustainable urbanisation in India. Hence it is imperative to incorporate a framework for sustainability in JNNURM and similar programmes in the future.

Inserting metrics of environmental sustainability in JNNURM investments could start to shift capital investments in a different direction. Even if the government did not adopt formal sustainability criteria, such toolkits could be useful in framing the public consultation and city development plans that are already an established part of selecting investments to be funded under JNNURM.

1.3 Methodology and Scope of Study

The study was broadly divided into three stages: literature review, field work and synthesis. Broadly, there were two intentions of the literature review: a. to develop a preliminary framework for assessment of environmental sustainability of urban infrastructure b. to assess the sustainability of JNNURM programme design and overall investments.

In order to develop the framework for environmental sustainability of urban infrastructure, literature review was carried out to examine various frameworks, indicators and criterion that exist for urban infrastructure systems in general for specific sectors. The specific infrastructure systems that are reviewed in this study are: Transportation, Water Supply, Sewerage and Sanitation, Solid Waste Management and Drainage, as investments in these systems constitute bulk of JNNURM investments. Relevant urban policy and programmes in India were also reviewed to glean relevant issues/ criteria. Based on this, an initial framework was developed.

Various documents of JNNURM (programme brochure, guidelines and set of reforms) were then reviewed against this framework. Also, the framework was refined to include missing aspects of sustainability as highlighted in these documents. This was followed by a desk review of 20 CDPs developed by various cities, and an analysis of which issues have been addressed in these CDPs. The first stage also identified Nanded as an appropriate city for fieldwork. Nanded was selected because of its population size, projects across multiple sectors and high utilisation rate.

The second stage involved primary study in Nanded. There were two-fold objectives of fieldwork: a. to understand the process of planning and implementation for JNNURM projects, b. to identify which issues of urban sustainability have been taken into consideration. The fieldwork primarily comprised of interviews with set of key stakeholders: officials of the ULB and other relevant government agencies, consultants, elected representatives, and civil society organizations. A reconnaissance survey of the city and site visits were carried out to assess the condition of urban services in the city, and also examine various JNNURM projects. Key findings from fieldwork were then presented.

The final stage was to compile and compare findings from three sources: programme design, CDPs and fieldwork. A set of process recommendations have been formulated in this report to increase the sustainability potential of programmes like JNNURM.

Given the practicalities of scale of implementation of national flagship programmes and limited capacities at the local level, the project was intended to formulate a simple set of guidelines/ checklists. The intention of this study was not come up with a comprehensive set of guidelines, but to arrive at some basic principles and rules of thumb. Hence this study has developed a checklist of

indicators that could be used to broadly assess sustainability of infrastructure projects. The report also contains broad process recommendations to ensure that national programmes like JNNURM could contribute to urban sustainability. Also, the primary focus of this study has been environmental sustainability, and so only those indicators of social and economic indicators have been selected that either have a bearing on urban poverty, or those that can undermine environmental sustainability.

1.4 Limitations of the Study

The first limitation is the depth and breadth of literature review. In the initial stages of literature review, we found that there was a vast literature around urban sustainability. Given the scope of the study, we have focussed only on the literature that would be helpful to us to arrive at the sustainability framework relevant for Indian context. Also, review was restricted primarily to concerns of urban sustainability.

The second limitation is that the primary study was done rapidly over a two-week period. Hence, it is possible that the finer nuances of the JNNURM process in a city might not have been captured. Since the aim of this study was to arrive at a generic sustainability framework across sectors, all criteria in the framework will not equally applicable or relevant to all sectors.

1.5 Structure of the Report

The next chapter presents an overview of the literature review, highlighting some general concerns of sustainability regarding urban infrastructure, and then diving into sectoral issues. It presents the sustainability framework used for this study at the end of the chapter. The third chapter is an overview of JNNURM, including details of funding released. The next chapter presents three sets of key findings: from the JNNURM design, the review of 20 CDPs and fieldwork. The last chapter puts forward a summary of conclusions, recommendations and further steps in research.

2 Framework of Urban Sustainability: A Literature Review

2.1 Urban Sustainability: Review of literature

Though sustainability as a term has been in prevalence for last couple of decades, there is no consensus on a universal definition (Sahely, Kennedy and Adams, 2005). In general, all definitions or frameworks of sustainability include a reference to three overlapping components: environmental/ ecological, social/ cultural, and economic. It is often understood that sustainability needs to address all the three (Sahely, Kennedy and Adams, 2005; Zavrl and Zeren, 2010; Jeon and Amekudzi, 2005). Increasingly, there is an understanding of embeddedness of systems within a particular political frame, and hence a fourth political/ institutional component is often added.

But this all-encompassing definition often leaves it open to wide range of interpretation. Often, either the environmental aspect is emphasised, neglecting the other two. Sometimes, sustainability is conflated with economic sustainability, neglecting the environmental aspects.

While visions of the sustainable city differ, there are some common themes that emerge across different reports and papers. These themes are presented below, divided broadly into three categories of sustainability:

Environmental and Physical

- Emphasis of public transport and non-motorised modes over personal cars
- Compact, polycentric , mixed used urban form
- Recycling of reuse of water
- Minimisation of waste
- A symbiotic relationship with the hinterland

Social and Political

- High quality accessible public realm
- Democratic, participatory planning and governance
- Just and equitable cities

Economic

- Adequate and fulfilling employment

(Kenworthy, 2006; Rogers, 1997; Costa, Marchettini and Facchini, 2004)

As is evident from the areas identified above, a number of those areas are concerned with physical infrastructure. As stated earlier, these infrastructural networks define and control the movement of energy, material and people through the cities. It is important to understand this movement of energy and material through these infrastructures to move cities towards becoming more sustainable.

While urban infrastructure is often recognised as an important aspect of sustainability, inadequate attention has been paid to restructuring of these systems at scale. The prevalent infrastructure systems are derivatives of the industrial age, which are based upon specific technical paradigms that may not necessarily taken environmental factors into consideration. Most conventional infrastructure systems are "end of pipe" solutions. It will thus be necessary to re-think, re-design and reconfigure urban infrastructure if cities are to transition and transform into more sustainable form of settlements.

While specific criteria and issues of urban sustainability with each of the infrastructure sectors are discussed later, some generic and cross cutting approaches and principles are discussed below.

One common approach to understand sustainability of an urban region is to view it as a complex system, and understanding flows of resources through it. Studying this complex flow of resources is the field of urban metabolism. Urban metabolism might be defined as "the sum total of the technical and socioeconomic processes that occur in cities, resulting in growth, production of energy, and elimination of waste" (Kennedy, Cuddihy and Engel-Yan, 2007). Generally four broad types of flows are considered: water, energy, materials and nutrients. Understanding urban metabolism does not only help us understand the overall impacts of the urban area, but also understand critical processes that fundamentally undermine sustainability.

A handful of detailed urban metabolism studies have been carried out in cities mostly in the developed countries (Newcombe, Kalma and Aston, 1978; Hendriks et al. 2000). These are typically multi-year studies, including detained analysis of stocks and flows. These studies typically require extensive data collection, and research. It is thus difficult to carry out these kinds of detailed studies for most cities, and it is not clear how far the results of one city can be extrapolated for purposes of urban policy. Thus, while urban metabolism might be a useful method for understanding processes in an urban area, it is not a feasible option for most cities. The situation is more complex in most Indian cities where not all households are serviced by formal centralised systems, thus making it even more difficult to trace various flows.

However, the concept of urban metabolism enables to visualise the city as a system of mostly high intensity and linear flows. It is understood that cities generally disrupt the natural cyclical flow of resources through linear activity (Ravetz, 2000; Rogers, 1997). They require huge inputs of food, energy, water and materials and they spew out emissions, waste water, and organic and inorganic waste. Thus, the first generic principle of moving towards sustainability in urban areas is transition from linear flows to cyclical flows. As cities are concentrations of human activity, it is not possible to close the loop within city or even regional limits. Even a global cycle is preferable to a linear loop, as long as the loop is closed (Ravetz, 2000). Typically, most urban infrastructures in place today are "end of pipe "solutions (Timmeren, Kristinsson and Roling, 2004).

The issue of scale is important. Sustainability, in principle means looking at urban areas as embedded into larger regional and global ecosystems. However, in reality, urban infrastructures are the responsibility of city authorities, who may or may not have jurisdiction and decision making power outside of the city area. Hence the issue of drawing appropriate boundaries when dealing with sustainability is critical.

While examining sustainability, one needs to look at expanded time horizons. It is often not understood that there are conflicting goals and priorities faced by managers and engineers. These conflicts can be divided as: (i) financial versus technical factors, (ii) short-term versus long-term planning horizons, and (iii) network versus project factors (Vanier, 2001). Also, these infrastructures are often path-dependent, often controlled by limited number of stakeholders (Timmeren, Kristinsson and Roling, 2004).

There are additional concerns when it comes to cities in the global South. It has been posited that cities at different stages of their development trajectory face different challenges. Historically, cities have progressed from a 'brown' agenda (concerns of provisioning of water supply and sewerage, and issues of localised pollution) to a 'grey agenda' (concerns of ambient air pollution and pollution of local water bodies), to a green agenda (concern with global environmental issues like carbon emissions). It is however generally recognised that cities in the South are faced with the challenge of all three agendas simultaneously (McGranahan, G. and D. Satterthwaite, 2000). While a substantial proportion of the urban poor lack access to safe drinking water and improved sanitation facilities, they also have to face the problems created by global challenges like climate change.

It has also been realised that relationship between city's wealth and environmental problems cannot be explained by a singular Kuznets curve. It has been claimed, and there is some evidence to highlight that while local environmental problems decrease with wealth, certain problems eg, carbon emission, waste generation progressively tend to increase with affluence, and only some like local pollution follow the Kuznets curve. It is claimed that while sustainability concerns of early 20th century, exemplified by the sanitary revolution, may have successfully addressed local environmental issues, in reality they have simply resulted in displacement of environmental issues, rather than resolving them (McGranahan, G., 2007).

It follows from the above discussion that Indian cities hence cannot afford to address concerns of coverage and equity (a typical 'brown agenda' issue) ignoring other pressing environmental concerns like climate change. Also, if Indian cities follow the historical path to achieving goals of service provision, which have typically been energy intensive, we might creating other environmental problems on the way.

The next section moves on from these generic principles, and examines sustainability concerns specific to each of the sectors.

2.2 Sectoral Analyses of Sustainability Issues

2.2.1 Water and Wastewater

The essential functions of urban water and waste water systems are supply of clean water for all users, removal and cleansing of waste water, draining storm water away to avoid flooding (Hellstorm et al. 2000). To move towards goals of environmental sustainability, the system needs to perform certain additional functions like: efficient use of resources, minimisation of waste through various means like reduction of losses, reuse and recycling, and be able to adapt to different

conditions. In addition, the system should contribute to public health, and also encourage people to change behaviour (Balkema et al. 2002, Hiessl, Walz and Toussaint, n.d.; Hellstorm et al. 2000; Lundin and Morrison, 2002; Valentin and Spangenberg, 2000; Milman and Short, 2008).

Most common characteristics of sustainable water and wastewater system are given below.

Table 1: Characteristics of Sustainable Water and Waste Water Systems	
Environment	Water Supply: Optimum resource utilisation (water, energy and land), Reduction in consumption levels, Reduction in losses, Protection of water sources Waste Water: Optimum resource utilisation (water, energy and land), Reduction in waste (water, emissions) Minimum acceptable quality of effluents, sullage and septage Common: Re-use of water and energy, Integration in natural cycles, increased resilience and adaptability
Design and Technology	Durability, ease of construction, flexibility/ adaptability, ease of maintenance, reliability, transferability
Social & Public Health	Increased Coverage and Accessibility to safe drinking water and improved sanitation facilities, Reduced risk of infectious and other diseases (including protection from toxic compounds), Cultural Acceptance, Equity (present and inter-generational), Awareness/ participation,
Economic	Low per capita cost, low costs of O & M, affordability, cost effectiveness
Compiled from: Balkema et al. 2002, Hiessl, Walz and Toussaint, n.d.; Hellstorm et al. 2000; Lundin and Morrison, 2002; Valentin and Spangenberg, 2000; Milman and Short, 2008; MoUD, 2009a.	

The formal water and wastewater system in most developed and developing countries today is characterised by centralised structures and open loop design (Balkema et al. 2002; Hiessl, Walz and Toussaint, n.d.). These systems were developed in industrialised countries between 1850-1920 and later spread to other parts of the parts through colonialism (Graham and Marvin, 2001).

These centralised systems require high levels of resources such as energy, money, space and expertise and also pose threat to environment through emissions (Balkema et al. 2002). Most of these systems mix different waste (e.g. domestic with industrial), thus making recovery and reuse of resources more expensive and difficult. (Balkema et al. 2002; Hiessl, Walz and Toussaint, n.d.) In addition, these infrastructure systems are associated with long life spans and huge sunk costs, and hence there is often high path dependency and high lock-in (Hiessl, Walz and Toussaint, n.d.; Nielsen et al. 2007). These systems are often bounded by large institutional apparatus, and often the investments are often made in routine ways because of inertia (Nielsen et al. 2007). In developing countries, there are additional challenges of covering existing backlog, providing for additional population and also coping with high capital costs (Varis and Somlyody, 1997).

There are apparent limits to how sustainable these conventional systems can be made. These systems were conceptualised and designed primarily to provide service provisions to large number of urban residents and ensure public health, and not for sustainability (Nielsen et al. 2007). Since service provision is the primary purpose, cities increasingly depend on conventional technology to source water from far away resources.

Historically, upgradation of infrastructure, especially waste water treatment has focused on decreasing the pollution load, whereas the more sustainable approach would be to recycle water (Niemczynowicz, 1993). Some of the alternative technological options are rainwater infiltration, recycling water or using rainwater for toilet flushing, urine separation etc. (Balkema et al. 2002).

While there are several technological breakthroughs which could be more sustainable, it is not clear how easily these can be integrated into existing systems or whether one will need to opt into newer systems (Balkema et al. 2002; Hiessl, Walz and Toussaint, n.d.). Moreover, there are huge financial implications for restructuring these existing systems (Hiessl, Walz and Toussaint, n.d.). However, there might be a possibility of this assimilation happening as major parts of existing systems, atleast in developed countries, are reaching end of their useful life (ibid). Moreover, as there is incomplete coverage in developing countries, alternative technological trajectory might be possible.

Key issues for water supply in India include:

- Incomplete coverage of water supply
- Insufficient and unreliable supply
- High Operational Inefficiencies, and high losses
- Old and dilapidated infrastructure, with little maintenance
- Water increasingly sourced from distant sources
- Dependence on ground water, which is not regulated

Key issues for sanitation and sewerage include:

- 12 % of households do not have access to toilets
- A large proportion of households do not have access to 'improved sanitation facilities'
- Only 1/3rd of wastewater is collected
- Only a small percentage of water is treated
- Sub-optimal functioning of system due to lack of O & M

2.2.2 Storm Water Drainage

Storm water drainage in urban areas is generally characterised by two interconnected drainage systems: the major system that reduces the risk of flooding and the minor system that eliminates inconvenience due to collection of surface water (UNESCO/IHP, 2006). Urban drainage interacts with the natural water system. Drainage also interacts with other water infrastructures and water resources. For example, there is often an influx of sewage and solid waste in storm water drains leading to pollution of receiving bodies (UNESCO/IHP, 2006).

With increase in urbanisation and built-up areas, there is a high incidence of impervious surfaces that leads to increased incidence and magnitude of storm water runoff and local flooding (Nielsen et al. 2007). Furthermore, the increase in impervious systems reduces the surface water recharge and also results in reduced groundwater recharge. Climate change is an additional challenge to drainage systems, as the rainfall patterns change, and the intensity of rainfall increases (Nielsen et al. 2007).

For storm water drainage to be sustainable it needs to go beyond its function of carrying rainwater, and reducing flooding, and needs to work in conjunction with natural water cycles. This implies reducing run-off by either allowing water to percolate to the underground water table, or reach surface water with minimum losses on the way. In addition, to be truly sustainable, there needs to be synergy between the natural drainage systems, and man-made ones. This means ensuring that processes of urbanisation do not disrupt natural water channels by construction of buildings and infrastructures in their course.

Characteristics of sustainable storm water drainage system will be:

Table 2: Characteristics of Sustainable Storm Water Drainage Systems	
Environmental	Preservation of natural drainage system, reduced run-off, ground water recharge, surface water recharge
Design and Technology	Ability to respond to seasonal fluctuations
Social and Public Health	Increased coverage, reduced instances of flooding, reduced risk of water-borne diseases
Economic	Low per capita cost, low O&M cost, cost effectiveness
Compiled from: UNESCO/IHP, 2006; Nielson et al. 2007; Sharma, 2008; MoUD, 2009a; MoUD, n.d.	

In developing countries, the incidences of local flooding are much higher, as urbanisation is often fast and unplanned, with drainage systems not in place. Even when in place, these systems are frequently unable to cope with sudden and heavy drains. There is an additional issue in developing cities of urban poor often dwelling along drainage channels, or in flood plains, at considerable health risks to themselves.

Key issues for storm water drainage in India include:

- Only 20% of road network is covered by storm water drains
- Increase in impermeable surface
- Natural drainage lines and waterways are altered by buildings, roads and other construction leading to disruptions and flooding
- Increase in magnitude and frequency of flooding
- Poor maintenance of drains

2.2.3 Solid Waste Management

Compared to industrial and other waste streams, municipal solid waste is more complex as it comprises of different heterogeneous wastes (Wang and Nie, 2001). Municipal solid waste is composed by different kinds of materials including paper, plastic (heavy plastic, bags and bottles), glass, organic, wood, metals, scraps, inert matter, and textiles (Costi et al. 2004). As cities grow economically and lifestyles change, the waste generated grows in quantity and the composition of the waste also changes (World Bank, 2001; Rathi, 2005; UNEP, 2009).

The overall goal of solid waste management is to collect, treat and dispose solid waste generated in an urban area to cause least environmental damage, in a socially acceptable manner, and most economically (World Bank, 2001). Work on municipal solid waste management began in the 1970s. The 1980s saw an understanding of solid waste management at the system level (Morrissey and Browne, 2004). During the 1990s, the concept of integrated solid waste management gained importance. Integrated solid waste management refers to the strategic approach to sustainable management of solid wastes covering all sources and all aspects, covering generation, segregation, transfer, sorting, treatment, recovery and disposal in an integrated manner, with an emphasis on maximizing resource use efficiency (UNEP, 2009).

The issues of solid waste management differ in developed and developing countries. Higher income countries generally recycle more, and have the capital to invest in new technologies to better treat their waste, but generally generate much more waste. On the other hand, in lower income countries, per capita waste generation is less, but is inefficiently handled. There is often low collection of waste, and even when collected, dumping is in the open. Inefficient management and disposal of solid waste has severe health consequences, and is also responsible for air, water and soil pollution (Kathiravale and Yunus, 2008).

In order to promote environmental sustainability, solid waste management needs to work towards the following: minimisation of waste production, maximisation of material re-use, recycling and recovery, safe disposal of remaining waste keeping in mind the absorption capacities of local sinks (Baud et al. 2001; Kathiravale and Yunus, 2008).

Table 3: Characteristics of Sustainable Solid Waste Management System	
Environmental	Waste minimisation, (reduce, re-use and recycle), Minimal resource use (land, energy), Reduction in Emissions
Technological	Appropriate
Social and Public Health	Change in consumption practices, participation, acceptance (e.g. segregation of waste at source), Reduced risk from waste, especially for workers
Economic	willingness to pay, per capita cost
Compiled from: Pacheco, 1992; Baud et al. 2001; World Bank, 2001; Morrissey and Browne, 2004; Kathiravale and Yunus, 2008; UNEP, 2009; MoUD, 2009a.	

The main options for waste disposal (MSW) conventionally have been sanitary land-fills. With limited land available within urban areas, landfilling is invariably done in the surrounding rural areas. Several technological options exist to reduce waste reaching land-fills. These include incineration, composting and recycling, and decentralized management. While incineration reduces the original volume of combustible solid waste by 80-90%, it often is an expensive capital investment for developing countries, and can pose health risks (Sharholy et al. 2008; Troschinetz and Mihelcic, 2009). With high levels of organic matter in the mix, composting is increasingly a desirable option for developing countries.

Besides environmental costs, there are often additional human costs associated with processes of solid waste management in developing countries. The collection and segregation is done by the urban poor, often women and children, who have no protection against the waste.

Key issues of solid waste management in India include:

- Gradual increase in per capita wastes
- Low collection efficiency
- Health hazards due to manual handling of wastes
- No segregation
- Open dumping and unscientific waste dump

2.2.4 Transportation

Recognition of the impact of urban traffic and transportation on the environment dates from the 1960s (Wee, 2012). Since then, increasing levels of motorised vehicle ownership and use have led to steady increase in a host of problems, including accidents, congestion, and environmental issues of noise and air pollution. The concern of fossil fuel depletion is a direct concern related to the traffic and transportation issues.

The history and development of contemporary cities is intricately tied up with different types of transportation systems. While there are huge discussions on sustainability in urban transportation systems, there is consensus on some critical issues. These are:

- Reduction in privately owned automobiles
- Shift to public transportation systems
- Shift to non-motorised modes like walking and cycling
- Use of better technology, and shifting to non-carbon sources of fuel

The other critical issue is the link between transportation systems, urban form and land use planning. Much of the work has been done on understanding the relation between automobile use, and urban form; studies that examine relation of form to other modes of travel are rare (Vance and Hedel, 2007). In one of the earliest international comparative studies, Kenworthy and Laube find a strong connection between automobile dependence, and land use pattern. There was a high co-relation with automobile dependency and density. While later studies confirm this connection, the jury is still out on causality (Vance, 2007). But undoubtedly appropriate land use policies can be conducive to sustainable transportation systems (Wee, 2012; Kenworthy, 2006).

Much of the discussions of harmful environmental impacts of transport have been limited to emissions. There is general agreement, but little understanding of loss of productive land, and land fragmentation, increase in local flooding due to increase in paved areas, and ground pollution due to bitumen and concrete roads. Road construction and widening also are likely to lead to loss of trees and biodiversity.

Table 4: Characteristics of Sustainable Transportation System	
Environmental	Reduction in use of fossil fuels, non-motorised vehicles, reduced emissions, reduced car use, reduced pollution levels, clean technology
Design and	Appropriate options

Technology	
Social and Public Health	Access, connectivity, choice (public transport), safety (reduced accidents, reduced air-borne diseases), reduced noise levels
Economic	Efficient, affordable, cost effective, reduced travel distance and time
Compiled from: Button, 2002; Ravetz, 2001; Jeon and Amekudzi, 2005; MoUD, n.d.	

Key urban transportation issues in India are:

- Sharp increase in ownership of private motorised vehicles especially two-wheelers
- Inadequate and poor quality public transport
- Large captive number of pedestrians and cyclists, but poor facilities for them
- Increasing pollution issues
- High accident rate

2.3 Sustainability Framework Adopted by the Current Study

Based on the literature review, and review of key issues in India, a select set of criteria for sustainability frame are selected. These indicators are broadly divided into four categories: Environmental, Design and Technology, Social and Public Health, and Economic. Design and Technology was added as a separate category as review shows that design of the infrastructure is a key determinant of sustainability of an infrastructure system. As stated in the scope of study, the focus here is on environmental sustainability, hence only select indicators under social and economic categories have been chosen; essentially those that may undermine the entire system and those that are relevant to urban poverty reduction.

Also, some indicators, though important, have been left out for various reasons. These include ones that are difficult to gauge from mere literature review, or insufficient information is available e.g. participation, and cultural acceptance. Some broader criteria like resilience have been left out since they are more complex, second order goals of the system, and difficult to define and evaluate. Important aspects of resilience have been included as individual criteria instead, e.g. adaptability and sustainability of source.

Literature review also reveals the need for each city to have its own context specific priorities, and solutions. Hence, no specific technology e.g. sewerage, or system like a metro rail system, has been chosen as a criterion. The criteria instead are representative of broad sustainability or system goals like resource reduction or equity. We have deferred from defining exact goals, as we believe these again have to be set at local levels, depending upon the current situation; otherwise there is a danger of setting of setting goals too high or low eg. 100% coverage of various services is clearly an ultimate goal.

An attempt has been made to use the same set of criteria across different sectors. It is however, recognised that not all of these criteria will be applicable to all sectors, and their importance will differ. A brief description and rationale of the 14 indicators is given below.

2.3.1 Environmental

a. **Resource Use (Water/ Energy/ Land/ Material):** One of the core sustainability goals is to reduce use of natural resources as far as possible. This criterion has been used to assess whether attempts have been made to design systems that economise on the use of each of these resources. While each of the four key resources (water, energy, land, material) are relevant for each of the sectors, one specific resource might be far more important for a particular sector.

b. **Sink/ Waste (Air Pollution/ Waste/ Water):** On the other end of the cycle, it is also essential to reduce waste generated from the systems, and to treat these adequately.

c. **Sustainability of Source/ Sink:** This criterion is especially important for environmental services. It is important to ensure that source(s) of water supply for the city are adequately protected, and that it is being replenished adequately. Similarly, the carrying capacity of sinks should not be exceeded.

2.3.2 Design and Technology

a. **Performance (Coverage, Quality, Reliability):** Besides the imperative of environmental sustainability, the infrastructure systems must provide reasonable services to the users. In the context of infrastructure backlog, one of the foremost criteria is that both the physical infrastructure and services must be extended to the entire city. Mere extension of services is not sufficient; there must be compliance to a certain minimum standard. Lastly, the systems need to be reliable and not prone to disruptions.

b. **Efficiency**: The system must deliver efficiently what it was designed for. This would mean that it is not performing sub-optimally, and there are minimum losses of water, energy and material.

c. **Adaptability:** It is important to increase adaptability of the system, because if the system can adapt to changed circumstances, it will increase the resilience of the system.

2.3.3 Social and Public Health

a. **Equity:** As stated earlier, there is a strong linkage between urban poverty and infrastructural services. Given the already unequal distribution of infrastructure and services, it is essential to move towards more just infrastructure systems. This aim is also in line with several national policies, and international goals like MDGs. Moreover, there are often separate specific programmes to target urban poverty; however, concerns of the urban poor might not be taken in consideration while doing city level planning. Hence, it is important how concerns of equity have been mainstreamed in city planning, even while exact solutions might differ. Also, this criterion can be used to assess equitable access across other groups like women, children, community etc.

b. **Public Health:** While public health is an aspect of urban poverty and equity, it is a critical issue in the Indian setting, and hence has been addressed separately. The urban poor in India carry a disproportionate health burden, even while contributing least to overall environmental risks. Moreover, inappropriate and dysfunctional environmental services pose a health risk to the entire urban population as well. One needs to assess whether this concern has been addressed, and how.

2.3.4 Economic

a. **Per Capita Investments:** As there is a deficit of infrastructure and services in India, there would be substantial capital investments required to cover the backlog, hence it is best to optimise capital investments. Often, investments are earmarked assuming a particular technology. It is important to assess per capita investment costs across different technologies and plans and then select an appropriate path. The least inexpensive may often not be an ideal solution, but this criterion will help question often static assumptions of technology.

b. **Operation and Maintenance:** Lack of proper maintenance and ensuing problems like breakdowns are common problems in Indian cities. There are often not enough resources to ensure operation and maintenance, and the resources required for this are often not factored in while choosing a particular technology. Hence, one needs to assess whether this issue is being addressed at various levels.

2.3.5 Process

a. **Inter-linkages:** There are often dependencies between different infrastructure systems, and proper/ improper functioning of one might be dependent on another e.g. clogging of sewerage system because of infiltration of solid waste. This criterion is thus used to assess whether these inter-linkages have been recognised, and whether overall priorities have been set keeping these in mind.

b. **Integration:** The CDP often is only one of the planning documents for a city, the others being master plan, sanitation plan, mobility plan, etc. One needs to assess whether the CDP takes cognisance of these documents, and makes an attempt to dovetail different plans.

c. **Capacity Development:** Inadequate capacity at the level of local bodies is often cited as one of the key issues in urban governance. This criterion is to gauge whether this need has been recognised, and what steps have been taken to address this.

d. **Monitoring and Evaluation:** Typically, there is a paucity of data and information at the city level as there is often no benchmark; it is difficult to assess how much progress has been made. Thus, it is important to set up an M & E system, no matter how rudimentary, to know the progress of the city.

Indicators for Sustainability Analysis of JNNURM

Table 5: Indicators for Sustainability Analysis of JNNURM							
Component	**Criteria**		**Water Supply**	**Sewerage and Sanitation**	**Storm Water Drainage**	**Solid Waste Management**	**Transportation**
Environmental	Sustainability of source/ sink		Is the source(s) sustainable? Are they been adequately protected? Is the water being replenished?	Has carrying capacity[1]of sinks been considered (e.g. What is the maximum load that the river can carry?)	Has carrying capacity been considered?	Has carrying capacity been considered?	
	Resource Use/ Source	Water	Have strategies for optimisation of water use been put in place? (e.g. Efficiency and reduction of losses? Recycling? Better Technology? Provision of different, appropriate quality water for different purposes? Recycling?	Covered under water			
		Energy	Is there cognisance of the energy requirements of the entire system? Is there a plan to economise energy used for energy used for sourcing, distribution and treatment? Any plans of bringing down per capita energy use?	Is there cognisance of the energy requirements of the entire system? Is there a plan to economise energy used for transportation and treatment (e.g. pumping sewage)? Any plans of bringing down per capita energy use?	Is there a cognisance of the energy requirements of the entire system?	Is there a cognisance of the energy requirements of the entire system? Is there a plan to minimise energy used for energy used for transportation and treatment? Any plans of bringing down per capita energy use?	Is the cognisance of the energy requirements of the entire system? Is there a plan to shift to more sustainable fuel mix? Are fuels source sustainable? Any plans of bringing down energy use per passenger per kilometre?
		Material	Is this concern mentioned?	Is there this concern mentioned?	Is there this concern mentioned?	Any thought to reduce consumption and waste generation? Any plans of reuse and recycling of materials?	
		Land	Is this concern mentioned?	Is there this concern mentioned? Is the technology use land intensive? If so, what are the plans to reduce land footprint?	Is linkage between urban planning, and disruption of channel realised? Is there plan to protect the "land" around the channels? Will the water disrupt ecosystems and biodiversity?	Is there thought given to how much land will be needed? Any plans of optimisation?	Has the linkage between land use planning and transport been realised? Are there plans to use transport as a means to achieve optimal densities?
	Waste/ Sink	Wastewater	To be covered in waste water	Are there plans to maximise treatment through a variety of means? What is the quality of effluent been released? Has pollution of ground water aquifers been considered?	Is it recognised that storm water may get polluted either by sewerage or solid waste? Can storm water be prevented from being polluted? Has pollution of ground water aquifers been considered?	Can the amount of water being polluted (through infiltration of solid waste) be minimised? Has pollution of ground water aquifers been considered (in dumping grounds, and land-fill sites?	

[1] It is recognized that carrying capacity is a contested term, and it is argued that there is no fixed carrying capacity, and can be extended with use of technology etc. However, here the term is used to assess whether certain limitations of natural resources.

Table 5: Indicators for Sustainability Analysis of JNNURM							
Component	**Criteria**		**Water Supply**	**Sewerage and Sanitation**	**Storm Water Drainage**	**Solid Waste Management**	**Transportation**
		Waste				Are there plans for segregation? Are different chains of waste been treated properly? Has leachate been properly treated?	
		Air Pollution	Is there a cognisance of emissions?	Is there a cognisance of emissions?	Is there a cognisance of emissions?	Is there a cognisance of emissions, especially during treatment? If incineration is used, is it being toxic waste is being separated?	Is there cognisance of emissions?
Design and Technology	Performance	Coverage	Does the system provide clean drinking water to everybody?	Is there a vision or plan to make the city open defecation free? Is there some plan to ensure that all residents (and migrant population) have access to "improved" sanitation facilities? Does sanitation system collects, conveys and treats adequately?	Is there a plan to extend storm water drainage in entire city?	Is there a plan to make provisions for collection of solid waste to be extended to the entire city? Are they plans to ensure safe disposal of all wastes?	Are there plans of making each part of city accessible by public transport? Have feeder services been thought through?
		Quality	Is there a concern for quality of water? Are there any steps being taken to ensure minimum quality of water? Are there minimum standards for duration of time the water is being supplied?	Have any minimum standards been set for provision of sanitation facilities? Has only construction toilet been thought of, or has thought been given to disposal system?	Are they some criteria for minimum functionality of the system?	Are they some minimum functionality of the system? Is there minimum frequency of waste collection?	Are they certain minimum standards for a. public transport b. roads, especially comfort levels for pedestrians and cyclists?
		Reliability	Will there be disruptions in service delivery? Is there plan for O & M systems and procedures?	Will the public/ community toilets remain functional? What is the plan to ensure that a treatment system works? Is there plan for O & M systems and procedures?	Will there be disruptions e.g. flooding? Is there plan for O & M systems and procedures?	Will there be disruptions? Is there plan for O & M systems and procedures?	Will the system deliver function equally for all users? Is it biased towards car users? Will there be disruptions e.g. Jams? Is there plan for O & M systems and procedures?
	Efficiency		Any plans for increasing efficiency of system? (e.g. to reduce non-revenue and unaccounted water? to increase energy efficiency?)	Any plans for increasing efficiency of system?	Any plans for increasing efficiency of system? Any planning of synergising with natural drainage systems?	Any plans for increasing efficiency of system? Segregation? Recycling? Reuse? Has it been considered how efficiency of other systems might be reduced because of solid waste?	Any plans for increasing efficiency of systems? Technology? Better feeder services?
	Adaptability		Has adaptability of infrastructures and plans been considered? Is there a back-up plan if the current sources fail to meet the requirements?	Has adaptability of infrastructures and plans been considered?	Has adaptability of infrastructures and plans been considered? How the system responds to changed pattern of rainfall?	Has adaptability of infrastructures and plans been considered? How the system responds to changed quantity and composition of waste?	Has adaptability of infrastructures and plans been considered? How the system responds to changing modal split?

Table 5: Indicators for Sustainability Analysis of JNNURM						
Component	**Criteria**	**Water Supply**	**Sewerage and Sanitation**	**Storm Water Drainage**	**Solid Waste Management**	**Transportation**
Social and Public Health	Equity	Is there a cognisance of differential socio-economic conditions of users/ residents? Plan to move to more equitable distribution? How will it be ensured that the urban poor and vulnerable will have access to physical infrastructure and services? Are the steps in line with national and state policies? Have issues of affordability been though through?	Is there a cognisance of differential socio-economic conditions of users/ residents? How will it be ensured that the urban poor and vulnerable will have access to physical infrastructure and services? Are the steps in line with national and state policies? Have issues of affordability been though through?	How will it be ensured that the urban poor and vulnerable will have access to physical infrastructure and services? Are the steps in line with national and state policies?	How will it be ensured that the urban poor and vulnerable will have access to physical infrastructure and services? Are the steps in line with national and state policies?	How will it be ensured that the urban poor and vulnerable will have access to public transport? Is the link between concern between livelihoods and access to transport recognised?
	Reduction in Diseases	Has the linkage between water and health been recognised? Is there some plan to reduce the incidence of relevant diseases?	Has the linkage between sewage and health been recognised? Is there some plan to reduce the incidence of relevant diseases?	Has the linkage between water and health been recognised? Is there some plan to reduce the incidence of relevant diseases?	Has the linkage between pollution and health been recognised? Is there some plan to reduce the incidence of relevant diseases? Specifically, have safety of workers been thought of? Has the concern of dumping sites near poor neighbourhoods been considered?	Is linkage between transportation and health been realised? Have both traffic accidents and emissions been recognised as causes? What is being done to address both?
Economic	Per capita investments	Have capital costs (per capita) across different technology and planning been considered? Is a certain technology or solution assumed? Have life cycle and their replacement cycles have been thought through?	Have capital costs (per capita) across different technology and planning been considered? Is a certain technology or solution assumed? Have life cycle and their replacement cycles have been thought through?	Have capital costs (per capita) across different technology and planning been considered? Have life cycle and their replacement cycles have been thought through?	Have capital costs (per capita) across different technology and planning been considered? Have life cycle and their replacement cycles have been thought through?	Have capital costs (per capita) across different technology and planning been considered? Is a certain technology or solution assumed? Have life cycle and their replacement cycles have been thought through?
	Operations and Maintenance	Is there a Financial Operating Plan to ensure resources for O & M?	Is there a Financial Operating Plan to ensure resources for O & M?	Is there some plan or strategy to take care of O & M?	Is there some plan or strategy to take care of O & M?	Is there some plan or strategy to take care of O & M of different components (road, public transportation? Cost recovery?
Process	Interlinkages with other sectors	Have the interlinkages between sectors identified? Do overall plans and priorities reflect these inter-linkages?	Have the interlinkages between sectors identified? Do overall plans and priorities reflect these inter-linkages?	Have the interlinkages between sectors identified? Do overall plans and priorities reflect these inter-linkages?	Have the interlinkages between sectors identified? Do overall plans and priorities reflect these inter-linkages?	Have the interlinkages between sectors identified? Do overall plans and priorities reflect these inter-linkages?
	Integration	Does CDP refer/ recognise other planning documents (e.g. Master Plan) and relevant policies? Does it take heed of	Does CDP refer/ recognise other planning documents (e.g. Master Plan) and relevant policies? Does it take heed of	Does CDP refer/ recognise other planning documents (e.g. Master Plan) and relevant policies? Does it take heed of	Does CDP refer/ recognise other planning documents (e.g. Master Plan) and relevant policies? Does it take heed of	Does CDP refer/ recognise other planning documents (e.g. Master Plan) and relevant policies? Does it take heed of them, or are there

Table 5: Indicators for Sustainability Analysis of JNNURM						
Component	**Criteria**	**Water Supply**	**Sewerage and Sanitation**	**Storm Water Drainage**	**Solid Waste Management**	**Transportation**
		them, or are there contradictions?	them, or are there contradictions?	them, or are there contradictions?	them, or are there contradictions?	contradictions?
	Capacity Development	Is there recognition of the need for capacity development (implementation, procurement, design, management etc.)? Is there a plan in place to augment capacities? Is there recognition of limitation of capacities outside the public sector (e.g. Vendors/ consultants for design and construction?	Is there recognition of the need for capacity development (implementation, procurement, design, management etc.)? Is there a plan in place to augment capacities? Is there recognition of limitation of capacities outside the public sector (e.g. Vendors/ consultants for design and construction?	Is there recognition of the need for capacity development (implementation, procurement, design, management etc.)? Is there a plan in place to augment capacities? Is there recognition of limitation of capacities outside the public sector (e.g. Vendors/ consultants for design and construction?	Is there recognition of the need for capacity development (implementation, procurement, design, management etc.)? Is there a plan in place to augment capacities? Is there recognition of limitation of capacities outside the public sector (e.g. Vendors/ consultants for design and construction?	Is there recognition of the need for capacity development (implementation, procurement, design, management etc.)? Is there a plan in place to augment capacities? Is there recognition of limitation of capacities outside the public sector (e.g. Vendors/ consultants for design and construction?
	Monitoring and Evaluation	Is the need for M & E recognised? Has a plan been put in place for it?	Is the need for M & E recognised? Has a plan been put in place for it?	Is the need for M & E recognised? Has a plan been put in place for it?	Is the need for M & E recognised? Has a plan been put in place for it?	Is the need for M & E recognised? Has a plan been put in place for it?

3 Overview of JNNURM

3.1 Context of JNNURM

The Jawaharlal Nehru National Urban Renewal Mission (JNNURM), launched in December 2005, is a flagship project of the Government of India. The objective of the project was to lead "a reforms driven, accelerated development of Indian cities, with a particular focus on urban infrastructure". The duration of the Mission was seven years beginning from 2005-06 to 2011-2012 (MoUD and MoUEPA, 2005a). The ongoing projects have been given a two-year extension upto 2013-14 to complete implementation (MoUD, 2012).

The Mission comprises two sub-missions: Urban Infrastructure and Governance (UIG) administered by MoUD, and Basic Services for the Urban Poor (BSUP) administered by MoHUPA. These 2 sub-missions focussed on select 65 cities (35 cities million plus cities and 30 others including capital cities/ the cities of religious/ historic/ tourist importance). For all other medium and small towns in the country, the UIDSSMT (Urban Infrastructure Development Scheme for Small and Medium Towns) and the IHSDP (Integrated Housing and Slum Development Programme) were launched. These sub-missions and programs replaced a couple of earlier government programmes (AUWSP, IDSMT under UIG and UIDSSMT, and VAMBAY, NSDP under BSUP and IHSDP programs).

The focus area of the UIG and UIDSSMT programmes is urban infrastructure: water supply, sewerage, drainage, solid waste management, road network, urban transport and redevelopment of inner (old) city areas. BSUP and IHSDP, on the other hand, focus on shelter for the urban poor, including re-development of slums. The current study focuses on UIG sub-mission of JNNURM.
Detailed information on JNNURM and UIG is available in Annex 1.

3.2 JNNURM: An Overview

The Government of India identified the lack of inadequate infrastructure as one of the road blocks to development of Indian cities. In order to facilitate this infrastructure creation, the need for a national level initiative that could catalyse investment flows in the urban infrastructure sector was felt. JNNURM was launched as an attempt to close the investment gaps in urban infrastructure. The stated aim of the programme is to expedite and facilitate "planned development" of identified cities, while its focus is to improve efficiency of urban infrastructure, service delivery, and accountability of local bodies, and also increase community participation.

The Government of India proposed substantial assistance through the JNNURM over the seven-year period. During this period, funds were to be provided for proposals that would meet the Mission's requirements. Under JNNURM, financial assistance was made available to ULBs and parastatal agencies for implementation of projects which met the requirements. The implementation could be done through ULBs themselves, or through SPV(s). The Central Government assistance was not expected to cover the entire costs; instead the State Governments and ULBs were expected to

contribute to the implementation costs. It was also envisaged that additional resources would be raised through PPPs.

JNNURM was however was not imagined as just a funding programme. It was also a linked to a set of reforms to further catalyse investments in urban infrastructure, create 'investor friendly environment', incentivise 'efficiency enhancement' and lead to 'sustainable infrastructure development'.

JNNURM provides assistance to 65 "mission" cities across 29 states and 2 Union Territories. Out of the 65 selected, 35 were million-plus cities according to the Census 2001, the remaining 30 included 18 state capitals and 12 cities of religious/ heritage/ tourism importance. The mission cities accounted for 42 per cent of the total urban population in 2001. There were only six non-class I cities in the list; Kohima and Panaji being Class II, and Nainital, Itanagar, Bodhgaya and Gangtok being Class III (Census of India, 2001). It was estimated that over a seven-year period, the 65 Urban Local Bodies would require a total investment of Rs. 12,05,360 million (Rs. 1,20,536 crores) in basic infrastructure and services with annual funding requirement being Rs. 1,72,190 million (Rs. 17,219 crores) (MoUD and MoUEPA, 2005a). Reported data on 65 cities on the JNNURM website (as on 15th September 2012) shows that total utilisation under the mission has been 361,101 million rupees against total approved cost of 622,508 million.

3.3 Process Flow of JNNURM

The process to be followed by the cities to access funds has been described below.

Preparation of City Development Plan: In order to avail funding, every city is required to prepare and submit a City Development Plan. The CDP is required to:

a) Undertake situational analysis of the city including SWOT analysis
b) Develop vision for the city
c) Identify development goals and strategies
d) Identify projects to meet above stated goals and strategies and earmark projects of high, medium, low priority

Stakeholder consultations and workshops were mandatory components during the preparation of the CDP. These consultations were required at every point of the CDP preparation. The CDP was also supposed to undertake financial assessment and outline an investment plan and financial operating plan (FOP) to ensure 'sustainability' of infrastructure.

Preparing Projects and Detailed Project Reports: Having identified projects in the CDP, the ULBs/ parastatal agencies were required to prepare Detailed Project Reports (DPRs) for the individual projects. In order to seek JNNURM assistance, projects were to ensure and demonstrate optimisation of the life-cycle costs over the planning horizon of the project including creation of a revolving fund to meet the O&M requirements of assets created. The guidelines also suggest incorporating private sector efficiencies in development, management, implementation and

financing of projects, through Public Private Partnership (PPP) arrangements for optimisation of life cycle costs. It was stated that projects with private sector participation would be given priority over projects to be executed by ULBs/ parastatals themselves (MoUD, 2006a). DPRs would be scrutinized by the Technical wing of MoUD before they are forwarded to Central Sanctioning and Monitoring Committee for approval and sanction.

Release and Leveraging of Funds: Once the project is approved, funds from the Central and State Government will flow directly to the State Level Nodal Agency (SLNA). The funds for identified projects across cities would be disbursed to the ULB/Parastatal agency through the designated SLNA. There was a differential financing pattern, based on the population size of the city. Funding pattern under JNNURM as below:

Table 6: Funding Pattern Across Cities under JNNURM

Category of Cities/ Towns/ UAs	Grant		ULB or Parastatal Share/ Loan from Financial Institutions
	Centre	State	
Cities/UAs with 4 million plus population as per 2001 census	35%	15%	50%
Cities/UAs with million plus but less than 4 million population as per 2001census	50%	20%	30%
Cities/towns/UAs in North Eastern States and Jammu & Kashmir	90%	10%	-
Other cities/UAs	80%	10%	10%
For setting up de-salination plants within 20 km from sea-shore and other urban areas predominantly facing water scarcity due to brackish water and non-availability of surface source	80%	10%	10%

Source: MoUD and MoUEPA, 2005a

Implementation of Reforms: The central assistance under JNNURM was linked to a set of reforms, in order to bring about a change in how urban governance works in India. The release of funds was linked to the implementation of mandatory reforms both for the state government and the urban local body (ULB)/ parastatals. Two optional reforms could be implemented every year; all mandatory and optional reforms need to be implemented by the end of the seven year period.

3.4 Analysis of Funding under JNNURM

Analysis of funding under JNNURM was carried out to discern pattern between approved and utilised costs against population size and state. These graphs have been presented in the Annex 1F, but some significant findings from the analysis are:

a. The total amount of funding is largely proportional to the city size.

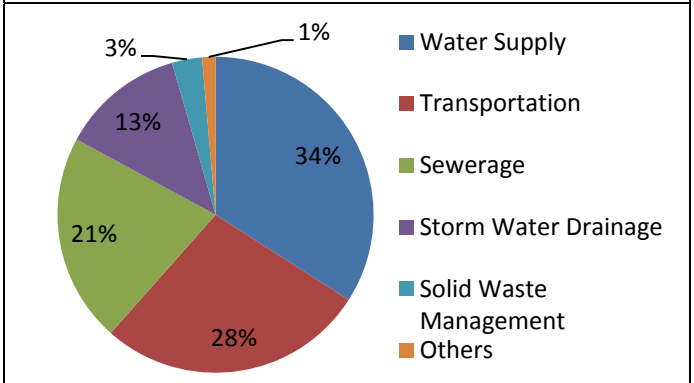
b. The per capita approved cost, apart from few outliers, is below Rs. 10,000 (Fig. 3). Per capita utilisation for most of the cities is below Rs. 5,000 indicating average 50 per cent utilisation as compared to approved cost.

c. There seems to be little correlation between urbanisation level of the state and funding.

3.5 Utilisation Across Sectors

The eligible sectors under the UIG sub-mission of JNNURM are given in the Annex. However, the guidelines do not stipulate the share of each sector. As stated above, total amount utilised till September 2012 is 361,101 million rupees. Distribution of amount utilised across sectors is as given in the Fig. 7. Maximum investment has gone into water supply projects followed by transportation and sewerage.

Fig. 1: Utilisation Across Sectors

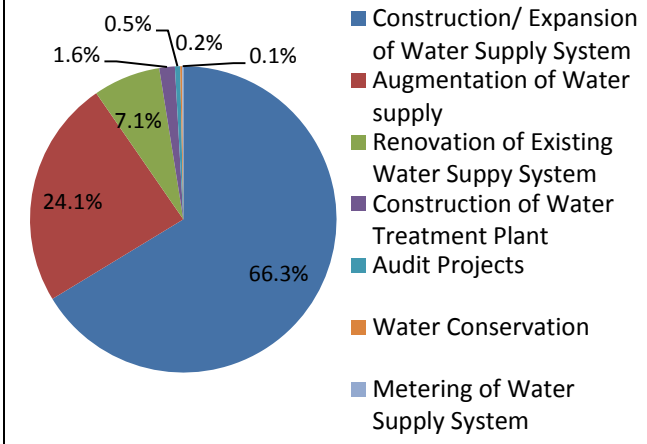


Source: Analysis of data sourced from http://jnnurm.nic.in/, September 2012.

3.5.1 Water Supply

Total amount utilised in water supply sector is 123,009 million rupees. Two-thirds of the money in the water supply sector has been spent on laying down new pipes and expanding the water supply system. Almost a quarter was spent on augmenting water supply. Water treatment plants received only 1.6% of the funding while projects like water conservation and metering of water supply system are a rarity.

Fig. 2: Utilisation in Water Supply Sector

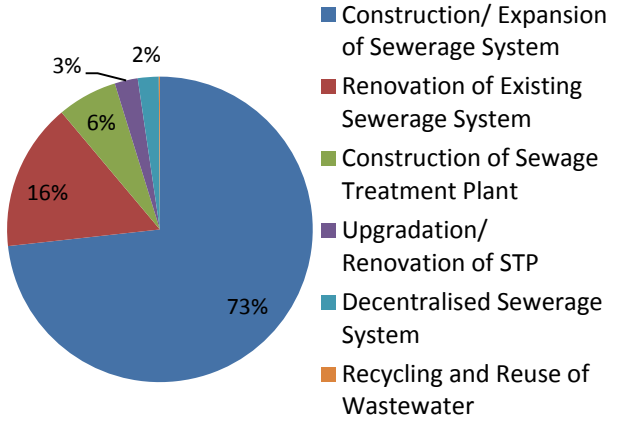


Source: Analysis of data sourced from http://jnnurm.nic.in/, September 2012.

3.5.2 Sewerage

Total amount utilised in sewerage sector is 77,152 million rupees. Almost three-fourths of the spending in this sector has been on the construction and expansion of sewerage system, essentially an off-site system. Only one project on a decentralised sewerage system and one involving recycling and reuse of wastewater have been implemented.

Fig. 3: Utilisation in Sewerage Sector

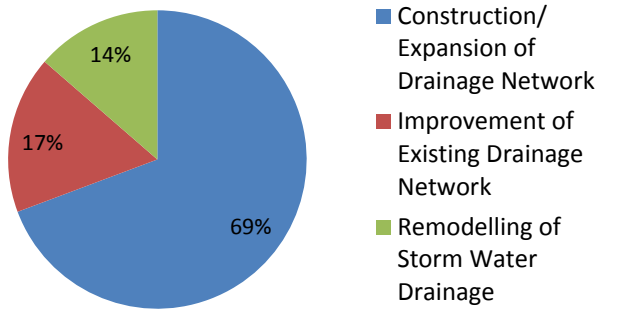


Source: Analysis of data sourced from http://jnnurm.nic.in/, September 2012.

3.5.3 Storm Water Drainage

Total amount utilised under storm water drainage projects is 45,708 million rupees. More than two-thirds of the investment has gone into the expansion of the drainage network while the remaining one-third has been utilised for improvement and remodelling of the existing storm water drainage network.

Fig. 4: Utilisation in Storm Water Drainage Sector



Source: Analysis of data sourced from http://jnnurm.nic.in/, September 2012.

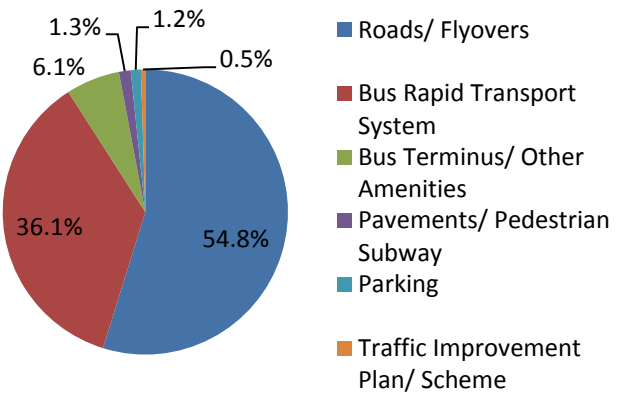
3.5.4 Solid Waste Management

Total amount utilised in solid waste management projects is 11,073 million rupees. Since most of the projects in solid waste management were titled as solid waste management for the city, it was difficult to further classify the projects.

3.5.5 Transportation

Total amount utilised in transportation sector is 99,229 million rupees. More than half of the money in transportation sector has been spent on building roads and flyovers. Public transportation has received about 36% of the investment. Only 1.3% of money has gone into construction of pavements and pedestrian subways.

Fig. 5: Utilisation in Transportation Sector



Source: Analysis of data sourced from http://jnnurm.nic.in/, September 2012.

Overall, 622,508 million rupees have been approved; out of which 287,780 million rupees have been committed by the Central Government and the rest by the State and local government. Central assistance released amounts to 179,717 million rupees. Total utilisation has been 361,101 million rupees (including state and ULB contribution[2]). Out of 554 approved projects, 143 projects have been completed; 42 in water supply, 62 in transportation, 18 in sewerage, 13 in storm water drainage, 5 in solid waste management, and 3 other projects.

[2] Amount committed and released by the state government and urban local body is not given in the documents.

4 Key Findings

4.1 Key Findings from JNNURM Design

Various JNNURM documents (overview, policy directives, reforms) were examined through the sustainability framework developed in previous chapter. The detailed tables are presented in Annex 4. The key findings of the analysis are presented in this section.[3]

4.1.1 Specific Sectoral Actions

a. **Rainwater Harvesting:** One of the optional reforms[4] recommended by the government is making rainwater harvesting mandatory. The chief stated objective is to recharge ground water and augment water supply. It is to be noted that rainwater harvesting is a specific strategy to address several sustainability concerns: efficient resource use, reduction of surface run off, etc. However, it may or may not be an effective and appropriate strategy for all cities.

b. **Re-use of Waste Water:** One of the optional reforms is to create/amend bye-laws to make reuse of waste water compulsory. The aim is to use water efficiently, reduce burden on the existing resources and provide for the growing demands. Reduced amount of sewage due to re-use will also help in lowering pollution levels in existing water bodies.

c. **Unaccounted for Water:** One of the goals mentioned in project appraisal guidelines is reducing unaccounted for water.

d. **Solid Waste:** Toolkit for project appraisal highlights that there need to be bye-laws or policies for segregation and recycling of waste and that existing formal and informal activities need to be considered while planning for solid waste management.

4.1.2 Cross Sectoral Concerns/ Issues

a. **Coverage:** 100 % coverage has been identified as one of the key outcomes of JNNURM.

b. **O & M:** O & M has been highlighted as a major issue, and is considered key to 'sustainable urban development'. Strategy for O&M is a pre-condition to avail JNNURM funding. Levy of reasonable user charges by the ULBs and parastatals is one of the

[3] This analysis includes the initial set of brief instructions for CDP preparation that were issued by MoUD. Subsequently, revised CDP toolkit was issued. While this has been analysed, and the table is presented in the Annex, it has not been included in this section, as that toolkit was issued after most of the CDPs had already been prepared, and hence is not relevant for this round of study.

[4] All mandatory and optional reforms were to be implemented by the State Governments and Urban Local Bodies. The ULBs had the option of implementing two optional reforms every year,

mandatory reforms under JNNURM and it is expected to cover hundred per cent O&M costs of water supply and solid waste management sector through this.

c. **Equity:** Equity concerns are highlighted in JNNURM documents. There are mandatory reforms regarding provisioning of basic services to the poor, and also internal earmarking of funds for the poor. There is separate sub-mission of JNNURM, Basic Services to Urban Poor (BSUP), focusing on these concerns. It is envisaged that all urban poor settlements will integrated and mainstreamed with municipal supply networks; however, with BSUP being a separate sub-mission administered by a different Ministry, it is not very clear how this will happen.

d. **Efficiency and Optimisation of Life Cycle Cost:** While designing systems, ULBS are required to take system efficiency and optimisation of life cycle costs into account.

4.1.3 Tools and Methods

a. **Environmental Impact Assessment:** Toolkit for DPR preparation highlights that Environmental Impact Assessment and Environmental Management Plan need to be prepared. It is however not clear how binding this constraint is. The toolkit also asks cities to list out all negative externalities and seek 'environmental compatibility 'while planning for projects.

b. **Water and Energy Audit:** The ULBs have been asked to conduct water and energy audits. Raw water analysis report, source reliability study and report are also asked for in the DPRs for water supply sector.

c. **Technical Feasibility and Commercial Viability:** While toolkit for project preparation asks for technical feasibility study and selection of technically feasible and commercially viable option, there is no clear definition of what is considered as technically feasible.

4.1.4 Processes

a. **Integration with National Policies:** Toolkit for DPR preparation highlights that sector specific DPRs need to be in line with National Policies and Rules.

b. **Inter-linkages with Other Processes:** According to the overview document, CDPs are supposed to integrate with land use, transport and environment management plans. Sewerage and drainage should be seen in parallel to water supply augmentation or to be phased immediately after a water supply project.

c. **Capacity Building:** It has been recognised as an issue, and 5 % of grant is to be reserved for preparation of capacity building and plan preparation. It is not clear whether this amount is sufficient. Moreover, this 5% is also not exclusive and includes funding for community participation, and information, education and communication as well.

d. **Monitoring:** A monitoring framework has been put in place at the national level; however, this framework does not have environmental concerns and only allows monitoring of flow of funds and physical status of project implementation.

4.1.5 Definition of Sustainability

In the JNNURM overview document, sustainable infrastructure development has been associated with O & M.

4.2 Key Findings from CDP Review

CDPs of 20 JNNURM cities were analysed for the prevalence and salience of their attention to specific sectors and sustainability dimensions thereof. The sustainability analysis of the 20 cities is given in Annex 4. The next step was to count the number of cities the CDPS of which took cognisance of that particular dimension. For example, if water resources were deemed important by the CDP, these were counted as "recognition" and as table 5 presents, 15 of the 20 cities were found to be doing so. Table 7 presents sustainability dimension for the 5 main sub sectors under study. The indicators against which the sub sectors have been mapped/ "counted" cover the aspects of environment, design and technology, social and public health, economic and process.

4.2.1 Specific Sectoral Actions

a. **Primacy of Water Supply:** Water supply enjoys primacy amongst the sectors as demonstrated by a large portion of sample cities and acknowledging its importance. Water supply is followed by sanitation and sewerage in number of cities recognising various aspects. Specific issues highlighted in these sectors are discussed below.

b. **Source Sustainability:** While many cities have mentioned sustainability of water source, it is not clear what exactly is meant. Most of the projects are related to preservation of water bodies. These projects themselves may not be directly related to conservation of water, but could be for development of part around the water body, or beautification of the ghats.

4.2.2 Cross Sectoral Concerns/ Issues

a. **Coverage:** Coverage, along with equity, is the single most important issue recognised by most CDPs. Maximum investments have been earmarked to achieve this goal across sectors. This result is not surprising as the core purpose of JNNURM was to close the infrastructure deficit. The critical question is that whether this important goal of universal coverage can be met, while satisfying other conditions. This issue and the related issue of equity have been dealt with in the next chapter. The bulk of the improvements are in extension of the system, improved collection as well as improving access to specific groups of households and/ or unserved areas of the city.

b. **Equity:** For most sectors, reaching out to unserved population has been highlighted as a key objective. Once more, it was expected, as the goal of BSUP was formulated to specifically reach out to the urban poor. However, it is only the concerns of urban poor, specifically slum population, that have been mentioned. There is no mention of concerns of other vulnerable population like women, children, etc.

c. **Efficiency:** Efficiency of infrastructure systems, especially, in the case of water supply, transport and sanitation have been recognised as an important area of concerns, as is evident by importance and investment accorded to it. In case of water supply and sanitation, efficiency of system has been most closely associated with refurbishment and rehabilitation of existing systems. In case of transport, efficiency of the system is largely associated with the issues of traffic jams and congestion.

d. **Limited Attention to Environmental Sustainability:** Compared to design and social issues, limited attention has been paid to various criteria under environmental sustainability. The issues of environmental sustainability that are clearly addressed pertain to pollution: land, water and air. Far less importance has been given to the issue of resource use.

e. **O & M:** While O&M is cited as a key concern in the JNNURM documents; it does not get the required attention in the CDP documents, except for the water supply sector. Operations and maintenance in the case of transportation and storm water drainage is the least thought of.

4.2.3 Processes

a. **Capacity Development:** While there is limited mention of any of the process indicators, capacity development of the urban local bodies finds most mention among all other indicators. While capacity building is recognised as an issue, there is a sharp drop when it comes to investments.

b. **Interlinkages and Integration:** The CDPs largely contain sectoral analysis and do not recognise the linkages between sectors e.g. there is hardly any recognition of how solid waste might be affecting the efficiency/ functioning of sewerage/ drainage systems. There is limited mention of integration with other policies and existing programmes.

c. **Logic:** Logical connection between goals, strategies and projects is often not evident. As the tables highlight, often the goals are in place, but they do not get translated either into strategies or into projects. Sometimes it is difficult to assess the connection between goals and eventual projects.

4.2.4 Understanding of 'Sustainability'

There is ambiguity around words environment and sustainability. The word 'sustainability' has been used in multiple different ways in the CDP. It has been most closely associated with financial sustainability and issues of O & M.

4.2.5 Technology Fixation

There is confusion between goals and strategies. Specific strategies/ technologies are often conflated with goals, e.g. in case of sewerage, not safe collection and disposal is often mentioned as a goal. The concern with this technological fixation is that ULBs may not notice other feasible options to achieve same goal (in this case treatment of waste water).

Table 7: Sustainability Analysis of Five Sub-Sectors in Selected CDPs

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water	15	12	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Energy	3	3	5	2	4	3	2	1	0	0	0	0	1	0	0	0	1	3	1	0
		Land	0	0	0	0	1	2	0	0	9	8	0	0	4	4	3	0	5	3	1	0
		Material	0	0	0	0	0	0	0	0	0	0	0	0	5	7	4	0	1	0	0	0
	Sink/ Waste	Wastewater	0	0	0	0	20	15	10	1	12	4	3	0	5	0	1	0	0	0	0	0
		Waste	0	0	0	0	3	1	0	0	11	4	1	0	18	17	16	0	0	0	0	0
		Air Pollution	0	0	0	0	2	1	0	0	0	0	0	0	1	1	1	0	10	10	0	1
	Sustainability of Source/ Sink		14	13	12	0	3	1	1	0	4	8	2	0	3	1	3	0	0	0	1	0
Design and Technology	Performance	Coverage	18	19	18	0	20	19	19	0	14	11	15	0	16	14	16	0	18	16	17	0
		Quality	15	9	9	1	9	9	4	0	4	2	2	0	6	3	0	0	15	14	12	0
		Reliability	17	10	6	0	9	6	5	0	16	14	12	0	4	2	0	0	3	4	0	0
	Efficiency		17	18	16	1	6	7	10	0	8	11	5	0	8	11	7	1	17	18	16	0
	Adaptability		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Social and Public Health	Equity		18	18	12	0	17	16	16	0	12	12	12	0	14	13	11	0	13	14	13	0
	Public Health/ Reduction in Diseases		3	2	1	0	5	0	0	0	3	0	0	0	6	1	0	0	9	11	4	0
Economic	Per Capita Investments		2	1	0	0	1	3	1	0	0	0	0	0	1	1	0	0	0	1	0	0
	Operation and Maintenance		14	15	14	0	9	11	7	0	6	4	4	0	8	9	7	0	3	3	4	0
Process	Inter-linkages		1	1	2	0	1	1	2	0	2	2	2	0	0	0	1	0	1	2	1	0
	Integration		7	0	0	0	4	1	0	0	2	1	0	0	0	3	1	0	7	2	0	0
	Capacity Development		7	11	6	0	5	8	4	0	6	4	4	0	11	7	4	0	6	4	4	0
	Monitoring and Evaluation		3	8	5	1	2	7	3	1	0	3	1	1	1	2	1	1	1	1	0	1

4.3 Key Findings from Nanded Field Study

4.3.1 Specific Sectoral Actions:

Interviews with people and analysis of DPRs reveal that following specific activities/ projects were undertaken to ensure sustainability:

a. Tree Plantation along road side
b. Segregation of Traffic by having dedicated lanes for motorised vehicles, cycles, parking, pedestrians and hawkers.
c. Extension of sewerage and storm water drainage to reduce both surface and ground pollution
d. Replacement of old pumps/ pipes to reduce energy consumption and increase efficiency
e. Installation of Energy Efficient Street Lights

4.3.2 Cross Sectoral Concerns/ Issues

a. O & M: While O & M was clearly recognised as an issue, it is not apparent how this concern was going to be addressed. It is not clear either from the CDPs or from interviews what was the assumption behind the O & M costs. As a response to meeting these costs, various user charges and taxes have been levied. Once more it is not clear whether these would be sufficient. Also, as a solution to undertaking maintenance of the STP, the plan is to outsource the operation, but the incentives for private party to do so is not clear.

While O & M manuals for certain components like bridges, flyovers, STP are being prepared by the consultants, the procedure for other parts of the systems is not clear. Also, apart from the components that are being outsourced, it is not clear who will be responsible for O & M.

b. Coverage: Given the service deficit, coverage is given importance at all levels, especially for water supply and sanitation. Coverage is an overarching concern with the ULB. Interestingly, according to one of the respondents, increasing coverage of sewerage and storm water drainage was addressing the concern of environmental sustainability. This is partially true since the waste water flows into open drains, resulting in both ground water pollution, and also in public health hazards.

c. Equity: The ULB is cognisant of challenges of urban poverty, and is taking steps that various services are accessible to them. It is too early to access the efficacy of these steps.

d. Efficiency: Various ULB officials expressed concerns with energy efficiency of various systems. The concrete action taken to address this concern was to refurbish old pumps.

e. **Pollution:** As mentioned elsewhere, concerns of pollution were taken into consideration

4.3.3 Tools and Methods

a. **Water and Energy Audits:** Water and energy audits have been carried out.

4.3.4 Process

a. **Importance of National Policy/ Directive:** While CDP does not mention any integration with national level policy, interviews revealed otherwise. NUTP and issues addressed therein were constantly raised. However, National Urban Sanitation Policy was not mentioned, but NUSP came into being much later than NUTP. There was also a close co-relation between concerns that have been raised in the JNNURM documents were the ones most recognised at city level eg. O & M, coverage.

b. **Limited Understanding and Capacities:** The government officials accepted the limited capacity within the ULB. It was put forward as a reason for hiring private consultants for planning and execution. However, it means that ULB may not have been able to assess the outputs of consultants. Moreover, it is not clear what the hand-over process is. Perhaps, from the perspective of sustainability, there was limited understanding of sustainability among the private consultants, infact the initial impression is that understanding of consultants was more limited than that of the ULB.

c. **Interlinkages and M & E:** M & E and Recognition of Inter-linkages is nearly completely missing.

4.3.5 Understanding of 'Sustainability'

Before asking specific questions about sustainability, most of the key respondents were asked a general question whether concerns of sustainability had been taken on board. While some respondents were unable to answer a broad question like this, the most response was related to the concern of O & M. Thus, this limited field work shows that sustainability has been appropriated by concerns of financial sustainability.

When they were asked specifically about environmental sustainability, the answers were varied, but among those concerns of water pollution stood out.

4.3.6 Assumptions of Certain Technology

Specific questions were asked regarding technological options; it was however not clear how specific technologies had been selected. Some of the interviews seemed to indicate that officials were surprised that there was a choice available.

5 Conclusions

5.1 Conclusion: A Recap

a. **Limited Understanding of the Term 'Sustainability':** One of the major concerns arising out of the study is the understanding of the term sustainability. While term is highly contested, and it is perhaps not possible to arrive at a common understanding of the term, yet it is problematic if it becomes narrowly associated with certain issues. JNNURM overview document identified it with O & M, and it was clear from interviews in Nanded, that sustainability is now largely associated with O & M and financial sustainability concerns. Important through these concerns are, they constitute a small subset of sustainability.

b. **Appreciation of Systemic Issue of Environmental Sustainability Missing:** Environmental sustainability is associated with a small number of issues. In Nanded, environmental sustainability was most strongly associated with pollution, and then with system efficiency. While one cannot infer anything from one city, review of the CDPs also illustrates that issues of pollution are more easily recognised, compared to issues of resource use. First, it is a narrow identification of problems. Second, since pollution is environmental impact at the last stage of cycle, it is possible to address this issue/ symptom without addressing other underlying and core issues of sustainability e.g. reduction of air pollution by use of fuel efficient cars, rather than restructuring the transportation system to public transport and NMVs.

c. **Restricted Comprehension of O & M:** Improper operations and maintenance has been the bane of urban infrastructure in India. It is thus heartening to see that this critical issue is receiving importance at all levels. However, there are three components to ensure O & M: dedicated funds, clear allocation of responsibility to specific personnel, and a clearly laid-out process. While the other aspects have been mentioned or are implied, the focus clearly has been on earmarking of funds. Addressing only one aspect is not sufficient to tackle issue.

   Moreover, the strategy favoured for ensuring funds for O & M has largely been to levy user fees through mandatory reform, and making it a pre-condition. However, it is not clear whether rise in user fees is going to be cover costs. Perhaps most important issue is that the focus is on raising sufficient funds to meet O & M costs, rather than thinking through whether these expenses can be brought down in the first place. This is closely linked to choice of specific technologies/ systems, and fixed costs associated with them; this issue of technology choice is addressed below.

d. **Opportunity to Leapfrog onto More Sustainable Path:** Along with O & M, coverage is recognised as an important issue. This is hardly surprising as one of the primary objectives of JNNURM was to achieve 100% coverage. Moreover, as literature review highlights that these modern infrastructure systems were created with the explicit functions of service provisioning. However, it also seems that linkage between lack of

coverage and poverty has been recognised as specific issues of extending services to the poor has been recognised as review of CDPs and fieldwork reveal.

This challenge of closing infrastructure deficit and simultaneously addressing concerns of environmental sustainability at the same time is typical of multiple environmental transitions facing cities of the South. However, it also represents an opportunity as it means an opportunity to put in more environment friendly systems in place in the first instance, instead of retrofitting. The current systems have long life cycles, and certain path dependencies, thus once put in place they may lock certain patterns in place. Indian cities can avoid historical mistakes, and leapfrog onto a more sustainable path by addressing the issue of service provisioning in innovative manner. This is possible if government at various levels could explore beyond certain technologies.

e. **Technological Fixation:** Both the issue of optimising O & M costs and challenge of service provisioning in innovative manner brings points us to the issue of technology and design of systems. One can clearly assess from various policy documents and field work that there is often a focus on specific strategies, methods and technologies rather than larger sustainability goals. To illustrate, minimisation of resource use and conservation is indeed a desirable goal, however as stated below it is not clear whether rainwater harvesting is the most appropriate strategy. Another example can be presented from the sanitation sector. Review of CDPs reveal that many cities have explicitly stated 100% sewerage coverage as the desired goal, it has to be realised that sewerage that it is only one of the options.

   The problem with the fixation with particular technologies is that it forecloses different pathways to sustainability. The entire discussion is constrained to making existing systems more efficient e.g. replacement of old pumps, rather than realising the overall design of the system might be inefficient in the first place. This tie in with the concern expressed with the O &M issue, where the focus is on raising sufficient resources rather than optimising costs by using alternate technology.

   Thus, selection of appropriate and context specific technology and systems can be seen as a key element to urban sustainability. It is not possible to identify these, but this emerges a major area of research, and has been mentioned in the last section. However, the concern is not limited to selection of appropriate technology. In fact, if one were to select area specific technology, there would need to be bundling of different technologies at the city scale. This means ULBs or government agencies need to have the capacity to select technology, but more importantly, integrate them into functional city wide system. Thus one needs the tools and methods to put in a mix of centralised and decentralised systems, and yet be able to plan it in a coherent manner.

f. **Lack of Integrated and Spatial Planning:** While the linkage between certain sectors is realised, on the whole planning for each sector is done in isolation. Also, there is limited evidence of integration of JNNURM with other existing programmes. There is little linkage between spatial plans and infrastructure planning.

g. **Strong Reflection of National Policies and Agendas at City Level:** It is clearly evident from the fieldwork in multiple ways that national policies and agendas set at the national level have a tremendous impact at the city level. However, it was not clear why certain policies like NUTP have been mentioned, and certain others like NUSP is ignored. One of the possible reasons for this might be that NUSP was released only in 2008. Also, the state level directives have also been followed. While there are variations, the discourse at the national level clearly has influences at city level, though officially JNNURM does not promote specific strategies.

5.2 Recommendations

a. **Consider the Whole Range of Environmental Issues:** Currently environmental issues taken into consideration are mostly at the end of the system. Instead the cities should take into account entire gamut of environmental issues and impacts, right from resource use to efficiency of the system to the disposal of wastes. Eg in case of water, it is not sufficient think of waste water and pollution, but one needs to consider intensity of water use, and plan at the regional level.

b. **Explore, Promote and Encourage a Wide Range of Technological Systems:** It seems that cities are foreclosing certain pathways by prematurely choosing particular technologies; and these technologies might or nor be best for a particular city. There might be limited capacity and resources with the ULB to explore and pilot different technologies. Hence the government needs to actively promote different technologies and build capacities for ULB to do so.

c. **National Policies and Documents to Emphasise Outcomes and Process:** As stated earlier, national directives have a tremendous impact at city level. Hence the national policies need to emphasise broad outcomes, rather than highlighting particular strategies or technology.

d. **Build Capacities for Integrated Planning:** The ULB or other concerned government agency need to have/develop capacity for integrated planning. While different technologies or methods might be used for different parts of the cities, these need to come together at the city level.

e. **Reforms to be linked to Infrastructure Investments:** One of the ways in which the JNNURM provided for instituting sustainability considerations was through linking reforms to investments. The idea was that these reforms would make the investments in turn sustainable – in either of its dimensions. For example, one of the mandatory reforms was to levy reasonable user charges for water supply and solid waste management in order to recover O&M costs incurred on these services. However, field study reveals that while user charges for water supply have been revised, the ULB has been able to recover only about 70% of the O & M costs. Plans for further revision to ensure 100% recovery are not clear. It appears that infrastructure investments are been undertaken without full

compliance to reforms. In the successor programme to JNNURM hence, there is a case to a) incorporate the above concerns appropriately in the principles and guidelines; and b) incorporate sustainability considerations project implementation processes on ground, rather than general reforms.

5.3 Further Areas of Research

This grant was not meant to fund an entire research project, but was meant to identify further areas of research, and long term project(s). As mentioned in first chapter, this study has several limitations given the paucity of time, and there are thus several steps that can be taken to build upon this initial study. Various ways of taking this project forward are listed below:

a. **Peer Review of Sustainability Framework:** It has not been possible to get the sustainability framework reviewed. One of the first steps would be to get the checklist review from select set of practitioners and policy makers.

b. **Comparative Study across Multiple Cities:** The conclusions drawn from the field work study are limited, and cannot be meaningfully extrapolated. The study has highlighted issues at the city level, but these need to be validated before any conclusion can be drawn from them.

c. **Interviews at National and State Level:** While the linkage between different levels of government was evident, it was not anticipated that there would be such a strong relation between the different levels of government. This is thus a relevant exercise to follow up on key government officials, particularly in the central government, to understand their conceptions of sustainability, and how it has influenced roll out of JNNURM.

d. **Follow-Up Study after Couple of Years:** This study began to examine the implementation of various projects/ components in India, specifically those regarding sustainability. However, while we could examine some of these activities eg. Construction of bicycle lanes, and how assess their use, it was not possible to do so in most cases. Preliminary visits to project sites seem to indicate that the money might not have been result in construction of high quality assets. Thus it would be useful to revisit the years after a couple of years to examine whether the specific projects related to sustainability were carried out. It would also be useful to examine whether the imagination of the government officials were fulfilled, e.g. the current imagination is that increase in coverage of sewerage and storm water drainage will result in decreased water pollution levels.

e. **Exploration of Different Technological Systems:** As mentioned in the earlier sections, technology selection is an important component. There needs to be in-depth study where different technological options for each sector are considered, and appropriateness for various sites should be understood.

f. Planning and Governance: While sustainability concerns need to be integrated in programmes like JNNURM, integration with specific programmes would not be sufficient. Hence one needs to understand how sustainability concerns can be integrated into the larger planning and governance framework.

g. Capacity Building/ Training Programmes: This is evident that there is lack of capacity on the issue of environmental sustainability and urban infrastructure. It would be extremely fruitful to run training programmes for government officials. Since IIHS already has a Programme for Working Professionals, it would be useful to build upon this strength.

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Annex I: Details of JNNURM

A. List of Mission Cities under JNNURM

4 million plus cities (7)	Other million plus cities (28)	Other selected cities/ towns/ UAs (state capitals, of religious/ heritage/ tourism importance) (30)
1. Greater Mumbai	8. Pune	36. Srinagar
2. Kolkata	9. Surat	37. Thiruvananthapuram
3. Delhi	10. Kanpur	38. Ranchi
4. Chennai	11. Jaipur	39. Guwahati
5. Hyderabad	12. Lucknow	40. Chandigarh
6. Bangalore	13. Nagpur	41. Mysore
7. Ahmedabad	14. Patna	42. Raipur
	15. Indore	43. Bhubaneswar
	16. Vadodara	44. Jammu
	17. Coimbatore	45. Dehradun
	18. Bhopal	46. Puducherry
	19. Ludhiana	47. Ajmer-Pushkar
	20. Kochi	48. Ujjain
	21. Vishakhapatnam	49. Nanded
	22. Agra	50. Bodhgaya
	23. Varanasi	51. Mathura
	24. Madurai	52. Tirupati
	25. Meerut	53. Shillong
	26. Nashik	54. Imphal
	27. Jamshedpur	55. Aizawl
	28. Jabalpur	56. Haridwar
	29. Asansol	57. Nainital
	30. Dhanbad	58. Porbandar
	31. Faridabad	59. Agartala
	32. Allahabad	60. Puri
	33. Vijayawada	61. Shimla
	34. Rajkot	62. Panaji
	35. Amritsar	63. Kohima
		64. Itanagar
		65. Gangtok

B. Eligible Sectors and Projects under JNNURM

The sectors and projects eligible for JNNURM assistance under **UIG sub-mission** are as follows:

1. Urban renewal, that is, redevelopment of inner (old) city areas, including:
    a. Widening of narrow streets
    b. Shifting of industrial and commercial establishments from non-conforming (inner city) areas to conforming (outer city) areas to reduce congestion
    c. Replacement of old and worn out pipes by new and higher capacity ones
    d. Renewal of the sewerage, drainage, and solid waste disposal system etc.
2. Water supply (including desalination plants) and sanitation
3. Sewerage and solid waste management
4. Construction and improvement of drains and storm water drains
5. Urban transportation including roads, highways, expressways, MRTS, and metro projects
6. Parking lots and spaces on PPP basis
7. Development of heritage areas
8. Prevention and rehabilitation of soil erosion and landslides only in cases of special category States where such problems are common
9. Preservation of water bodies

The sectors and projects eligible for JNNURM assistance under **BSUP sub-mission** are as follows:

1. Integrated development of slums, housing and development of infrastructure projects in slums in the identified cities
2. Projects involving development, improvement, and maintenance of basic services to the urban poor
3. Slum improvement and rehabilitation of projects
4. Projects on water supply, sewerage, drainage, community toilets, and baths etc.
5. Projects for providing houses at affordable cost for slum dwellers, urban poor, economically weaker sections (EWS) and lower income group (LIG) categories
6. Construction and improvement of drains and storm water drains
7. Environmental improvement of slums and solid waste management
8. Street lighting
9. Civic amenities like community halls, child care centres etc.
10. Operation and Maintenance of assets created under this component
11. Convergence of health, education and social security schemes for the urban poor

C. Objectives of JNNURM

The objectives of the JNNURM are to ensure that the following are achieved in the urban sector:

a) Focussed attention to integrated development of infrastructure services in cities covered under the Mission
b) Establishment of linkages between asset-creation and asset-management through a slew of reforms for long-term project sustainability
c) Ensuring adequate funds to meet the deficiencies in urban infrastructural services
d) Planned development of identified cities including peri-urban areas, outgrowths and urban corridors leading to dispersed urbanisation
e) Scale-up delivery of civic amenities and provision of utilities with emphasis on universal access to the urban poor
f) Special focus on urban renewal programme for the old city areas to reduce congestion
g) Provision of basic services to the urban poor including security of tenure at affordable prices, improved housing, water supply and sanitation, and ensuring delivery of other existing universal services of the government for education, health and social security.

D. Expected Outcomes of JNNURM

a) Modern and transparent budgeting, accounting, financial management systems, designed and adopted for all urban service and governance functions
b) City-wide framework for planning and governance will be established and become operational
c) All urban residents will be able to obtain access to a basic level of urban services
d) Financially self-sustaining agencies for urban governance and service delivery will be established, through reforms to major revenue instruments
e) Local services and governance will be conducted in a manner that is transparent and accountable to citizens
f) E-governance applications will be introduced in core functions of ULBs/Parastatal resulting in reduced cost and time of service delivery processes.

E. Reforms under JNNURM

Mandatory Reforms at the Level of ULBs/ Parastatal Agencies

a) Adoption of modern accrual-based double entry system of accounting in ULBs and parastatal agencies
b) Introduction of a system of e-governance using IT applications
c) Reform of property tax with GIS
d) Levy of reasonable user charges by ULBs and Parastatals
e) Internal earmarking, within local bodies, budgets for basic services to the urban poor
f) Provision of basic services to the urban poor

Mandatory Reforms at the Level of States

a) Implementation of 74thConstitutional Amendment Act
b) Repeal of ULCRA
c) Reform of Rent Control Laws
d) Rationalisation of Stamp Duty
e) Enactment of the Public Disclosure Law
f) Enactment of the Community Participation Law
g) Assigning or associating elected ULBs with "city planning function"

Optional Reforms (common to States, ULBs and Parastatal Agencies)

a) Revision of bye-laws to streamline the approval process for construction of buildings, development of site etc.
b) Simplification of legal and procedural frameworks for conversion of land from agricultural to non-agricultural purposes
c) Introduction of Property Title Certification System in ULBs
d) Earmarking at least 20-25 per cent of developed land in all housing projects (both public and private agencies) for EWS and LIG category with a system of cross subsidisation
e) Introduction of computerised process of registration of land and property
f) Revision of byelaws to make rain-water harvesting mandatory in all buildings and adoption of water conservation measures
g) Byelaws for reuse of recycled water
h) Administrative reforms
i) Structural reforms
j) Encouraging PPP

F. Analysis of Funding Under JNNURM

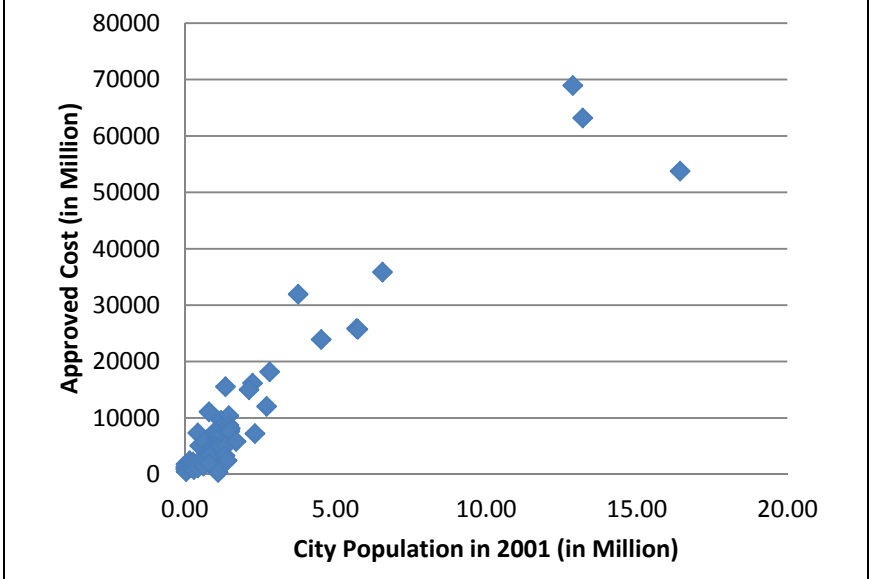
All financial and other data on JNNURM is regularly updated on a website dedicated to the mission (http://jnnurm.nic.in/). This section presents key analysis of the financial data available from the government website.

Utilisation vs. City Size

Analysis of funding under JNNURM was carried out to discern pattern between approved and utilised costs against population size and state. These graphs have been presented in the Annex, but some significant findings from the analysis are:

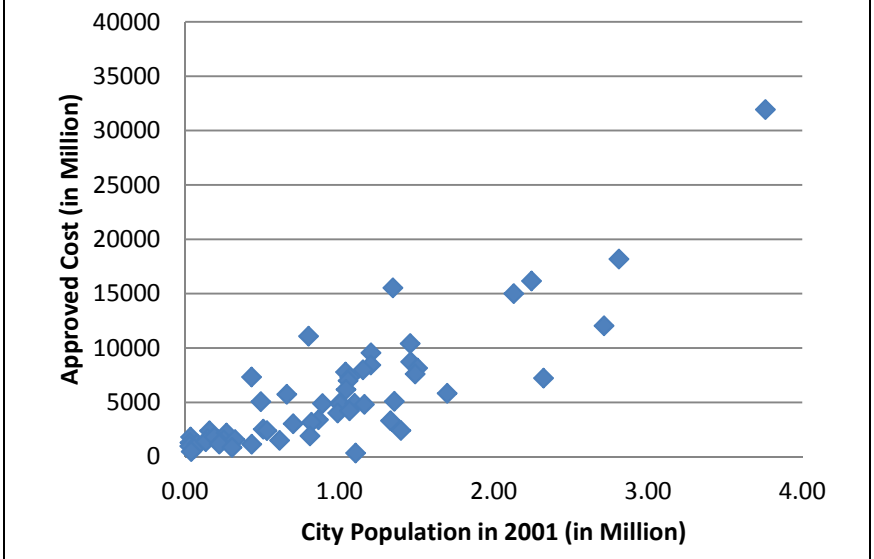
Reported data on 65 cities on the JNNURM website shows that total utilisation under the mission has been 361,101 million rupees against total approved cost of 622,508 million. Analysis of funding patterns (with data available on http://jnnurm.nic.in/ as on 28th September 2012) indicates that the total amount of funding approved is proportional to the city size in general (refer Fig. A and Fig. B). Hence, the per capita approved cost, apart from few outliers, is below Rs. 10,000 (Fig. C). Per capita utilisation for most of the cities is below Rs. 5,000 indicating average 50 per cent utilisation as compared to approved cost (Fig. D). While per capita costs can be one of the indicators of meaningful distribution of funds, there are a couple of factors to be taken into account. Most of the previous government schemes have been implemented in bigger cities and these cities have also had access to multilateral assistance, as also private investments.

Fig. A: City Population vs. Approved Cost



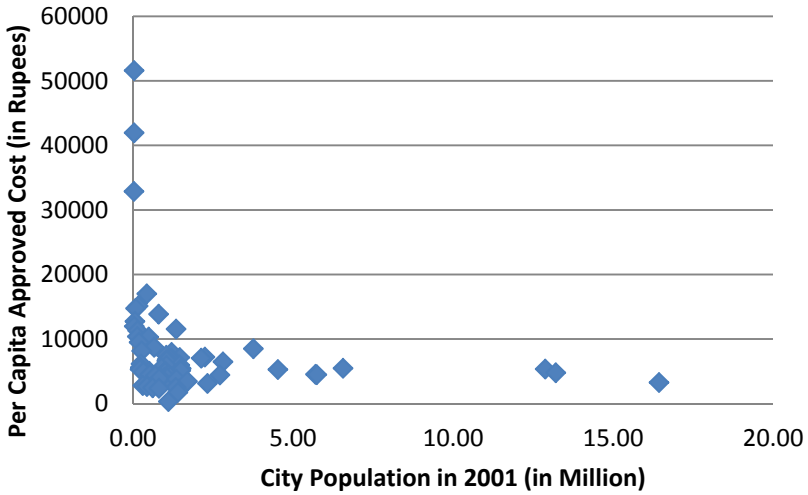
Source: Analysis of data sourced from http://jnnurm.nic.in/, September 2012; Census of India, 2001.

Fig. B: City Population vs. Approved Cost (< 4 million cities)



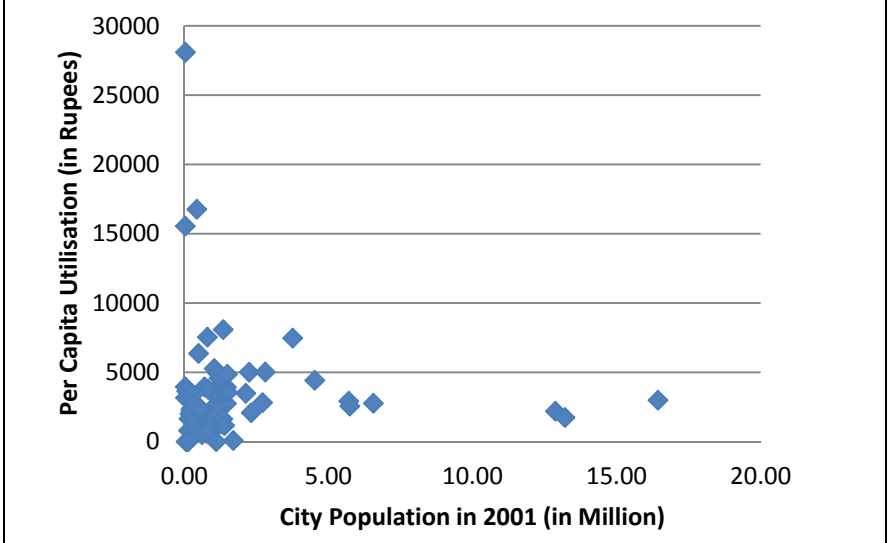
Source: Analysis of data sourced from http://jnnurm.nic.in/, September 2012; Census of India, 2001.

Fig. C: City Population vs. Per Capita Approved Cost



Source: Analysis of data sourced from http://jnnurm.nic.in/, September 2012; Census of India, 2001.

Fig. D: City Population vs. Per Capita Utilisation

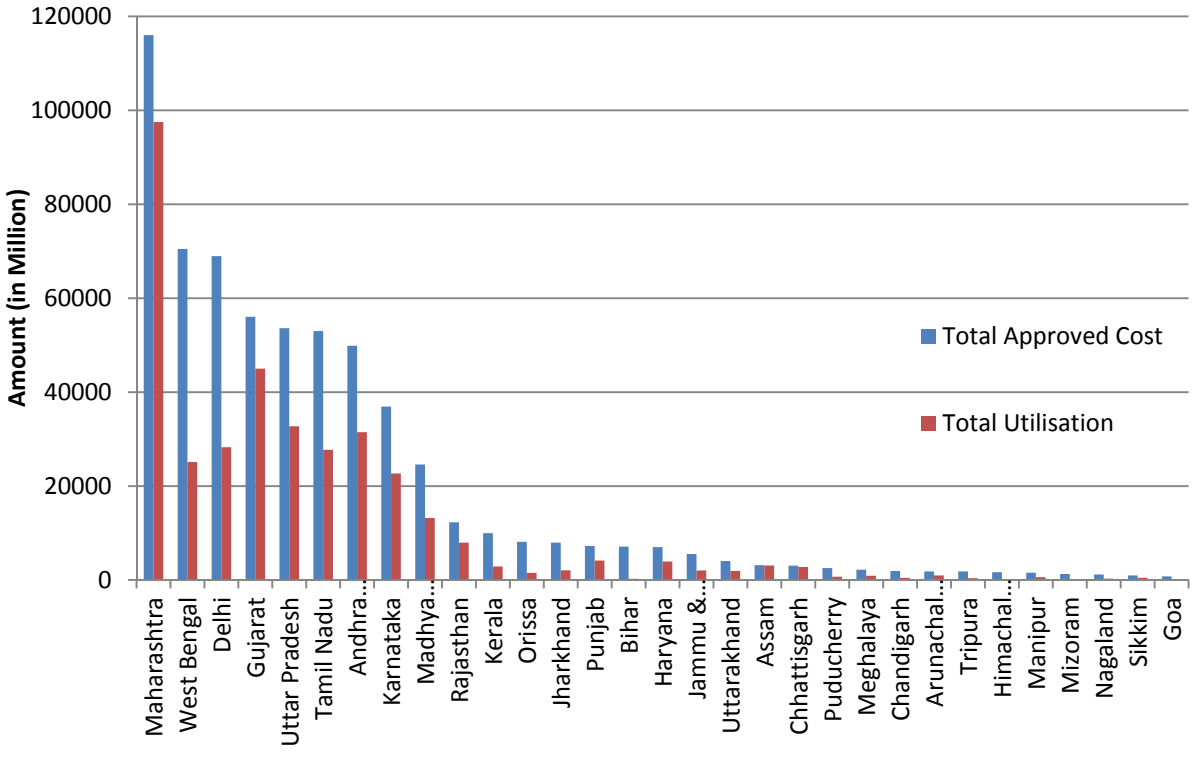


Source: Analysis of data sourced from http://jnnurm.nic.in/, September 2012; Census of India, 2001.

Utilisation vs. State Level of Urbanisation

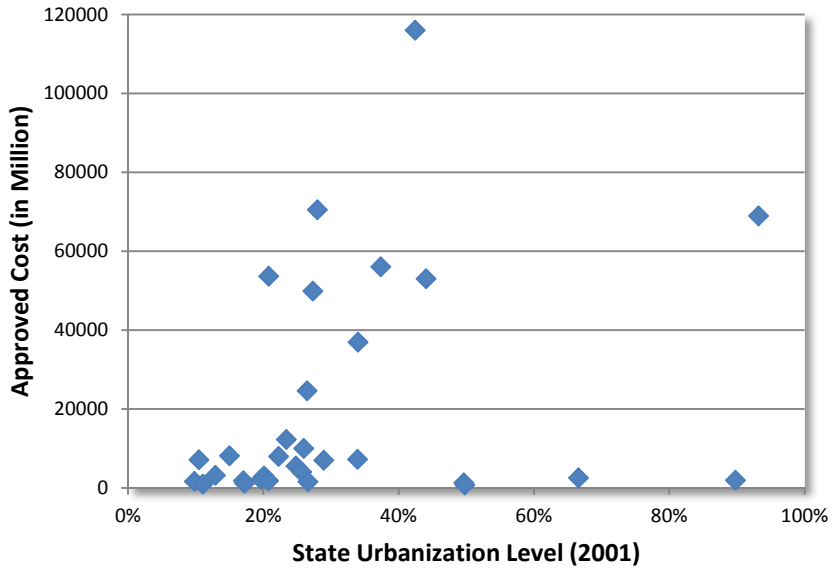
The state-wise approved costs and total utilisation are given below (Fig. E). Analysis of state-wise funding and levels of urbanisation do not show any correlation (Fig. F).

Fig. E: Total Approved Cost and Utilisation across States



Source: Analysis of data sourced from http://jnnurm.nic.in/, September 2012.

Fig. F: State Urbanisation Level vs. Approved Cost



Source: Analysis of data sourced from http://jnnurm.nic.in/, September 2012; Census of India, 2001.

Annex 2: Review of Urban Policy Framework in India

Although there were a few government schemes directed at urban India since independence, and a renewed interest in urban areas since 1980s, the Indian government has only recently recognised the importance of urbanisation (Sivaramakrishnan, 2011). A review of the urban policy framework in India, with a special emphasis on urban sustainability of infrastructure, is presented below.

A. Urban and Infrastructure Development in Five Year Plans[5]

A review of the Five Year Plans[6], the primary instrument of planning in India, shows that though there were some investments made towards infrastructure development in urban India since independence, rural and industrial development was the primary focus of public investment for the first three decades.

The First Plan laid stress on surveys of urban conditions and the preparation of master plans for cities. The Plan also provided for subsidised housing schemes and advocated slum clearance. Provisions of environmental services were dealt under the health component and Public Health Engineering Departments were created in the states to provide for the same. The Second Plan highlighted the need for developing competent staff and strengthening local government, while the Third Plan called for the preparation of regional and urban development plans. By the end of the Third Plan period, almost all the states had introduced town planning legislation. Environmental improvements in slums gained importance and provisions for water supply and sanitation were also made separately under the health budget. The Fourth Plan recognised the concept of minimum needs, and asked for fulfilment of these needs. Water and Sanitation was moved from the Ministry of Health to the Ministry of Works and Housing.

Urban development was recognised as a separate subject only in the Fifth Five Year Plan of 1974. The Fifth Plan (1974-79) concentrated on completion of earlier programmes. Slum Improvement was made a part of the Minimum Needs Programme (MNP). The MNP continued in the Sixth Five Year Plan (1980-85), and the focus for water and sanitation was on completion of spill over programmes. This Plan emphasized the crucial linkage between water, sanitation and housing, and also focused on small and medium size towns. In 1981, the GoI launched the Integrated Low Cost Sanitation (ILCS) programme with an aim to abolish manual scavenging. During the Seventh Five Year Plan (1985-1989), the Urban Basic Services Programme (UBSP) was launched in collaboration with UNICEF, while the Environmental Improvements of Urban Slums Programme (EIUSP) continued under the MNP. In 1985, the National Commission for Urbanisation was constituted that submitted its report in 1988.

In 1990-91, the UBS scheme was revised to bring about functional integration with EIUS and came to be known as Urban Basic Services for the Poor (UBSP) with 100 per cent central funding. The focus was on integration of projects and converting dry latrines to remove scavengers. In 1996, the GoI

[5] Based on Government of India Planning Commission's Five Year Plans Documents accessed at http://planningcommission.nic.in/plans/planrel/fiveyr/welcome.html, September 2012.

[6] Five Year Plans are developed by the Planning Commission, Government of India. These plans guide the socio-economic development of India by indicating investment across sectors.

launched National Slum Development Programme (NSDP) with the objective of upgrading urban slums by providing physical, social amenities and shelter upgrading.

The Ninth Five Year Plan (1997-2002) emphasized the strong linkages between sanitation and health. Alongside government schemes, the 1990s witnessed a range of donor funded projects taking off in various cities. During the same time, recognising severe gaps in infrastructure provision, the GoI constituted an expert group on the Commercialisation of infrastructure projects in 1996. In 2001, the GoI launched VAMBAY with the primary objective of facilitating construction and upgradation of dwelling units in slums and to provide a healthy and enabling urban environment through community toilets under the Nirmal Bharat Abhiyan (Clean India Campaign).

The Ninth Plan was the first plan to highlight the goal of developing economically efficient, socially equitable, and environmentally sustainable entities as a core objective. In this way, the Planning Commission begins to adopt the language of the Green Agenda for urban sustainability.

With regards to the environmental sector, the Tenth Plan (2002-2007) continued on the same trajectory as the Ninth Plan. On the other hand, for the housing and urban affairs sector, the Tenth Plan began to address urban poverty alleviation and slum upgrading, issues which were targeted by JNNURM. The Eleventh Plan, still under implementation, uses JNNURM as the tool for achieving balanced and sustainable urban development.

The approach paper to the XII Five Year Plan recognises the potential of Indian urbanisation to enable growth and employment creation, along with the potential for synergistic rural-urban linkages. It also highlights the severity of urban India's challenges, and hence places a high priority on urban development. Key intervention areas identified by the Planning Commission include: long-term urban and regional planning, investment in new urban infrastructure assets and maintenance of assets with separate budget for O&M expenditure, strengthening urban governance, strengthening soft infrastructure along with building hard infrastructure, addressing basic needs of the poor and ensuring environmental sustainability of urban development.

Sustainability concerns are explicit in the Twelfth Plan. It calls for ensuring the environmental sustainability of urban development through the creation of an institutional mechanism for convergent decision-making. The Plan specifically recommends for improved water management, including recycling of waste water in large cities and new townships, and strengthening of public transport, especially in under-served urban centres.

B. Landmarks in Urban and Infrastructure Development

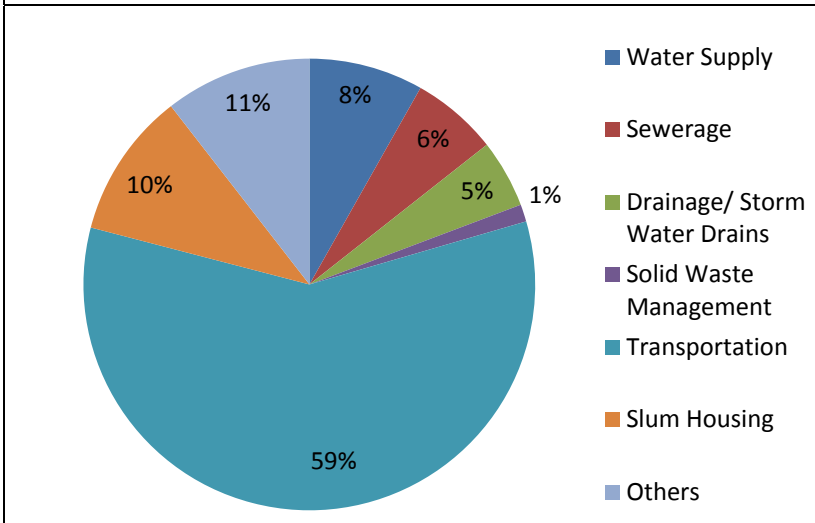
The National Commission on Urbanisation was set up in 1985 under the chairmanship of Charles Correa to understand the process of India's urbanisation and make recommendations for the same. Released in 1988, NCU report called for balanced and sustainable development of urban centres in the city. The recommendations of NCU Report were essentially advisory in nature. No effort was made at either central or at state level to implement them and the exercise remained on paper (Planning Commission, 2007). About a decade after NCU, the GoI constituted the expert group on the Commercialisation of infrastructure projects in 1996 under the chairmanship of Dr. Rakesh

Mohan. The group identified serious deficiencies in terms of access to facilities, the lack of O & M, and a huge gap in investment. Lack of investment was attributed to two reasons: limited financial capacity of the government and the services being not financially sustainable on their own. An important issue the report stressed was the need of an independent regulator with statutory powers for each sector. Moreover, it clearly recommends the separation of regulatory and operator roles (MoF, 1996).

While urban infrastructure received attention in various plans and programmes, it was only in 2005 that a concerted effort was made to provide for urban infrastructure services. JNNURM was launched in order to cater to the infrastructure demands of cities. It linked funding for provision of infrastructure with the implementation of reforms. It made available funding for cities to invest in water supply, sewerage, drainage, solid waste management and urban transportation. Provision of basic services to the urban poor was given due importance in the JNNURM (MoUD and MoUEPA, 2005a).

The High Powered Expert Committee (HPEC) was set up by MoUD in 2008 for estimating investment requirements for the provision of urban infrastructure services. Recognising inevitability of urbanisation, and deficit of services in urban areas, the Committee made recommendations on how to deal with the challenge. It has projected huge investment requirements for providing public services to specified norms and also supporting the growth process 0.7 per cent of GDP in 2011-12 to 1.1 per cent by 2031-32. It also proposed framework for governing and financing such infrastructure and public services. The Committee has estimated an overall funding of 39,18,670 crores to be spent over 25 years. This implies 35 times increase in investment as compared to investments made under JNNURM (HPEC, 2011). A shift in the proposed sectoral composition can be seen with almost 60 per cent of the investment to be made in transportation sector. The focus of the transport projects, however, remains on roads. The HPEC recommendations seem to continue to allocate substantial funding to the larger cities.

Fig. G: Sector-wise Urban Infrastructure Requirement as proposed by HPEC (2012-31)



Source: HPEC, 2011.

The HPEC made a case for a comprehensive framework for urban policy and planning to be achieved through increased investment in urban infrastructure provision and maintenance, renewal and development of urban areas including slums, regional and metropolitan planning, integration of transportation and land use planning, provision of services to the urban poor, institutional reforms and decentralisation. The HPEC has also proposed for New and Improved JNNURM (NIJNNURM) with hundred per cent coverage and increased outlay (HPEC, 2011).

C. Sectoral Policies and Programmes

A brief review of national policies, programmes and schemes under each sector is presented below; implications to sustainability are discussed.

Water Supply

Water supply and Sanitation are State Subjects according to the Indian Constitution[7]. However, the Government of India, provides considerable financial and technical assistance to States, and hence exercises considerable influence by developing guidelines to implement projects using GoI resources. The Union Government also provides advisories and directives from time to time.

There is no national level policy for urban water supply in India. The National Water Policy, 2002 and subsequent Draft National Water Policy, 2012 briefly talked about urban water supply and sanitation and suggested use of surface water for urban domestic water supply. It recommends the re-use of treated water for secondary purposes and integration of water and sewerage schemes.

The Central Public Health and Environmental Engineering Organization (CPHEEO) sets out norms for planning, design construction, O & M and environmental protection for water supply systems. These norms are typically necessary to follow in accessing funding from Govt. of India schemes. Also various baseline criteria for water quality have been put in place by the Central Pollution Control Board (CPCB) of the Government of India.

The government of India launched a Service Level Benchmarking Initiative for environmental services: water, waste water, solid waste and drainage. A Handbook on Service Level Benchmarking (SLB) was developed and released by the MoUD in 2008. It identified minimum set of standard performance parameters for the environmental services; defined a common minimum framework for monitoring and reporting on these indicators; and set out guidelines on operationalizing this framework in a phased manner. The National Urban Water Awards are presented by the Government of India to recognise best efforts in water supply services since 2008.

[7] The Constitution of India provides for legislative subjects under three Lists: List 1 ('Union list' containing subjects for Parliamentary legislation and Central authority), List II (or the 'State List' containing entries which are matters of state legislation and state authority) and List III ('Concurrent List', over which both Union and states have authority and can be subjects of legislation by both legislatures)

The intention of the SLB initiative is to enable the cities to benchmark their current status against a set of parameters, and also measure their progress. The initiative will create consensus on desired service standards, enable comparisons across time and cities, highlight and help address issues of data quality, and enable ULBs to self-report. The emphasis is placed on performance improvement planning based on the SLB data generated. The indicators do not talk about environmental sustainability explicitly but focus on the coverage of environmental services and efficiency in cost recovery.

Service level benchmarks for water supply sector are presented in Box A.

Box A: Service Level Benchmarks in Water Supply Sector	
Coverage of water supply connections	100%
Per capita supply of water	135 lpcd
Extent of metering of water connections	100%
Extent of non-revenue water	20%
Continuity of water supply	24 hours
Quality of water supplied	100%
Cost recovery in water supply services	100%
Efficiency in redressal of customer complaints	80%
Efficiency in collection of water supply-related charges	90%
Source: MoUD, 2010.	

Recognising the importance of water supply, the government has put in place several central programmes and schemes urban water supply. Launched in 1993-94, The centrally sponsored scheme Accelerated Urban Water Supply Program (AUWSP) was meant to finance the infrastructure for safe and adequate water supply facilities to urban population of the towns having population less than 20,000 (as per 1991 Census) (MoUD, 1994). The underlying objectives of the program were to improve the environment and the quality of life, and to enhance socio-economic conditions and productivity to sustain the economy of the country. The program emphasised rationalisation of tariffs, increased investment in water supply sector, extension of subsidies to target groups, water conservation, and operation and maintenance (O&M). Distribution systems were given priority over new capital works along with leak detection and preventive maintenance and rehabilitation of existing system (MoUD, 1994). The programme has been subsumed under UIDSSMT (JNNURM) since 2005.

Another Centrally sponsored scheme of Integrated Development of Small & Medium Towns (IDSMT) initiated in the year 1979-80 and subsequently subsumed in the UIDSSMT Scheme (JNNURM) in 2005, also provided funding for water supply projects to towns/cities with an urban local body and population upto 5 lakhs (MoUD, n.d.). The underlying premise of IDSMT was that investment in the development of small urban centres would help in reducing migration to large cities and support the growth of surrounding rural areas as well. The scheme aimed at improving infrastructural facilities and helping in the creation of durable public assets; decentralising economic growth and employment opportunities and promoting dispersed urbanisation; increasing the availability of serviced sites for housing, commercial and industrial uses; integrating spatial and socio-economic planning as envisaged in the Constitution (74th Amendment) Act, 1992; and promoting resource-generating schemes for urban local bodies to improve their overall financial position.

Mega cities (Mumbai, Kolkata, Chennai, Bangalore and Hyderabad) also received central assistance for water supply under the programme called 'Infrastructure Development in Mega Cities'. This programme is on-going Check. In addition to the programmes and schemes discussed, water supply has been provided to the slums and urban poor through a number of other schemes discussed later.

In addition, there are a number of smaller schemes for specific regions (north-eastern urban areas) and towns for specific improvements in water systems including Lump Sum Provision for the Projects/Schemes for the Benefit of North-Eastern States including Sikkim and Urban Infrastructure Development Scheme in Satellite Towns.

Sanitation and Sewerage

Along with investments in water supply, the AUWSP used to fund limited investments in sewerage systems in Indian cities – especially since sewerage was assumed the only solution suitable for urban India until the mid-2000s when on-site sanitation was recognized as a legitimate alternative, and found a place in the National Urban Sanitation Policy (NUSP) formulated in 2008.

The aim of NUSP is to transform urban India into "community-driven, totally sanitised, healthy and liveable cities and towns". The goals of the Policy are to generate awareness of environmental health and change behavior to adopt healthy sanitation practices; achieve open-defecation free cities and sanitary and safe disposal; re-orient institutions to mainstream sanitation; and promote proper operation and maintenance of sanitation facilities. It stresses on the outcomes of universal coverage and 100% treatment of waste, but does not stipulate a particular method. It also recommends looking beyond conventional sewerage systems, stresses process, and hence recommends constitution of a City Sanitation Task Force for each city, preparation of City Sanitation Plans and State Urban Sanitation Strategies. The projects identified under CSPs are to be funded wherever possible from existing schemes like JNNURM UIG and UIDSSMT.

Rapid implementation of these plans is encouraged through a national award scheme that rewards cities based on outcomes. While this policy pertains to management of human excreta and associated public health and environmental impacts, it recognises that integral solutions need to take account of other elements of environmental sanitation, i.e. solid waste management; generation of industrial and other specialized / hazardous wastes; drainage; as also the management of drinking water supply.

The Policy has several implications for urban sustainability. Hundred per cent coverage and open-defecation free cities would mean increased access to safe sanitation and reduction in water contamination, both of which would lead to improved health outcomes. It also suggests recycling and reusing treated wastewater for non-potable uses, which conserves water. Providing for operation and maintenance of the system through levy of tariffs and proper revenue collection has been recommended in the policy to ensure financial sustainability. The policy addresses the needs of the urban poor by highlighting the disease burden caused by inadequate sanitation, and prioritises 100% coverage of all urban residents, including homeless.

In parallel, the service level benchmarking initiative also proposed for sewerage and sanitation sector, indicators for coverage and proper collection and treatment. The other benchmarks are as given in Box B.

Box B: Service Level Benchmarks in the Sanitation Sector	
Coverage of toilets	100%
Coverage of sewage network services	100%
Collection efficiency of the sewage network	100%
Adequacy of sewage treatment capacity	100%
Quality of sewage treatment	100%
Extent of reuse and recycling of sewage	20%
Efficiency in redressal of customer complaints	80%
Extent of cost recovery in sewage management	100%
Efficiency in collection of sewage charges	90%
Source: MoUD, 2010.	

Sanitation rating exercise for Class I cities was also commissioned by the MoUD in the year 2009. The key indicators used in the exercise included: no open defecation, adequate public sanitation facilities, elimination of manual scavenging, increasing proportion of safely collected, treated and disposed excreta, and increasing recycling and reuse of treated waste water. Process related indicators included: monitoring and evaluation systems to track incidences of open defecation, proper functioning of sewerage systems, transportation and disposal of septage from on-site systems. Outcome related indicators include: quality of drinking water, water quality in water bodies in and around city, and reduction in water borne diseases (MoUD, 2009a).

Like for water and other environmental services, there is no dedicated urban sanitation investment programme at the national level, and JNNURM/ UIDSSMT are the primary funding lines.

Storm Water Drainage

Storm water drainage in India has not received dedicated attention in either the policy framework or national programmes. Storm water drainage projects were subsumed under the JNNURM/UIDSSMT schemes as infrastructural services. The service level benchmarks have been set for the sector by MoUD recently.

Box C: Service Level Benchmarks in Storm Water Drainage Sector	
Coverage of storm water drainage network	100%
Incidence of water logging/flooding	0
Source: MoUD, 2010.	

Key indicator used under sanitation rating exercise include: proportion of total storm water and drainage that is efficiently and safely managed, storm water drainage systems functioning and maintained (MoUD, 2009a).

Solid Waste Management

While there is no national policy on solid waste management, the Municipal Solid Wastes (Management and Handling) Rules stipulate the standards in the sector. These rules were formulated by the Ministry of Environment and Forests in 2000 and are applicable to every municipal authority. The Rules recommend segregation of waste through community participation; prohibit manual handling of the waste, and mandates covered vehicles to be used for transportation

of waste. Landfilling has been restricted to non-biodegradable, inert waste and other waste that are not suitable either for recycling or for biological processing. The rules also lay out minimum standards for water and air quality in order to prevent pollution.

Service level benchmarks for solid waste management are given in Box D. Key indicators used in sanitation rating include: proportion of total solid waste generation that is regularly collected, treated and safely disposed, no adverse impacts on surrounding areas outside city limits, and efficient solid waste management (collection and treatment) (MoUD, 2009a).

Box D: Service Level Benchmarks in Solid Waste Management Sector	
Household level coverage of solid waste management services	100%
Efficiency of collection of municipal solid waste	100%
Extent of segregation of municipal solid waste	100%
Extent of municipal solid waste recovered	80%
Extent of scientific disposal of municipal solid waste	100%
Efficiency in redressal of customer complaints	80%
Extent of cost recovery in SWM services	100%
Efficiency in collection of SWM charges	90%
Source: MoUD, 2010.	

Transportation

Realising the growing problems in mobility on the one hand and its importance in accelerating economic growth and improving quality of life on the other, National Urban Transport Policy (NUTP) was formulated in 2006.

The policy envisions people-centric transportation plans, liveable cities and evolution of appropriate urban form`. The objective is to ensure access to safe, affordable, quick, comfortable, reliable and sustainable transportation for all urban residents. It aims to achieve this through integrating land use and transport planning, equitable allocation of road space with people as focus and not vehicles, promoting and reserving lanes for public transportation, providing infrastructure for non-motorized transport, disincentivising private car use, improving access to business areas and planning for freight traffic. The policy also recommends for reducing pollution through change in travel practices and use of cleaner technologies. Institutional and financial mechanisms and capacity building have been proposed to realise the objectives of the policy; importance of pilot projects has been highlighted.

The policy has both direct and indirect implications for urban sustainability. Direct impacts include possible reduction in emissions due to decrease in use of personal vehicles, increase in public transportation and non-motorised vehicles. The policy will also make transportation more equitable by increasing access, and possibility improved road safety. Possible indirect impacts include restriction of urban sprawl by designing of transportation system, which encourages growth around itself.

Service level benchmarks for urban transport have been developed by the MoUD that evaluate level of services in urban transport on the basis of presence of public transport, pedestrian infrastructure, non-motorised transport facilities, travel speed along major corridors, availability of parking spaces,

road safety, pollution levels, integrated land use transport system, and financial sustainability of public transport.

There have not been any national level programmes on urban transportation except Infrastructure Development in Mega Cities and IDSSMT and subsequently JNNURM.

D. Infrastructure and Urban Poverty in India

As discussed in the section on Five Year Plans, infrastructure provision to the urban poor has taken place through a number of schemes and programmes including EIUS, UBSP, NSDP, VAMBAY, etc. Since JNNURM all these schemes and programmes have been subsumed under JNNURM for mission and non-mission cities (BSUP and IHSDP respectively).

Realising the growing problem of slums and the limitations of piecemeal programmes and schemes, MoHUPA launched RAY in 2009 with the vision of a "Slum free India", aiming to tackle the challenge of slums and accessible shelter in urban areas. The program hopes to bring slums within the formal system, address failures of the formal system, and tackle the challenge of shortage of land and housing.

RAY lays down conditionalities for the States to access funding through the program; the critical conditionality being security of tenure and legal title to the poor. It also stresses the implementation of three pro-poor reforms under JNNURM: internal earmarking within local body budgets for basic services to the urban poor; provision of basic services to urban poor, and earmarking at least 20-25 per cent of developed land in all housing projects (both public and private agencies) for housing for economically weaker segments and lower income groups. It also requires each state to prepare a Plan of Action for Slum Free Cities, and a specific plan for identified cities. The states also need to commit to a 'whole-city' approach.

The support from the Government of India would include financial and technical support. RAY is also significant because though it lays out a particular methodology of process to be followed, it is agnostic about specific solutions taken up by the city, and approves of a whole range of models from in-situ slum upgradation to low cost housing.

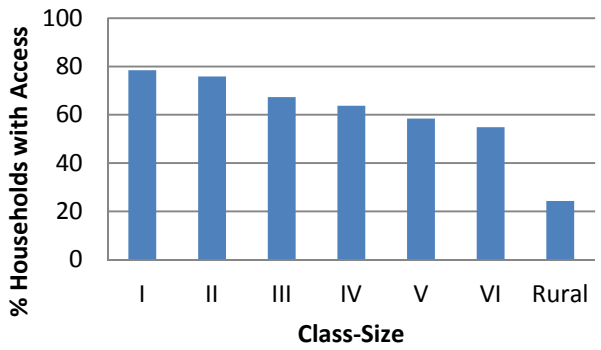
The scheme essentially is in the framework of equity and access to housing and sanitation services. The environmental aspects of sustainability do not feature explicitly. The scheme, however, emphasises on the provision of total sanitation with individual water sealed toilets and water connections to each household. Provision of total sanitation in slums is in line with the objectives of the NUSP. The scheme also calls for reconfiguration of slums based on the plan for internal infrastructure giving due importance to the provision of infrastructure in the first place.

Annex 3: Overview of Sectors in India

A. Water Supply

India is ranked as one of the lowest domestic and industrial water users in per capita terms (Amarasinghe et al. 2005). According to the 2001 Census, 64% of urban population is covered by individual connections and stand-posts. More than 20 million people do not have access to safe water supply in India (Census of India, 2001; Singh, Upadhyay and Mittal, 2010). Class-wise data indicates how access to household water connection varies across different class sizes.

Fig. H: Access to Household Water Connection (2001)



Source: Census of India, 2001.

While the planning/design norm as per the Centre of Public Health and Engineering Organisation (CPHEEO) is at 135 litre per capita per day (lpcd), approximately 203 of the Class I towns in India have per capita availability less than 100 lpcd (CPCB, 2009). The agency decides on extraction, quantities and supply channels based on accepted norms and water resource allocations. Typically, water is supplied for just one to three hours per day, regardless of the quantity available, or in some cases, water supply is only on alternate days. There are wide seasonal variations as well. There are also wide variations within a city as there are often piped water services that are not extended to the entire city (NIUA, 2005).

The existing piped infrastructure suffers from a high degree of operational inefficiencies with approximately 40-50 per cent of the water pumped into the system being not available for consumption since it is lost in transmission, through theft, and so on (Singh, Upadhyay and Mittal, 2010; CGWB, 2011). Many large Indian cities have to source water from long distances ranging from 50 to 200 km due to exhaustion or pollution of nearby sources (CSE, 2012). This increases the cost of raw water and enhances the possibility of leakage during transmission. Significant dependence on groundwater is reported in most Indian cities irrespective of the size (Datta, 2005; CSE, 2012). Almost 50% of urban water demand is met by groundwater sources (ibid).

Though the predominant mode in Indian cities remains that of centralised pipe water supply provided by the concerned government agency, the real picture is more varied and complex. Due to limited coverage in terms of actual infrastructure and services, end-users access other modes of supply like self-supply (surface/ground water extraction through own asset), tanker supplies (usually sourced from peri-urban bore-wells) or communal water sources (ponds, lakes, etc.) (Srinivasan, 2008). The decision-making agents in the different modes of supply (other than the ULB) are mostly private parties, comprised of households and small business, with a few larger business entities in the packaged water market. Studies on coping strategies by households also point to the discerning ability of households to differentiate quality of water in each supply-mode and optimise access

(Srinivasan, 2008). Temporal variability of centralised water supply has also been reported in some of the urban centres and resultant gaps are satisfied by alternate modes of supply (ibid).

There are over 20 million private wells in India in addition to the government tubewells (Datta, 2005). Unregulated groundwater use and pollution generation has crossed sustainable limits in many parts of the country (Datta, 2005). While there is a mix of surface and groundwater supply in the city cores, peripheral areas and city extensions essentially depend on ground water (CGWB, 2011).

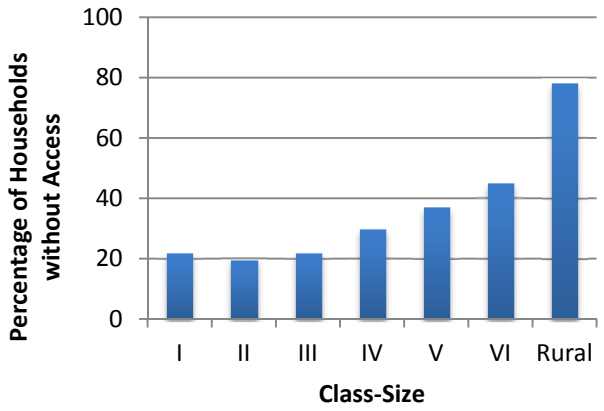
The limited infrastructure for wastewater collection and treatment (only 30% of urban wastewater is safely treated according to CPCB, 2009) has rendered surface water sources within the city boundaries polluted and unsafe and also contaminated the groundwater making it unfit for domestic consumption.

Urban local bodies and utilities are plagued by a host of management problems. Low tariffs, operational inefficiencies, and poor collection practices by the utilities have resulted in low cost recovery rates at 40-50 per cent of O&M cost in most cities (Singh, Upadhyay and Mittal, 2010). These shortcomings are compounded by the low levels of technical, financial, and managerial capacity of local governments, which are inadequate to meet the service needs of their citizens. Consumer level metering is still not the norm in most cities and, where adopted, the maintenance and functionality of meters tend to be poor.

The public sector is clearly struggling to meet the demand. There is a likelihood of this situation getting aggravated with increasing urban population, and additional demands on water. Climate change is likely to add to the woes. The story of each city may be different, but the main reasons for the water crisis are common: increasing demand, inequitable distribution of water supply, transfer losses, lack of ethical framework, inadequate knowledge and resources, major land-use changes, long term water level declines, increase in salinity and pollution (Datta, 2005; Singh, Upadhyay and Mittal, 2010).

B. Sanitation and Sewerage

Fig I. Lack of Latrines (2001)



Source: Census of India, 2001.

The 2011 Census indicates that around 81% of urban households have access to toilet facilities within the household premises, 6% access public toilets, and 12% have no access to toilet facilities and are forced to resort to open defecation. This number might be an under estimation of people without access to safe sanitation, as it also includes dilapidated toilets with non-functional waste disposal systems and highly overloaded community toilets (CSE, 2012). There is also a difference across different

classes of cities. According to 2001 Census, as much as 45% of households did not have access to latrines (Fig. I).

Almost 80% of the water supplied for domestic use comes out as wastewater (CPCB, 2009). Majority of the households in India are dependent on on-site sanitation systems, only a third of the city population is serviced by city-wide piped infrastructure. Even in cities where a sewerage system exists, the coverage is partial, and limited to affluent and planned localities. There is no reliable data on wastewater generation and collection, however, it is estimated that collection is only one third of total waste water generated (CPCB, 2009).

The sewerage systems, where they exist, are faced with multiple problems. Often the trunk sewers are laid down, but the distribution network is not connected to the main, leading to inadequate collection, and hence the system does not function properly. Sometimes, the sewerage network does not function optimally due to infiltration of storm water or solid waste. The sewers in most Indian cities are badly maintained resulting in frequent blockages, siltation, missing manhole covers, gulley pits. There is no preventive maintenance; repairs are done only in case of crisis (WSP, 2008).

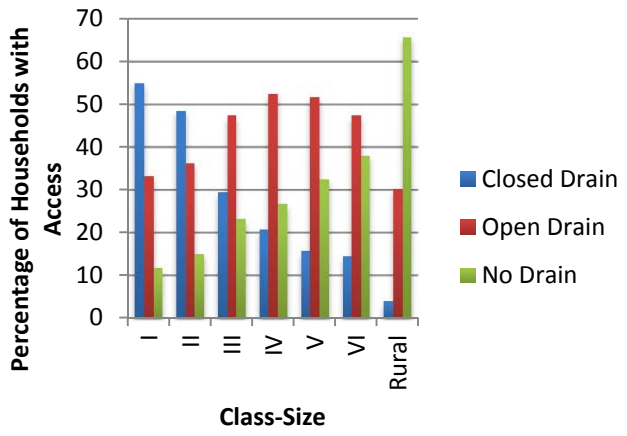
Again, there is limited data available on waste water treatment. However, a CPCB study shows that treatment capacity exists only for 30% of the total sewage generated in Class I and II cities. It is estimated that most plants work only at 70% of their capacity, and hence the total untreated sewage is estimated at 30,000 MLD. Problem is sometimes exacerbated by mixing of industrial water with domestic waste-water. There is minimal reuse/ recycling of waste water (CPCB, 2009). Moreover, 39% of plants do not conform to standard rules laid down under Environmental (Protection) Rules. Treatment plants may not function properly for a number of reasons: insufficient wastewater due to inadequate conveyance system, frequent power cuts, breakdowns due to lack of maintenance.

Disposal of sewage is the biggest point source of river pollution in India. Due to non-availability of proper collection, conveyance and treatment systems in most Indian cities, there is serious contamination in ground water and also surface water. In most cases, wastewater is let out untreated, which either sinks in the ground and potentially pollutes underground aquifers, or is transported along natural or manmade drainage channels, causing pollution in downstream areas (CPCB, 2009).

C. Storm Water Drainage

Compared to water supply and sanitation sectors, there is little data available on storm water drainage and little work has been done on this. Less than 20% of the road network is covered by storm water drains (MoUD, 2009a). According to Census 2001, 12% of households in Class I cities did not have access to drainage system; this proportion was as high as almost 40%

Fig J. Storm Water Drainage in India (2001)



Source: Census of India 2001.

for Class VI cities.

Storm water drainage in urban India is characterised by inadequate coverage. Most cities in India do not have an effective storm water drainage system in place. Growth and densification of Indian cities have ignored natural waterways on one hand and increased impermeable surfaces on the other (MoUD, 2009a). Sometime there is also illegal development on natural areas, or on drainage systems. Often, often permanent changes to the catchment are caused, leading to changes in runoff patterns. The most visible outcome is an increase in both magnitude and frequency of flooding. Flooding is a common, annual event in Indian cities.

In recent years, frequency of flooding has increased, and the issue is often in the limelight due to huge traffic jams caused. While the natural drainage system of most cities has been disrupted, the problem of flooding is also exacerbated due to ineffectiveness of storm water drainage systems, which often are clogged by debris, and poorly maintained (Mohapatra and Singh, 2003; Sharma, 2008).

Storm water drainage also poses additional health issues. As stated in the sanitation section, storm water drainage often carries sullage which is then disposed of untreated into surface water bodies. To address this issue, in some cities, major drainage channels are intercepted before reaching the water body, and treated. It involves huge investments in hardware creation and but it is usually ineffective and extremely energy consuming as the amount of water to be treated is huge.

D. Solid Waste Management

Annual generation of municipal solid waste in India is estimated to be about 115000 metric tonnes (Planning Commission, 2007). Per capita waste generation in cities varies between 0.2–0.6 kg per day and it is increasing by 1.3% per annum (Planning Commission, 2007; CPCB, 2004). With the growth in urban population, the increase in solid waste is estimated at 5% (Planning Commission, 2007). Per capita generation of solid waste is lesser in smaller cities and towns as compared to large cities and metros (CPCB, 2004). Owing to urbanisation and changing lifestyles, there has been an eight-fold increase in generation of solid waste from 1947 to 2008 (Sharholy et al. 2008).

Waste collection and safe disposal is the responsibility of the urban local body of the city. The coverage in terms of waste collection ranges from 70 per cent to 90 per cent in major metropolitan cities, and is less than 50 per cent in smaller cities (Planning Commission, 2007), average collection being almost 70% (Rathi, 2006; Sharholy et al. 2008). It is quite possible that actual collection rates are much less than the official figures. The collection efficiency in Indian cities is governed by availability of manpower and transportation facilities, which in turn are dependent on the financial situation of the urban local body. It is found that 50 per cent of the waste is collected manually (CPCB, 2000); this poses health hazards to the workers on-site.

Besides low collection rates, there are other problems. Though the proportion of organic waste to total waste is much higher in India (about 60%) as compared to other countries, segregation at source is rarely practised (UN-HABITAT, 2010). The proportion of recyclable material in collected

waste is also low because of segregation and collection being done by rag pickers generation sources, collection points and disposal sites (Sharholy et al. 2008).

The collected waste is transported to disposal sites to processing or disposal sites through a variety of vehicles, either owned by the municipal body or private contractor. Collection and transportation of waste constitute about 80-95 per cent of total expenditure in solid waste management (Sharholy et al. 2008).

Land-filling is the most common method of solid waste disposal practised in India. Even with a high proportion of organic waste providing an opportunity for composting, the burden on landfill sites is huge because less than 30% of solid waste is segregated (MoUD, 2009a; Planning Commission, 2007). Disposal practices at the open dumping sites are highly unscientific and hazardous for the on-site workers; at many places, waste is dumped at low lying areas without any consideration. The expansion of city limits has brought old landfill sites within the city.

Two innovative mechanisms of waste disposal being adopted in India include composting (aerobic composting and vermi-composting) and waste-to-energy (WTE) (incineration, pelletisation, biomethanation); however, these concepts are still being tested out in India and the implementation is very limited (Sharholy et al. 2008).

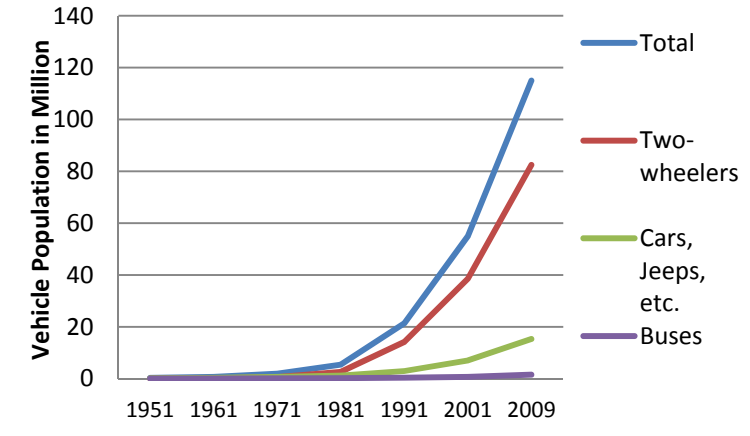
The Municipal Solid Waste Rules were put in place in 2000; however, the enforcement has been poor. Though several NGOs, CBOs and private companies are also involved in the collection of solid waste, yet attention is rarely paid to proper and safe disposal.

Inadequate collection efficiency and poor management of solid waste lead to health hazards and contamination of groundwater and surface water. Focus remains on increasing collection efficiency of solid waste and its disposal. Even though there has been effort towards segregation of waste and composting, reduction in generation of solid waste has not been given due importance in India.

E. Transport

India has seen a tremendous growth in ownership of motorised vehicles, especially two wheelers (Fig. K). Almost 70% of the vehicle population in India constitutes of two-wheelers (Fig. L). Cars and two wheelers together make up 85% of vehicles on India's roads, but account for only 29% of trips and are a significant cause of congestion (Fig. M).

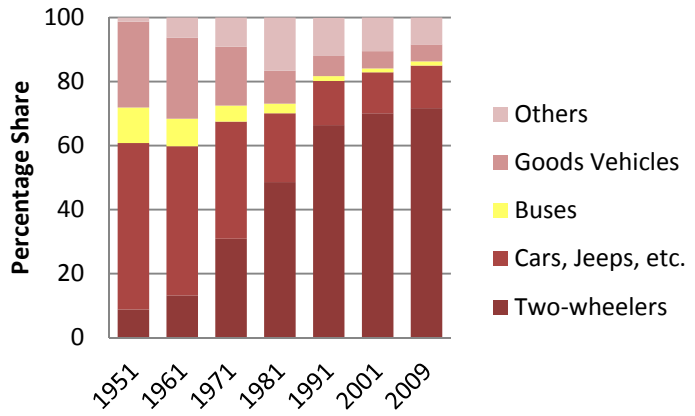
Fig. K: Growth of Vehicle Population in India (1951 - 2009)



Source: MoRTH, 2011.

While reasons for growth of personal vehicles are many, studies indicate that one of the possible reasons is the lack of adequate public transport (Pucher et al. 2005). The number of buses, which account for 90% of public transport, has remained almost constant. Only a few cities have a public transport system and bulk of cities are dependent on personal transport or para-transit.

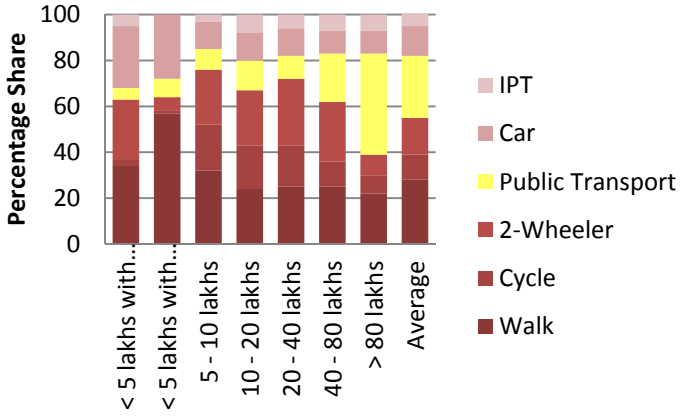
Fig. L: Vehicular Composition in India (1951 - 2009)



Source: MoRTH, 2011.

Even in cities where public transport is available, it is grossly inadequate, and inefficient (Pucher et al. 2005). Though a large percentage of urban residents still walk or cycle, an 'epidemic' of traffic accidents puts them at high risk.

Fig. M: Modal Split of Trips by Type of Cities (2007)



Source: MoUD and Wilbur Smith, 2008.

The transportation issue that seems to attract the most attention is congestion, as it is the most highly visible. The dominant policy response to congestion has been to improve road infrastructure for improved movement of motor cars (Tiwari, 2002). This bias persists despite the fact that there are a large number of captive users for whom the primary mode of transportation is walking or cycling. This captive audience exists because the urban poor in India cannot even afford costs of public transportation. Until now, this was facilitated by the fact that many Indian cities were mixed use, and largely mixed income. Now, the urban poor are being displaced to the periphery, either being forced out of land markets or being evicted (Badami, 2009). Budgets for provision of facilities for pedestrians and cyclists are minimal. Unsafe, inadequate pedestrian facilities lead to the increased use of motor vehicles, even for short distances (Badami, 2009).

Traffic accidents are given far less importance as compared to the issues of air pollution (Tiwari, 2003; Badami, 2009). This can be attributed to the fact that air pollution affects everyone in the city including the car users, while traffic accidents are considerably skewed, affecting mostly pedestrians, cyclists and two-wheelers. The elite and upper middle class, who are mostly car users, are not affected substantially by this issue. Also, whatever little attention that this issue gets is focussed on fatalities, while the number of people suffering minor and major injuries is substantially higher (ibid).

While the national transportation policy talks about encouraging non-motorised vehicles and pedestrians, there is little evidence from the ground to show so. Most projects still are focused on expanding and widening the road network.

There are also larger contradictions at the policy level. While national transport policy encourages public transport, the rise in the increase of vehicle ownership is considered as one of the indicators of economic growth by the Government of India (Badami, 2009).

Annex 4: Review of JNNURM Documents

A. Review of Guidelines and Toolkits

Component	Criteria	Summary of Issues highlighted in various JNNURM Documents	Sustainability Implications
Environmental	Resource Use/ Source	*Optional Reform at ULB Level: Revision of Byelaws to Make Rainwater Harvesting Mandatory*[8] • The main objective is to recharge ground water and augment overall availability; rainwater itself can meet domestic water demands in certain situations. • RWH will also help in reducing energy required for pumping out/ up groundwater by raising the aquifer level. • Rainwater harvesting will also help in reducing surface run-offs and flooding of roads and other low lying areas. *Optional Reform at ULB Level: Bye-laws for Reuse of Wastewater:* The aim is to use the water efficiently and provide for the growing demands; treated wastewater can provide incremental supply for non-potable applications • Burden on existing resources will be reduced • This will lower the volume of sewage to be discharged, which will reduce the pollution levels in the existing water bodies *Toolkit for DPR Preparation:* • Raw water analysis report, source reliability study and report to be part of the DPR	As stated in the document, rainwater harvesting is likely to augment water supply. However, rainwater harvesting does not define a sustainability goal, but is a specific strategy. It is not clear a. whether rainwater is the most suitable strategy b. whether in certain cases; RWH will be successful at all. Reuse of Water is a suitable and relevant goal/ criterion. It is not possible to assess impact of this byelaw, till one has seen the byelaws formulated. This will be done in the fieldwork. Addresses the issue of source sustainability and water quality
	Waste/ Sink	*Toolkit for Project Appraisal:* • Solid waste management projects to include	Segregation is required, but this analysis

[8] Except for Imphal and Kohima, Rainwater harvesting reform has been implemented in all other cities.

Component	Criteria	Summary of Issues highlighted in various JNNURM Documents	Sustainability Implications
		considerations/introduction of systems/bye-laws/policies and measures to improve source separation and recycling, taking into account existing formal and informal activities and the requirements of different waste reusers/reprocessors. • Introduction of acceptable and reliable treatment and/or disposal system for solid waste (which could include waste reuse and/or reprocessing to a product of market value (gas, energy, manure, etc.).	needs to be done at city level instead of project level
	Sustainability of Source/ Sink	*Toolkit for Project Preparation:* • Environmental compatibility to be considered while planning for projects *Toolkit for DPR Preparation:* • Environmental Impact Assessment to be part of the DPR along with Environmental Management Plan • List of negative externalities to be given including recognition of trade-off. Pollution, reduced green cover, displacement, etc. are some of the negative externalities mentioned.	While these analysis need to done at the project level, these also need to done at the city level
Design and Technology	Performance (Coverage, Quality, Reliability)	*JNNURM Overview:* • Hundred per cent coverage has been envisaged as one of the outcomes of JNNURM. *Toolkit for Project Preparation:* • Technical feasibility to be part of the project proposal *Toolkit for Project Appraisal:* • Planning to include: targets of service levels proposed to be achieved, such as reduction in system losses/ Unaccounted for Water (UFW),	While 100% coverage is the final goal, it may not be realistic for all urban areas to achieve it immediately. Hence it would help if intermediate goals are set.

Component	Criteria	Summary of Issues highlighted in various JNNURM Documents	Sustainability Implications
		expanding service coverage in terms of population served, delivery of water supply (duration of supply/quality of supply), support activities proposed to be undertaken as a part of this plan including water audit, energy audit, system performance benchmarks (pressure/ flow measurements) to be maintained. *Toolkit for DPR Preparation* • Project reports to list out benefits from societal perspective like access, coverage, service quality, improved efficiency, supply continuity, safety, environment improvement, improved quality of life, etc.	This planning is needed across projects
	Efficiency	*JNNURM Overview:* • Focus on efficiency in urban infrastructure and service delivery features in the mission statement of the JNNURM • Optimisation of life cycle cost *Toolkit for Project Preparation:* • Selection of the most technically feasible and commercially viable option	Efficiency and optimisation of life cycle costs are both relevant goals, but nothing more can be said till fieldwork. No clear definition of what is considered technical feasibility
	Adaptability		
Social and Public Health	Equity	• *Mandatory Reforms at ULB Level: Basic Services for the Urban Poor and Internal Earmarking of Funds for the Urban Poor*[9] The goal is to "Provide basic services (including water supply and sanitation) to all	Earmarking of funds is not enough, but integration of poor households into the main infrastructure systems is necessary.

[9] Internal earmarking of funds for services to urban poor has been achieved in all cities except Panaji, Vadodara and Porbandar; however, provision of basic services to the urban has not been achieved in 54 cities.

Component	Criteria	Summary of Issues highlighted in various JNNURM Documents	Sustainability Implications
		poor including security of tenure, and improved housing at affordable prices and ensure delivery of social services of education, health and social security to poor people". • It is envisaged that all urban poor settlements will be integrated and mainstreamed with municipal supply networks resulting in sustainable improvements in quality of life of the urban poor *Mandatory Reform at ULB Level: Levy of Reasonable User Charges by ULBs and Parastatals* • Talks about cross subsidisation for the vulnerable group; the reform proposes to set affordable and acceptable user charges. *Toolkit for Project Preparation:* • Social and political acceptability	This has been mentioned below, but it is not clear whether there is synergy between projects for the urban poor, and overall planning. It is not clear whether only cross subsidisation is sufficient to extend services.
	Reduction in Diseases	*Mandatory Reforms at ULB Level: Basic Services for the Urban Poor* • Improved quality of environment in the cities • Provision of basic services to urban poor is expected to improve their quality of life and reduce vulnerability • Reduction in incidence of diseases is set as one of the indicators to assess improvement in quality of lives of slum dwellers.	
Economic	Per capita investments	There is no mention of per capita investments; Overview documents on JNNURM only talk about adequate funds for meeting deficiencies in urban infrastructural services. *Toolkit for Project Appraisal:* • The proposal to demonstrate technical feasibility and selection of a	It is not clear whether it refers to different

Component	Criteria	Summary of Issues highlighted in various JNNURM Documents	Sustainability Implications
		least life-cycle cost-based option for implementation as well as sustainability through financial and economic viability parameters. • Technical designs shall be based on least-cost solution, taking into account life-cycle costs and demand assessment based on actual consumption estimates.	designs, within the same "technology" or across technology
	Operations and Maintenance	*JNNURM Overview:* • O & M has been identified as a crucial aspect in ensuring sustainable infrastructure development. • The mission calls for establishing linkage between asset creation and maintenance and optimisation of life cycle cost of projects. • Strategy for O&M is a pre-condition to avail JNNURM funding. • Creation of revolving fund to meet O&M requirements of assets created, over the planning horizon. (is this revolving fund for O & M) *Mandatory Reform: Levy of Reasonable User Charges by ULBs and Parastatals*[10] • Objective of this reform is to enable ULBs/parastatals to start recovering O&M costs by 2012. *Toolkit for Project Appraisal:* An investment proposal shall be considered sustainable if its cash flows are able to meet the financial commitments underlying the project, its operations and maintenance expenditure and set aside revenues to provide for replacement investments.	O & M is a critical issue in Indian cities, and hence it is laudable that the government recognises this issue. However, the JNNURM funding can only be availed for capital expenditure, and given the weak state of ULB finances; it is not clear how the O & M expenditure will be taken care of. Also, it is not known whether strategy for O & M functioned as a pre-condition on the ground. Not clear whether this is sufficient to recover O & M
Process	Interlinkages	*JNNURM Overview:*	

[10] 46 out of 65 cities have not been able to recover costs in the water supply sector and only seven cities have able to recover costs in solid waste management sector. These include: Hyderabad, Vishakhapatnam, Surat, Pune, Greater Mumbai, Shillong and Chennai; these cities have also been able to recover costs in water supply sector.

Component	Criteria	Summary of Issues highlighted in various JNNURM Documents	Sustainability Implications
	with other sectors	• Focus on integrated development of infrastructure • CDPs to integrate land use with services, urban transport and environment management • Sustainable development of cities has been mentioned as a desired outcome at the end of the mission *Toolkit on Project Appraisal:* • When water supply is augmented, it is required that provisions for wastewater disposal be considered. This should include drainage and sewerage as a parallel (or immediately following) phased activity.	While integrated development has been mentioned, most cities have relied heavily on sectoral analysis, as will be seen later
	Integration	*Mandatory Reform at State Level: Implementation of the 74th Constitutional Amendment Act and Integration of City Planning and Delivery Functions* • Convergence of planning and delivery of urban infrastructure development and management functions • Cooperation among different stakeholders *Toolkit for DPR Preparation:* • Sector-specific DPRs to be in line with National Policies and Rules. E.g. Transport related projects to be in line with NUTP.	Same as above; there is no evidence of the integration of various functions at city level
	Capacity Development	*Toolkit for Framework and Process:* • 5 % of central grant is reserved for preparation of CDPs and DPRs, training and capacity building, community participation, information, education and communication *Mandatory Reform at State Level: Implementation of the 74th Constitutional Amendment Act and Integration of City Planning and Delivery Functions* • Devolution of functions and powers to the urban local bodies	Given the huge deficits, it is not clear whether 5 % is sufficient, more importantly, it is not known how well this grant has been utilised

Component	Criteria	Summary of Issues highlighted in various JNNURM Documents	Sustainability Implications
		• Development authorities and parastatals to be technical arms of the urban local bodies	
	Monitoring and Evaluation	*Toolkit for Framework and Process:* • Monitoring framework at the national level has been developed. • Ministry of Urban Development and Ministry of Urban Employment and Poverty Alleviation would periodically monitor the schemes; State Level Nodal Agency (SLNA) to send quarterly reports. • Monitoring of progress and implementation of reforms would be outsourced to specialised/ technical agencies.	Sustainability indicators not within this remit

B. Review of Revised Toolkit for Preparation of CDP

Component	Criteria	Summary of Issues Highlighted in Revised CDP Toolkit	Sustainability Implications
Environmental	Resource Use/ Source	The CDP should reflect on conservation, sustainable use or destruction of available resource Study of physiography, climatic parameters and geology to be done to understand how development is affected by them and vice-versa. Revised toolkit also suggests doing a complete inventory of available surface water and ground water to assess the existing water supply potential. Possibilities of source augmentation should be seen by assessing rainfall, catchment areas, ground water, etc. Study of traditional water systems is proposed; this may help to reduce costs and make the system more sustainable. Provision of adequate public transport has been highlighted to discourage personal vehicles.	Implicit considerations of energy and water losses An inventory is a first step, not clear what action needs to be taken after this step
	Waste/ Sink	Baseline environmental status needs to be established by determining baseline levels of significant environmental parameters (air quality, water quality and environmental sensitivity) Coverage and types of toilets and their ecological considerations need to be assessed. Potential of alternate sewerage system plus reuse and recycle of treated wastewater need to be assessed. Waste to energy options need to be looked at while planning for solid waste management	

Component	Criteria	Summary of Issues Highlighted in Revised CDP Toolkit	Sustainability Implications
	Sustainability of source/ sink	Areas of natural heritage and environmental sensitivity need to be outlined and immediate steps to be taken to protect these natural resources.	
Design and Technology	Performance	Reliability of service is identified as a key issue in the water supply sector Service level benchmarking should be done periodically to set targets and ensure service delivery Inadequate coverage has been raised as a concern in the toolkit, which needs to be considered while formulating strategies.	
	Efficiency	Rehabilitation of old pipes should not be seen as the only solution to reduce transfer losses, studies should be done to identify the technical causes.	
	Adaptability		
Social and Public Health	Equity	Equity in the planning process to be addressed by means of representation by and participation of all stakeholders including the ones below poverty line. Consultative planning is central to the preparation of the CDP. Urban poverty need to be treated as a cross-cutting component while doing city assessment.	
	Reduction in Diseases		While this analysis is necessary, it is not clear whether the CDP is required to take the

Component	Criteria	Summary of Issues Highlighted in Revised CDP Toolkit	Sustainability Implications
			necessary steps to reduce disease burden. Also differential health impacts not taken into consideration.
Economic	Per capita investments	Possible alternatives to be assessed based on the capital costs and O&M costs involved	This does not mention the different costs of various technologies
	Operations and Maintenance	Financial sustainability of ULBs is recognised as a critical issue to implement infrastructure projects, manage operations and maintenance processes and sustain urban infrastructure through effective cost recovery mechanisms.	While this is necessary step, it is not clear how the ULBs will provide for these costs
Process	Interlinkages with other sectors	The revised toolkit suggests a resource based approach to planning taking into consideration social, economic, natural and cultural resources. Inter-sectoral and intra-sectoral aspects of sectors to be addressed by CDP so that inter-linkages for sustainable development can be achieved. All services should follow 'common network' approach, which should be related to the activity pattern or land-uses in the city. Linkage between capital investment, socio-economic development, spatial development and urban poverty alleviation should be established. The toolkit recommends CDPs to not focus on admissible sectors but	This is an important point, but there is no guideline or examples of how to achieve this.

Component	Criteria	Summary of Issues Highlighted in Revised CDP Toolkit	Sustainability Implications
		be as comprehensive as possible and include all sectors of planning and development. Integration of land use and transport is identified as one of the key issues. One of the roles of CDP Technical Committee is to ensure the linkages and cohesiveness among the sub-components of the CDP and suggest measures for sustainability and implementation of projects for maximising the benefits to the city.	
	Integration	CDP to integrate spatial planning and infrastructure planning.	
	Capacity Development	Needs for urban reforms and institutional processes to equip ULBs to carry out infrastructure development are recognised. Institutional study should assess the need for capacity development and training for the elected representatives, staff of local body and para-statal agencies, vendors, community groups, etc. The CDP should lay out how civic agencies plan to meet human resource shortage for planning, development and urban management activities.	
	Monitoring and Evaluation	A monitoring mechanism should be established for measuring the identifiable indicators for the implementation of CDP formulated	

Annex 5: Review of CDPs

A. Greater Mumbai

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water	✓																			
		Energy																		✓		
		Land									✓	✓										
		Material														✓						
	Sink/ Waste	Wastewater					✓	✓			✓		✓									
		Waste									✓				✓	✓	✓					
		Air Pollution																		✓		
	Sustainability of Source/ Sink		✓		✓										✓							
Design and Technology	Performance	Coverage		✓	✓		✓												✓	✓	✓	
		Quality	✓				✓												✓	✓	✓	
		Reliability	✓				✓	✓			✓	✓							✓	✓		
	Efficiency		✓	✓							✓	✓							✓	✓		
	Adaptability			✓																		
Social and Public Health	Equity		✓	✓			✓	✓	✓			✓			✓							
	Public Health/ Reduction in Diseases																			✓		
Economic	Per Capita Investments																					
	Operation and Maintenance																			✓		
Process	Inter-linkages																					
	Integration																					
	Capacity Development																					
	Monitoring and Evaluation							✓								✓						

B. Kolkata

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water																				
		Energy																		✓		
		Land																		✓		
		Material																				
	Sink/ Waste	Wastewater					✓	✓														
		Waste														✓						
		Air Pollution																	✓			
	Sustainability of Source/ Sink		✓	✓	✓				✓				✓				✓				✓	
Design and Technology	Performance	Coverage	✓	✓	✓		✓	✓	✓		✓	✓	✓			✓	✓		✓	✓	✓	
		Quality																		✓	✓	
		Reliability	✓				✓															
	Efficiency			✓	✓			✓	✓												✓	
	Adaptability																					
Social and Public Health	Equity																			✓		
	Public Health/ Reduction in Diseases														✓				✓	✓		
Economic	Per Capita Investments																					
	Operation and Maintenance		✓	✓			✓				✓				✓				✓			
Process	Inter-linkages																			✓		
	Integration		✓																			
	Capacity Development																					
	Monitoring and Evaluation								✓													

C. Delhi

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water	✓		✓																	
		Energy			✓		✓												✓	✓	✓	
		Land									✓	✓			✓	✓			✓			
		Material																				
	Sink/ Waste	Wastewater					✓	✓	✓		✓											
		Waste													✓		✓					
		Air Pollution																	✓	✓		
	Sustainability of Source/ Sink		✓	✓								✓										
Design and Technology	Performance	Coverage	✓	✓	✓		✓	✓	✓										✓	✓	✓	
		Quality	✓																	✓		
		Reliability	✓				✓				✓	✓	✓							✓		
	Efficiency		✓	✓	✓		✓		✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	
	Adaptability																					
Social and Public Health	Equity		✓	✓			✓	✓			✓	✓			✓	✓	✓		✓	✓	✓	
	Public Health/ Reduction in Diseases		✓	✓															✓	✓	✓	
Economic	Per Capita Investments																					
	Operation and Maintenance		✓		✓				✓		✓		✓				✓				✓	
Process	Inter-linkages										✓	✓							✓			
	Integration											✓				✓			✓	✓		
	Capacity Development																					
	Monitoring and Evaluation																					

D. Chennai

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water	✓	✓	✓																	
		Energy		✓	✓			✓	✓													
		Land													✓							
		Material																				
	Sink/ Waste	Wastewater					✓			✓												
		Waste													✓	✓	✓					
		Air Pollution																	✓	✓		
	Sustainability of Source/ Sink		✓	✓	✓							✓				✓	✓					
Design and Technology	Performance	Coverage	✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	
		Quality		✓	✓			✓	✓				✓						✓	✓		
		Reliability						✓	✓		✓	✓	✓							✓		
	Efficiency		✓	✓	✓				✓			✓	✓						✓	✓	✓	
	Adaptability																					
Social and Public Health	Equity		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	
	Public Health/ Reduction in Diseases																			✓		
Economic	Per Capita Investments																					
	Operation and Maintenance		✓	✓	✓		✓									✓						
Process	Inter-linkages			✓	✓			✓	✓				✓							✓		
	Integration		✓								✓											
	Capacity Development			✓	✓			✓	✓													
	Monitoring and Evaluation			✓	✓			✓	✓			✓					✓					

E. Hyderabad

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water	✓		✓																	
		Energy	✓	✓	✓		✓	✓	✓													
		Land									✓											
		Material														✓						
	Sink/ Waste	Wastewater					✓	✓	✓													
		Waste									✓				✓	✓	✓					
		Air Pollution																	✓	✓		
	Sustainability of Source/ Sink		✓	✓																		
Design and Technology	Performance	Coverage	✓	✓	✓		✓	✓	✓		✓		✓		✓	✓	✓		✓	✓	✓	
		Quality		✓				✓				✓	✓							✓		
		Reliability	✓	✓	✓						✓	✓	✓						✓	✓		
	Efficiency		✓	✓	✓		✓		✓			✓			✓	✓	✓	✓	✓	✓	✓	
	Adaptability																					
Social and Public Health	Equity		✓	✓	✓		✓	✓	✓		✓		✓		✓		✓		✓	✓	✓	
	Public Health/ Reduction in Diseases																		✓	✓	✓	
Economic	Per Capita Investments																					
	Operation and Maintenance		✓	✓	✓		✓	✓			✓					✓						
Process	Inter-linkages				✓		✓		✓		✓		✓				✓				✓	
	Integration																					
	Capacity Development			✓	✓										✓				✓		✓	
	Monitoring and Evaluation			✓	✓			✓				✓										

F. Bangalore

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water	✓	✓	✓																	
		Energy		✓																		
		Land										✓								✓		
		Material														✓						
	Sink/ Waste	Wastewater					✓	✓	✓													
		Waste									✓				✓	✓						
		Air Pollution																		✓		
	Sustainability of Source/ Sink		✓	✓	✓																	
Design and Technology	Performance	Coverage	✓	✓	✓		✓	✓	✓			✓	✓		✓	✓	✓		✓	✓	✓	
		Quality													✓							
		Reliability	✓				✓	✓	✓		✓	✓	✓			✓			✓			
	Efficiency		✓	✓	✓		✓		✓							✓			✓	✓	✓	
	Adaptability																					
Social and Public Health	Equity		✓	✓	✓		✓	✓	✓				✓		✓	✓			✓	✓	✓	
	Public Health/ Reduction in Diseases		✓				✓													✓		
Economic	Per Capita Investments																					
	Operation and Maintenance		✓	✓	✓		✓	✓	✓						✓	✓	✓					
Process	Inter-linkages																					
	Integration		✓				✓									✓						
	Capacity Development																					
	Monitoring and Evaluation			✓				✓														

G. Ahmedabad

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water	✓	✓																		
		Energy																				
		Land										✓							✓			
		Material													✓							
	Sink/ Waste	Wastewater					✓	✓	✓		✓				✓							
		Waste					✓								✓	✓	✓					
		Air Pollution																		✓		
	Sustainability of Source/ Sink		✓	✓	✓							✓										
Design and Technology	Performance	Coverage	✓	✓	✓		✓	✓	✓		✓		✓		✓	✓	✓		✓	✓	✓	
		Quality	✓		✓			✓											✓	✓	✓	
		Reliability	✓	✓			✓	✓	✓		✓		✓									
	Efficiency		✓	✓	✓										✓	✓			✓	✓	✓	
	Adaptability																					
Social and Public Health	Equity		✓				✓									✓						
	Public Health/ Reduction in Diseases			✓															✓			
Economic	Per Capita Investments																					
	Operation and Maintenance			✓																		
Process	Inter-linkages																					
	Integration																					
	Capacity Development																					
	Monitoring and Evaluation			✓			✓															

H. Kanpur

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water																				
		Energy																				
		Land																				
		Material																				
	Sink/ Waste	Wastewater					✓	✓														
		Waste						✓			✓	✓	✓		✓	✓	✓					
		Air Pollution																	✓	✓		
	Sustainability of Source/ Sink		✓	✓	✓																	
Design and Technology	Performance	Coverage	✓	✓	✓		✓	✓	✓				✓						✓			
		Quality	✓				✓	✓											✓	✓	✓	
		Reliability	✓	✓	✓		✓															
	Efficiency		✓	✓	✓			✓	✓						✓	✓	✓		✓	✓	✓	
	Adaptability																					
Social and Public Health	Equity		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓		✓	
	Public Health/ Reduction in Diseases																					
Economic	Per Capita Investments																					
	Operation and Maintenance		✓	✓	✓			✓								✓	✓					
Process	Inter-linkages																					
	Integration																					
	Capacity Development		✓				✓				✓				✓				✓			
	Monitoring and Evaluation																			✓		

I. Indore

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water	✓	✓																		
		Energy																				
		Land																				
		Material																				
	Sink/ Waste	Wastewater					✓	✓														
		Waste													✓	✓	✓					
		Air Pollution																	✓	✓		
	Sustainability of Source/ Sink				✓																	
Design and Technology	Performance	Coverage	✓	✓			✓	✓	✓		✓	✓	✓		✓	✓			✓	✓	✓	
		Quality	✓				✓															
		Reliability	✓	✓	✓						✓		✓		✓							
	Efficiency		✓	✓	✓		✓		✓						✓				✓	✓	✓	
	Adaptability																					
Social and Public Health	Equity		✓	✓	✓		✓	✓	✓			✓	✓			✓	✓		✓	✓	✓	
	Public Health/ Reduction in Diseases																			✓		
Economic	Per Capita Investments																					
	Operation and Maintenance			✓				✓				✓				✓						
Process	Inter-linkages																					
	Integration																		✓			
	Capacity Development			✓											✓							
	Monitoring and Evaluation		✓	✓															✓			

J. Ludhiana

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water	✓		✓																	
		Energy																				
		Land																				
		Material																				
	Sink/ Waste	Wastewater					✓		✓		✓	✓										
		Waste													✓	✓	✓					
		Air Pollution					✓												✓			
	Sustainability of Source/ Sink		✓																			
Design and Technology	Performance	Coverage	✓	✓	✓		✓	✓	✓		✓	✓	✓		✓		✓			✓	✓	
		Quality	✓																✓	✓	✓	
		Reliability	✓	✓			✓	✓			✓	✓										
	Efficiency			✓								✓							✓	✓	✓	
	Adaptability																					
Social and Public Health	Equity		✓	✓					✓												✓	
	Public Health/ Reduction in Diseases						✓												✓			
Economic	Per Capita Investments																					
	Operation and Maintenance																					
Process	Inter-linkages																					
	Integration		✓				✓												✓			
	Capacity Development			✓											✓	✓						
	Monitoring and Evaluation		✓		✓																	

K. Kochi

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water		✓	✓																	
		Energy				✓	✓			✓					✓							
		Land									✓	✓							✓			
		Material																				
	Sink/ Waste	Wastewater					✓	✓							✓							
		Waste									✓				✓	✓	✓					
		Air Pollution																				✓
	Sustainability of Source/ Sink			✓	✓						✓	✓										
Design and Technology	Performance	Coverage	✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	
		Quality	✓					✓			✓				✓	✓			✓	✓	✓	
		Reliability	✓	✓	✓						✓	✓	✓		✓							
	Efficiency			✓	✓		✓	✓	✓							✓			✓	✓	✓	
	Adaptability																					
Social and Public Health	Equity		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	
	Public Health/ Reduction in Diseases						✓				✓				✓							
Economic	Per Capita Investments																					
	Operation and Maintenance		✓	✓	✓		✓	✓							✓							
Process	Inter-linkages																					
	Integration																					
	Capacity Development				✓			✓					✓				✓					
	Monitoring and Evaluation				✓			✓								✓						

L. Varanasi

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water			✓																	
		Energy				✓																
		Land									✓						✓				✓	
		Material																				
	Sink/ Waste	Wastewater					✓	✓	✓		✓		✓		✓		✓					
		Waste													✓		✓					
		Air Pollution																	✓			
	Sustainability of Source/ Sink		✓	✓	✓		✓															
Design and Technology	Performance	Coverage	✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	
		Quality	✓	✓	✓		✓	✓	✓						✓				✓	✓	✓	
		Reliability	✓		✓		✓		✓		✓	✓	✓									
	Efficiency		✓	✓	✓	✓		✓	✓		✓								✓	✓	✓	
	Adaptability																					
Social and Public Health	Equity		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓				✓	
	Public Health/ Reduction in Diseases														✓						✓	
Economic	Per Capita Investments																					
	Operation and Maintenance				✓																	
Process	Inter-linkages																					
	Integration																✓					
	Capacity Development		✓	✓	✓			✓	✓				✓		✓		✓					
	Monitoring and Evaluation				✓				✓				✓		✓							

M. Dhanbad

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water	✓	✓	✓																	
		Energy						✓														
		Land						✓														
		Material													✓							
	Sink/ Waste	Wastewater					✓	✓	✓		✓	✓										
		Waste									✓				✓	✓	✓					
		Air Pollution																		✓		
	Sustainability of Source/ Sink		✓	✓	✓																	
Design and Technology	Performance	Coverage	✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	
		Quality	✓	✓	✓			✓	✓		✓				✓	✓			✓	✓	✓	
		Reliability	✓	✓				✓			✓	✓	✓									
	Efficiency		✓	✓	✓							✓				✓				✓		
	Adaptability																					
Social and Public Health	Equity		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	
	Public Health/ Reduction in Diseases														✓							
Economic	Per Capita Investments						✓	✓														
	Operation and Maintenance		✓	✓	✓			✓	✓			✓				✓	✓					
Process	Inter-linkages																					
	Integration																					
	Capacity Development			✓				✓							✓	✓						
	Monitoring and Evaluation			✓			✓	✓														

N. Guwahati

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water	✓	✓	✓																	
		Energy	✓																			
		Land									✓	✓				✓						
		Material															✓					
	Sink/ Waste	Wastewater					✓	✓			✓				✓							
		Waste									✓	✓			✓	✓						
		Air Pollution																	✓	✓		
	Sustainability of Source/ Sink		✓	✓			✓	✓			✓											
Design and Technology	Performance	Coverage	✓	✓	✓		✓	✓	✓		✓				✓	✓	✓		✓	✓	✓	
		Quality	✓	✓	✓		✓									✓			✓	✓	✓	
		Reliability	✓	✓							✓	✓	✓									
	Efficiency		✓	✓	✓			✓			✓								✓	✓	✓	
	Adaptability																					
Social and Public Health	Equity			✓			✓	✓	✓													
	Public Health/ Reduction in Diseases						✓				✓								✓	✓		
Economic	Per Capita Investments																					
	Operation and Maintenance		✓	✓	✓			✓							✓	✓						
Process	Inter-linkages																					
	Integration																		✓			
	Capacity Development		✓	✓	✓				✓				✓			✓	✓				✓	
	Monitoring and Evaluation																					

O. Raipur

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water	✓	✓																		
		Energy			✓		✓															
		Land										✓					✓			✓		
		Material													✓	✓	✓					
	Sink/ Waste	Wastewater					✓	✓	✓		✓	✓										
		Waste									✓	✓				✓	✓					
		Air Pollution														✓	✓					
	Sustainability of Source/ Sink			✓	✓							✓	✓									
Design and Technology	Performance	Coverage	✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓			✓	✓	
		Quality	✓	✓	✓	✓	✓	✓	✓										✓	✓	✓	
		Reliability		✓							✓	✓	✓		✓							
	Efficiency		✓	✓	✓						✓	✓	✓		✓				✓	✓	✓	
	Adaptability																					
Social and Public Health	Equity		✓	✓	✓			✓	✓				✓				✓			✓		
	Public Health/ Reduction in Diseases		✓																			
Economic	Per Capita Investments		✓																			
	Operation and Maintenance		✓	✓	✓				✓				✓				✓				✓	
Process	Inter-linkages																					
	Integration		✓				✓				✓					✓			✓			
	Capacity Development			✓				✓				✓				✓				✓		
	Monitoring and Evaluation																					

P. Nanded

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water	✓	✓																		
		Energy	✓																			
		Land										✓										
		Material														✓	✓					
	Sink/ Waste	Wastewater					✓															
		Waste					✓								✓	✓	✓					
		Air Pollution																				
	Sustainability of Source/ Sink																					
Design and Technology	Performance	Coverage	✓	✓	✓		✓	✓	✓						✓	✓	✓		✓			
		Quality			✓		✓												✓	✓	✓	
		Reliability	✓	✓			✓				✓	✓	✓									
	Efficiency		✓	✓	✓			✓								✓	✓		✓	✓	✓	
	Adaptability																					
Social and Public Health	Equity		✓	✓	✓		✓	✓			✓	✓			✓	✓			✓	✓		
	Public Health/ Reduction in Diseases										✓									✓		
Economic	Per Capita Investments							✓														
	Operation and Maintenance		✓	✓	✓		✓	✓	✓		✓				✓				✓			
Process	Inter-linkages																					
	Integration		✓				✓	✓											✓	✓		
	Capacity Development		✓	✓			✓	✓			✓	✓			✓	✓			✓	✓		
	Monitoring and Evaluation																					

Q. Haridwar

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water	✓	✓																		
		Energy																				
		Land						✓			✓				✓	✓	✓		✓			
		Material													✓	✓			✓			
	Sink/ Waste	Wastewater					✓	✓			✓	✓										
		Waste					✓				✓	✓			✓	✓						
		Air Pollution					✓	✓											✓			
	Sustainability of Source/ Sink														✓							
Design and Technology	Performance	Coverage	✓	✓	✓		✓	✓	✓		✓		✓		✓	✓	✓		✓		✓	
		Quality	✓	✓	✓							✓			✓				✓			
		Reliability	✓								✓				✓							
	Efficiency		✓	✓	✓				✓			✓	✓		✓	✓	✓		✓	✓	✓	
	Adaptability																					
Social and Public Health	Equity		✓	✓	✓		✓		✓		✓		✓		✓		✓		✓	✓	✓	
	Public Health/ Reduction in Diseases						✓								✓	✓			✓	✓		
Economic	Per Capita Investments			✓											✓							
	Operation and Maintenance		✓	✓	✓		✓	✓	✓				✓				✓				✓	
Process	Inter-linkages											✓										
	Integration		✓																✓			
	Capacity Development		✓				✓				✓				✓	✓			✓			
	Monitoring and Evaluation			✓																		

R. Panaji

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water	✓	✓	✓																	
		Energy																				
		Land					✓				✓				✓	✓			✓			
		Material																				
	Sink/ Waste	Wastewater					✓	✓	✓		✓		✓									
		Waste									✓				✓		✓					
		Air Pollution																				
	Sustainability of Source/ Sink		✓	✓	✓		✓				✓	✓			✓		✓					
Design and Technology	Performance	Coverage					✓	✓	✓						✓		✓		✓	✓		
		Quality	✓		✓		✓	✓			✓				✓				✓			
		Reliability	✓		✓				✓		✓	✓										
	Efficiency		✓	✓	✓		✓				✓	✓	✓			✓	✓		✓	✓	✓	
	Adaptability																					
Social and Public Health	Equity		✓	✓			✓	✓	✓		✓	✓			✓	✓			✓	✓		
	Public Health/ Reduction in Diseases				✓														✓	✓	✓	
Economic	Per Capita Investments		✓													✓				✓		
	Operation and Maintenance		✓	✓	✓		✓	✓	✓			✓	✓		✓	✓	✓			✓	✓	
Process	Inter-linkages		✓																			
	Integration																					
	Capacity Development			✓				✓			✓	✓			✓					✓	✓	
	Monitoring and Evaluation		✓																			

S. Itanagar

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water																				
		Energy			✓																	
		Land									✓											
		Material													✓	✓	✓					
	Sink/ Waste	Wastewater					✓		✓		✓											
		Waste									✓				✓	✓	✓					
		Air Pollution																				
	Sustainability of Source/ Sink		✓									✓										
Design and Technology	Performance	Coverage	✓	✓	✓		✓	✓	✓		✓	✓	✓		✓		✓		✓		✓	
		Quality	✓	✓			✓												✓		✓	
		Reliability	✓									✓				✓						
	Efficiency		✓					✓			✓	✓			✓							
	Adaptability																					
Social and Public Health	Equity		✓	✓			✓	✓	✓		✓	✓	✓		✓	✓			✓	✓	✓	
	Public Health/ Reduction in Diseases																		✓			
Economic	Per Capita Investments																					
	Operation and Maintenance		✓		✓		✓				✓				✓				✓			
Process	Inter-linkages																					
	Integration																					
	Capacity Development		✓				✓				✓				✓				✓			
	Monitoring and Evaluation			✓				✓				✓										

T. Bodhgaya

Indicators			Water Supply				Sewerage				Storm Water Drainage				Solid Waste Management				Transportation			
			Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E	Recog.	Imp.	Invest.	M & E
Environmental	Resource Use	Water	✓	✓	✓																	
		Energy																				
		Land																				
		Material																				
	Sink/ Waste	Wastewater					✓				✓				✓							
		Waste													✓	✓	✓					
		Air Pollution													✓							
	Sustainability of Source/ Sink										✓	✓										
Design and Technology	Performance	Coverage	✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	
		Quality	✓	✓							✓								✓			
		Reliability																				
	Efficiency		✓								✓	✓				✓	✓		✓	✓		
	Adaptability																					
Social and Public Health	Equity		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	
	Public Health/ Reduction in Diseases														✓							
Economic	Per Capita Investments							✓	✓													
	Operation and Maintenance			✓				✓			✓	✓			✓	✓				✓		
Process	Inter-linkages																					
	Integration																					
	Capacity Development		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓	
	Monitoring and Evaluation					✓				✓				✓				✓				✓

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