Kala Seetharam Sridhar · Guanghua Wan
*Editors*

# Urbanization in Asia

## Governance, Infrastructure and the Environment

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# Preface

This volume originated from the International Conference on Public Policy & Governance which Public Affairs Centre co-hosted with the Department of Management Studies, Indian Institute of Science, Bangalore. Given the overarching importance of urbanization in Asia, and the large number of papers received for that track, we decided to bring out this volume on the theme.

It should be remembered that the 21st century Asia has become urban, the process itself has not been smooth, since many problems have occurred as a result. The most important of them relate to migration from rural areas, urban infrastructure including highways, basic services such as solid waste management and their impacts on the urban environment. In this volume, we have made an attempt to capture all these aspects of urban problems and the papers included reflect on various aspects of the above.

Nonetheless, we recognize that the most important of all problems is governance, as Paul and Sridhar (2013) point out, skilled labour and technology can be imported. Substitutes can be found to make up for infrastructure gaps. Power shortage can be relieved through the use of generators or of a national grid. Railways may make up when roads fail, but governance cannot be imported. Hence that's the common underlying theme for all aspects of urban problems we discuss here.

We also understand that different countries define urbanization in different ways, but most of the chapters make only intra-country comparisons. We have a note of caution which is also a caveat. Most papers in this volume focus on urban problems in India. However, given the Conference was held in Bangalore, India, this focus was unavoidable. The next caveat is that there are no papers focusing on the major Asian giant, China. However, we were able to include a few relevant papers one each in the context of Indonesia, Fiji and a cross country comparison chapter.

We hope that this volume will stimulate provocative debates on the ways in which these pressing urban problems can be solved across Asia. We sincerely hope that relevant policymakers, including those that have contributed to this volume, will take cognizance of the findings and recommendations here.

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We place on record our appreciation and thank all the reviewers of the various papers, whose comments helped to substantially improve the quality of the papers in this volume. We would err if we did not thank the various staff members at Springer India, Sagarika Ghosh, Nupoor Singh, Sahadi Sharma (who has left Springer now) who patiently answered many of our queries pertaining to the volume. Finally, we acknowledge the patient copy-editing of the various chapters in this volume by Puja Kumari.

Any errors remain ours.

# Contents

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# Chapter 1
# Introduction

**Kala S. Sridhar and Guanghua Wan**

In 2007, half of the world population became urban. Some countries have managed urbanization well in terms of providing a reasonable level of public services and infrastructure. Some other countries, however, have not been successful, where fast urbanization brought about slums, pollution and traffic jams. While the failure can be attributed to various causes, this volume puts governance at the forefront of challenges governing urban areas in the developing world and more specifically Asia. As Paul and Sridhar (2013) point out, skilled labour and technology can be imported; Substitutes can be found to make up for infrastructure gaps; Power shortage can be relieved through the use of generators or of a national grid; Railways may substitute when roads fail; but governance cannot be imported.

In the context of urbanization, the issue of governance is not limited to managing urban affairs. Rural–urban linkages must be considered. Thus, the first part of this volume focuses on India's rural programmes. The second part of the volume focuses on urban governance, infrastructure and service delivery. The focus of the last part of the volume is on urbanization and environment.

The first part of the volume focuses on rural programmes in the context of India which include the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), and India's Total Sanitation Campaign (now the Nirmal Bharat Abhiyan (NBA)).

Both these programmes have impacted urbanization since a professed objective of the MGNREGA is to reduce rural–urban migration, based on the assumption that migration is necessarily an evil. Similarly, India's NBA aims at improving rural sanitation. It should be noted that lack of adequate public services is shown to promote rural–urban migration in India and globally.

The paper by Moitri Dey focuses on the implementation of the MGNREGA in a district of Rajasthan and suggests several recommendations to plug the loopholes in

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terms of identification of beneficiaries, their lack of awareness, grievance redressal and sustainability of the programme.

The paper by Anand Rao and Manik Dive on India's Total Sanitation Campaign (now NBA) discusses the practices followed by a local government (gram-panchayat, as it is called) of a semi-urban village and one private service provider helping in the solid waste management in a town, Manchar in Pune district in Western India. The comparison of the approaches by the government and private service providers indicates that there is a significant scope for public-private partnership (PPP) interventions to tackle this problem within the NBA guidelines.[1]

The third paper by Ashima Sood provides the transition from the rural to the urban areas, and highlights coping mechanisms in urban areas and policy implications for urban governance, from the viewpoint of rural migrants. The paper focuses on the emerging portrait of temporary and short-term migration and offers an in-depth study of how an informal market accommodates and is in turn shaped by these transient migration flows, taking the case of the cycle-rickshaw rental market in Bilaspur, Chhattisgarh in central India. Findings from this paper highlight the central role of urban informal markets in accommodating and supplying much-needed services to these underserved populations. Both qualitative and quantitative evidences indicate the close interdependence of informal markets and mobile workers offer a critical benchmark for evaluating policy interventions for informal and multilocational workers in urban settings. Connecting the policy discourses on informal self-employment and rural-to-urban mobility is key to framing appropriate policy, programmatic and regulatory responses to these most unprotected and invisible segments of the urban population. Three channels for such a policy connection need to be recognized: (1) existing regulatory frameworks for the informal sector impact the livelihoods of temporary migrants; (2) interventions for informal livelihoods that fail to account for mobile workforces may suffer from biased coverage and (3) informal markets that provide livelihoods for temporary and commuter migrants can suggest lessons and programmatic avenues to reach these workers.

The second part of this volume is concerned about urban governance, infrastructure and service delivery. Regarding urban governance, we first present a template for benchmarking cities in India. It is important to point out that inadequate data and information have undermined the ability of analysts and policy makers in India to comprehend the complex forces shaping cities and to develop and implement effective urban policies. Given the importance of cities in the country's economic growth and development, Sridhar and Kashyap undertake a review of the country's

[1] The main objectives of India's NBA are the following: (1) Bring about an improvement in the general quality of life in the rural areas. (2) Accelerate sanitation coverage in rural areas to achieve the vision of Nirmal Bharat by 2022 with all gram-panchayats in the country attaining Nirmal status. (3) Motivate communities and Panchayati Raj Institutions promoting sustainable sanitation facilities through awareness creation and health education. (4) Cover the remaining schools not covered under Sarva Shiksha Abhiyan (SSA) and Anganwadi Centres in the rural areas with proper sanitation facilities and undertake proactive promotion of hygiene education and sanitary habits among students. (5) Encourage cost-effective and appropriate technologies for ecologically safe and sustainable sanitation.

four major cities—Delhi, Mumbai, Kolkata and Chennai. While it is clear that no existing studies present a state of cities in India's context, not collecting this information has disastrous consequences for cities, as they would neither be in a position to understand their own growth nor predict their future planning for public services. This chapter attempts to fill in this vacuum by developing indicators and benchmarks for six thematic areas that capture the dynamics and potential of urban areas: history and governance, demographics, economic dimensions, infrastructure and public services, resources and quality of life. Policy makers, city officials, investors, real estate developers, infrastructure agencies, financiers, industry, credit rating agencies, the educated general public and researchers would be interested in the research since it has implications for the business environment and quality of living in the cities.

The next set of chapters in this part of the volume intends to evaluate infrastructure programmes for cities and towns in India at various governmental (state and central government) levels. Taking the case of the south Indian state of Karnataka, the paper by Sridhar and Reddy studies the institutional processes of programme implementation and computes cost and time overruns in urban infrastructure programmes from the state and central government. It also makes a number of policy recommendations. Overall, while the authors find centrally funded programmes in India are better in drawing and enforcing formal processes, local governments are better at implementation of the state-funded urban infrastructure programmes. With respect to the state-centric urban infrastructure programme, the paper finds that cities implemented infrastructure projects with great interest and enthusiasm, since they are eventually locally owned and used and these projects facilitated the mobility of residents and improved the ambience of the neighbourhood. With respect to the centrally funded programme of the Ministry of Urban Development, Government of India, Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT), the paper finds that more engineers need to be recruited. Meanwhile, some training in e-tendering and e-payment would be helpful for better implementation of similar programmes in the future.

Public-private partnership (PPP) concessions for transportation infrastructure, especially road projects, have high degree of risk exposure and complex nature of risk profile. The paper by Roy, Kalidindi and Soundararajan studies the evolution of contractual allocation of critical risks for PPP road projects, in different generations of Concession Agreements (CA), for national and state highways in India. The study is limited to PPP projects in Indian national highways, expressways and state highways with toll-based concessions. Through literature review and subsequent questionnaire survey, this chapter identifies land acquisition, revenue, permit/approval, cost overrun and political risks as the most critical risks in Indian PPP road projects. The chapter concludes from the above analysis that over the years, risks relating to revenues and cost overruns have been always passed on to the private party, which reflects the belief of the policy makers that the private party is more capable of mitigating the risk. On the other hand, in the case of risks relating to land acquisition, and permits/approvals, there is a shift in the risk of allocation towards the government, which might be in the best interest of the projects.

The next couple of chapters present a balanced view of urban mass transport options, namely the metro in two mega Indian cities, Delhi and Kolkata. The chapter by Pawan Kumar attempts to quantify the value of travel time saved at Rohini (West) metro station in Delhi to appreciate various other attributes which contribute significantly in modal shift. Given Delhi roads are saturated with all kinds of modes of transport, the paper finds that saving in travel time is one of the reasons for modal shift from bus to metro along the Delhi metro corridor Line I. The study shows that the average time saved due to modal shift from bus to metro is 29 minutes, with the value of saved travel time being ₹ 2.54/min and ₹ 2.12/min for government employees and private-sector employees respectively.

While the above is necessarily a positive view of the metro, the next chapter by Sutapa Das examines hidden costs in public infrastructure projects, taking the case of the East–West Metro in Kolkata. Using data from surveys, this paper finds a road-blockage of 1.5 km with a diversion of 0.9-1.09 km, and finds a loss of ₹ 8.4 million per year for extra fuel, subsidy, lost man-hour and pollution (excluding cost for vehicle maintenance and accidents).

In the section on public service delivery, the chapter by Pooja Ravi investigates the impact of reforms introduced in Solid Waste Management (SWM) in India, focusing on the informal sector in Delhi, more specifically ragpickers engaged in the management of waste. The chapter concludes that reforms in policy making are successful only when they are informed by the context and have proper accountability measures and a social system which takes into consideration the needs of even the most marginalized in society such as ragpickers.

Next, Socrates and Hari Govindaraj estimate welfare loss due to improper municipal solid waste management in Tirunelveli Corporation—one of the fast-developing cities in southern India. The welfare loss is estimated using the logit and tobit models with the purpose of discovering willingness to pay for improving the quality of municipal solid waste management. The authors find that household income, family size, years of residing, distance from the landfill sites and respondent's education, sex and perception of health risks were significant determinants of a household's willingness to pay to avoid such vector-borne diseases caused by rampant municipal solid waste. The authors measure man-days loss, wage loss and number of hospital visits due to municipal solid waste management.

When we discuss governance, it is not just infrastructure or public services that need attention. As highlighted by the World Bank (2011), the city administration of Cape Town launched in 2002 its award-winning 'Smart City' strategy, the objectives of which were to achieve:

- A city where 80 % of residents, businesses and institutions are connected to each other and the world through well-developed ICT skills;
- A city where 80 % of the population will be able to interact with the city administration through the use of ICT, allowing citizens to deal with local government services in an integrated manner, via 'one-stop-shops' and
- More customer-friendly and citizen-oriented local government via easy, timely access to relevant, accurate council information.

As components of the 'Smart City' strategy, a number of initiatives were implemented by the city administration of Cape Town: *Externally* focused projects included 'Smart Cape Access' (which made computers with free internet access available to any citizen in six public libraries); 'Library Business Corners' (providing accessible information and support networks for starting and running small and medium enterprises (SMEs)); 'Digital Business Centers' (providing telephones, faxes, scanners, etc., and business services such as accounting, legal, tourism)and 'Training Learnership in ICT' (ICT training opportunities to unemployed, disadvantaged individuals).

In the spirit of the earlier chapter, the next chapter by Salvin Nand focuses on SMEs with a view to reducing the regulatory burden on them, and the implications for urban local bodies in Fiji (along with that for the other levels of government) are summarized. The chapter finds that there should be a "one stop" checklist (according to the business type) detailing all the regulatory compliance needed to be fulfilled in opening and maintaining a business. It suggests that a checklist should be readily available in different languages. In addition, streamlining of legislation is a policy issue and not an administrative issue. Drafting streamlined legislation can only proceed once the details of the policy framework are clear. This can only begin by examining each existing law applicable to small and microenterprises, as well as those in the grey market, to see if it is still consistent with implementing present policy on SMEs. Finally, a stand-alone legislation on SMEs may be considered desirable for SMEs, rather than a plethora of provisions in different legislations.

The focus of the last part of the volume is on urbanization and environment. Rathee presents findings which show that the change in land area under non-agricultural uses is significantly associated with urbanization, which is a cause of concern in India's context, given the need for national food grain self-sufficiency. The chapter by Geetika Rathee presents land-use statistics at the national level and for major metropolitan regions to explore the direction and scale of land-use changes. The chapter concludes with the issues and concerns these changes have thrown up, suggesting a way forward.

The chapter by Sigit Arifwidodo explores the relationship between urban form and residential energy use in Bandung, Indonesia. He finds that urban form plays a role in residential energy use, directly and indirectly and compact cities contribute to energy conservation. A dispersed land use brings about larger houses and more detached units, which consume more energy than the smaller houses and attached units typical of more compact communities. The study concludes that combining the concept of compact urban development and energy-efficient housing design will contribute to better solutions for creating a more energy-efficient city.

The volume concludes with a chapter by Wan and Kahn which depicts a cautiously optimistic picture on Asia's urbanization–environment nexus. This chapter tackles two growing concerns—environmental sustainability and rapid urbanization. Asia is home to almost half of the global urban population and is urbanizing at a pace faster than any other region, resulting in an unprecedented growth in urban residents and increased number of densely populated megacities. Consequently, the region will be confronted with even greater environmental challenges that are

already serious, including air pollution, congestion, $CO_2$ emission, deprivation of water and basic sanitation and growing vulnerability to natural disasters. But with urbanization comes the rise of the middle class and property owners, the development of the service sector, declining fertility and increased educational attainment and, more importantly, innovations in green technology. These urbanization–related forces and mechanism are important for attaining a win-win scenario of environmental improvement and economic growth. Through establishing and exploring the environment–urbanization nexus in Asia, the chapter offers a cautiously optimistic environmental prospect for Asia as the region urbanizes.

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# Part I
# Rural-urban Linkages

# Chapter 2
# Implementation of MGNREGA: A Study of Two Gram Panchayats in Jhalawar, Rajasthan

**Moitri Dey**

## Introduction

MGNREGA is the first ever law internationally to guarantee wage employment on such an unprecedented scale. The idea is to provide a legal guarantee of employment to anyone who is willing to do casual/unskilled manual labour at the statutory minimum wage. Any adult who applies for work under the Act is entitled to being employed on public works without delay.

Some of the main objectives of the Act are to ensure social protection for the rural poor by providing employment opportunities, ensuring livelihood security for the poor through creation of durable assets, effecting greater transparency and accountability in governance and checking distress migration by providing work within the vicinity of the village. Thus, an employment guarantee Act provides a universal and enforceable legal right to the most basic form of employment.

The chapter starts with a review of various studies, which have been taken up after the implementation of MGNREGA. The next section discusses the methodology adopted for the study. The third section presents the findings of the field study conducted in the two Gram Panchayats of Jhalawar. The chapter concludes with suggestions on effective implementation of the Act.

## Review of Literature

In India, providing employment as entitlement for the welfare of the public has a long history. During the fourth century BC, the ancient political economist Kautilya, in his *Arthashastra*, emphasised the welfare of the public through relief work, particularly during famines. Kautilya stated: "In the welfare of the people lies the welfare of the King." As the economic policies of the colonial era were based on the

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economic interest of the imperial masters rather than that of the colonised people, when India attained independence, the impact of such economic policies was visible on all spheres of the Indian economy. India at that time faced a high incidence of poverty and unemployment, and the concomitant social and economic challenges before the country were enormous. Ever since, poverty reduction and providing basic needs to its people have constantly been one of the major aims of independent India. Decades after independence, India is still struggling to address the issue of poverty. This is evident from the fact that India is ranked 119th among 182 countries in the Human Development Index (HDI). Despite India's booming economy, which now stands as the tenth largest in the world, 302 million people (21.8 % of its total population) were living below the poverty line in 2004–2005 (61st NSSO round), where the poverty line is equated at ₹ 356 monthly per capita consumption expenditure for rural areas and ₹ 539 for urban areas. According to the Human Development Report (HDR) 2003 of the United Nations Development Programme (UNDP), India has the largest number of poor population among single countries of the world and is home to one-fourth of the world's poor population.

Based on the experiences of previous poverty alleviation and employment generation policies, and a long-drawn struggle by various sections, MGNREGA was enacted in 2005 by the Government of India to tackle poverty more efficaciously. During this period, most of the developing nations were in distress, largely due to neoliberal policies. As has been rightly put forward by Hirway et al. (2010), the neoliberal policies have treated employment very indifferently, creating shortages of decent work opportunities in most developing countries. MGNREGA was enacted to reinforce the commitment towards livelihood security in rural areas. The significance of MGNREGA lies in the fact that it creates a right-based framework for wage employment programmes and makes the government legally accountable for providing employment to those who ask for it.

In the initial phase of the implementation of the Act, the evaluation of the policy was based on the official data of the Ministry of Rural Development (MoRD). Drèze and Oldiges (2011) have presented the outcomes of the initial 2 years (2006–2008) of implementation of the programme. According to their findings, MGNREGA generated 90 crores (nearly 1 billion) person-days of employment in 2006–2007, at a cost of about ₹ 9,000 crores. In addition, there are startling differences in the levels of MGNREGA employment generation amongst different states. Some state governments have clearly decided to 'own' MGNREGA, and seized the opportunity to provide large-scale employment to the rural poor at the cost of the central government (which foots about 90 % of the bill). In some states, the whole programme is yet to take off.

Rajasthan was the best performer among all the states in India in 2006–2007 (in terms of employment generation per rural household). Indeed, employment guarantee has been a lively political issue in Rajasthan for quite a few years, and the state also has a high level of preparedness for the Act, having organised massive public works programmes almost every year in living memory. Note, however, that the small state of Tripura in the northeast is doing even better than Rajasthan, with 87 days of MGNREGA employment per rural household in 2006–2007. In both states,

employment generation under MGNREGA is already quite close to the upper limit of "100 days per rural household." This is an unprecedented achievement in the history of social security in India.

Yet, things are far from satisfactory. Although MGNREGA has become an important tool for social change, particularly for women, it was found that the mandatory provision of crèche facilities at MGNREGA worksites has been brazenly ignored. It is also alarming to find that some states are evidently paying less than the statutory minimum wage, in flagrant violation of the Act. The most glaring offender in this respect is none other than Rajasthan, where MGNREGA workers earned a meagre ₹ 51 per day on average in 2006–2007, even though the statutory minimum wage was ₹ 73 per day.

As per the official data for the financial year 2011–2012, provided by the website of the MoRD (www.nrega.nic.in), till date (accessed on 23.05.12), 4.99 crore households have been provided employment in India. It is also interesting to note that women's participation rate in overall states is quite high at 48.18 %. In particular, it holds the powerful prospect of bringing about major changes in the lives of women. It is also to be noted that women's work participation rate has increased over the years. The wider acceptability of MGNREGA work derives from several factors: it is locally available; being government work, there is regularity and predictability of working hours; less chance of work conditions being exploitative; and work is considered socially acceptable and 'dignified' (Khera and Nayak 2009). It has the potential to revolutionise the status of rural livelihoods in India. It has been rightly put by Dutta et al. (2012), that, "a scheme such as this can also provide valuable insurance against the many risks faced by India's rural poor in their daily lives." In a similar vein, Ghosh (2006) states that, "employment generation schemes, if imaginatively conceived and properly implemented, can have very substantial effects in terms of creating conditions for much higher levels of economic activity and therefore growth, especially in the rural areas."

According to the Act, 50 % of the implementation work will be carried out by the Panchayati Raj Institutions (PRIs). The MoRD claims that the village panchayats are implementing close to 83 % of total MGNREGA works, while others including independent implementing agencies and block panchayats are implementing around 17 % of works. A study conducted on 200 backward districts of MGNREGA by the Planning Commission revealed that in some of the 200 districts, panchayats do not exist, or are non-functional, and the Gram sabhas, which are required to scour through the shelf of projects, are dormant in some of the cases.

However, the Comptroller and Auditor General of India (CAG) report revealed lapses in the implementation of the Act. The key findings of the report are that the delivery of the MGNREGA has deteriorated significantly. There are two aspects to this. First, a very small segment of the people who sought jobs under MGNREGA actually received employment; in the period April 2006 to March 2007, a mere 10 % of all such applicants received a minimum wage job; from April to December 2007, the number of actual beneficiaries dropped even further to just 3.3 % of the total job seekers registered under the scheme. Second, even within the beneficiaries, only a small minority received the promised compensation in entirety. Thus, the

CAG sample reported the average employment per person under the scheme as 45 days in April 2006 to March 2007, dropping further to just 38 days during April–December 2007. In addition, the CAG reported that the MGNREGA is afflicted with corruption and misutilisation of funds, as well as inefficiency and unreliable documentation in most of the districts covered by this study. The worst performance in this regard came from the poorer states of Bihar, Orissa, Jharkhand and Uttar Pradesh. These are the states that have the greatest need for a comprehensive rural employment scheme (Goswami 2008).

The CAG report noted "significant deficiencies" and their impact on MGNREGA implementation: "The main deficiency was the lack of adequate administrative and technical manpower at the block and GP levels. The lack of manpower adversely affected the preparation of plans, scrutiny, approval, monitoring and measurement of works, and maintenance of stipulated records at the block and GP levels. Besides affecting the implementation of the scheme and the provision of employment, this also impacted adversely on transparency, and made it difficult to verify the provision of the legal guarantee of 100 days of employment on demand. Planning was inadequate and delayed, which resulted in poor progress of works. Systems for financial management and tracking were deficient, with numerous instances of diversion/ misutilisation, and delay in transfer of state share. Monthly squaring of accounts at different levels to maintain financial accountability and transparency was also not being done. Maintenance of records at the block and GP levels was extremely poor, and the status of monitoring, evaluation and social audit was also not up to the mark (Government of India 2007)."

A study of four states (Gujarat, Madhya Pradesh, Maharashtra and Rajasthan), conducted by the NGO Disha (2007), reveals that most of the respondents had a low level of education, which was an impediment in their awareness regarding the provisions of the Act (Jaswal and Mistry 2007). It was also found that their common problems constituted lack of proper information, temporary job cards (JCs), JCs without photographs and delayed application process for work. The average period of employment was around 39 days. However, the two districts of Dungarpur and Udaipur in Rajasthan, with 63 and 67 days of work, respectively, were in a better position as compared to the other states. A delay in payment of wages was a common phenomenon in all the districts. An analysis of the average wages paid for different work across districts show that at many instances, the wages paid are even below the minimum agriculture wage as decided by the central government (for example, ₹ 50 per day for Gujarat, ₹ 73 for Rajasthan and ₹ 63 for Madhya Pradesh).

The All-India Report on Evaluation of MGNREGA: A Survey of Twenty Districts (2007), carried out by the Institute of Applied Manpower Research for the Planning Commission, assessed the effectiveness of the Act. The study revealed that 80 % of the households did not get work within the stipulated 15 days' time from demand for work in writing; neither were they paid unemployment allowance, as stipulated. An enquiry was also made to assess the impact of the scheme on the overall quality of life of the beneficiaries. Due to the income generation through this scheme, the number of beneficiaries at the low earning level was reduced by nearly half, resulting in the rise of households with marginally higher income.

Another study, this time with special focus on women, was undertaken by the National Federation of Indian Women (NIFW) for MoRD (2008). The study was conducted in the four districts of Rajnandgaon (Chhattisgarh), Jhabua (Madhya Pradesh), Mayurbhanj (Orissa) and Cuddalore (Tamil Nadu). In all these districts, it was found that respondents were very optimistic about the importance of MGNREGA in their lives. It was also found that women workers in these districts were taking their wages directly. The major concern realised through the study was that the awareness level of the respondents, most of who were illiterate and belonged to the economically weaker class. They were unaware of the provisions of the Act. It was also seen that there was lack of worksite facilities, particularly safe drinking water, protective shed and first aid facility.

Khera and Nayak's study on women workers and perceptions of the MGNREGA enquired into the significance of MGNREGA in the lives of rural women. There were variations in women's participation across the sampled areas. There were also issues of lack of crèche for mothers of young children and the continued illegal presence of contractors. Given the critical gains made by women workers—of accessing work and generating income, food and health care for themselves and their families, and of leaving potentially hazardous work—it needs to be ensured that the problems in implementation do not derail its gains.

They further pointed out the potential of MGNREGA to have a wider impact on gender relations over time as MGNREGA employment can enhance women's economic independence by providing them access to cash earnings. Moreover, MGNREGA can bring about a sense of equality fostered by earning, for the first time, the same wage as men.

MGNREGA has been enacted with a lot of hope and aspirations for the poor and the vulnerable. A number of studies have been conducted to review the implementation of MGNREGA in the various states of India. It shows a general picture of the implementation of the Act (Shah 2007; Kumar and Prasanna 2010). Most of the studies conducted are based on secondary data and official reports provided by the government (Chakraborty 2007; Mehrotra 2008; Dutta et.al. 2012). This paper is a study based on primary data collected at the Gram Panchayat level where the actual implementation takes place. It helps to identify the loopholes in implementation at the micro-level.

## Methodology

The fieldwork on the implementation of MGNREGA was carried out in Jhalawar and four other districts of Rajasthan. Rajasthan was selected because of its pioneering role in the enactment and implementation of the Act. The origin for enactment of the Act can also be traced back to the state. The people's movement in Rajasthan led to the enactment of the Right to Information Act (RTI) and MGNREGA. The people of Rajasthan were actively engaged in the long struggle for RTI, MGNREGA and the current right to food campaign spearheaded by civil society organisations,

particularly the Mazdoor Kisan Shakti Sangathan (MKSS). This created awareness about the MGNREGA before it was enacted.

Jhalawar is one of the districts in Rajasthan where MGNREGA was implemented in the initial phase. Jhalawar is an industrially backward district as well. It has been identified as one of the least developed areas of the country comprising mostly marginal farmers and forest dwellers. Poverty in this district has increased despite the consistent focus of several poverty alleviation programmes (Government of India 2003). In 2009, the Ministry of Panchayati Raj named Jhalawar as one of the country's 250 most backward districts (out of a total of 640). It is one of the 12 districts in Rajasthan currently receiving funds from the Backward Regions Grant Fund Programme (BRGF) (Government of India 2009). Even though it occupies a prime position in the production of soya bean, orange and coriander, the agro-processing industry in the district has failed to pick up. The district lacks basic facilities for the development of industries. With MGNREGA's objective of job creation with minimum wages and creation of productive assets like water harvesting, road connectivity, land cultivation and others, Jhalawar is appropriate for the study.

The study employed survey method covering the two blocks of Jhalawar districts, Jhalrapatan and Pirawa, which were selected as sample blocks. As MGNREGA is implemented at the Gram Panchayat level, two Gram Panchayats, one in each block, were randomly selected. The Durgpura Gram Panchayat in Jhalrapatan and the Sunel Gram Panchayat in Pirawa were accordingly selected. About 30 respondents were selected in each of the Gram Panchayats using purposive sampling technique. The assumption behind purposive sampling is that by using good judgement and an appropriate strategy, the researcher can handpick the cases to be included and develop samples that are satisfactory. By using this technique, the researcher can use his/her expertise to select subjects that represent the population being studied (Bailey 1982). In a purposive sample, respondents are chosen because they possess the necessary characteristics, and they are accessible to the researcher.

The data were collected using a structured questionnaire prepared for the collection of information from households who have benefitted from the Act. The questionnaires were prepared on the basis of the guidelines provided by the MoRD for the implementation of the Act (Government of India 2005). The interview in Durgpura was carried out at a worksite near Durgpura village. A road was being repaired, which was constructed under MGNREGA. As there were very few people working at the worksite, interviews of beneficiaries were carried out in the villages of Kotra and Durgpura, both coming under Durgpura Gram Panchayat. There was no work carried out during the field visit in Pirawa. As a consequence, the interview of the beneficiaries was held in Suhas village. A total of 60 people were interviewed in Jhalawar district.

The data collected from the beneficiaries were analysed using Statistical Package for the Social Sciences (SPSS). The data analysis was confined to cross tabulation and frequencies of descriptive statistics.

**Table 2.1** Sample respondents in Jhalawar

| Caste | Male | Female | Total |
|---|---|---|---|
| *Durgpura* | | | |
| SC | 1(3.3) | 4(13.3) | 5(16.7) |
| ST | 1(3.3) | 5(16.7) | 6(20) |
| OBC | 3(10.0) | 16(53.3) | 19(63.3) |
| *Total* | 5(13.3) | 25(83.3) | 30(100) |
| *Sunel* | | | |
| SC | 12(40) | 0 | 12(40) |
| ST | 11(36.7) | 0 | 11(36.7) |
| OBC | 7(23.3) | 0 | 7(23.3) |
| *Total* | 30(100) | 0 | 30(100) |

Figures in brackets indicate percentage

## Results

This section of the chapter is based on the findings of the primary data collected from the two Gram Panchayats of Durgpura and Sunel. Some of the major findings of the study are discussed below.

### *Sample Respondents*

Out of the 30 respondents in Durgpura, 25 were females. The female work participation rate among the Scheduled Caste (SC) and Scheduled Tribe (ST) was low, as compared to the Other Backward Class (OBC), which had a female participation of 53.3 %. The male workforce in these social categories was low (refer to Table 2.1).

In Sunel, there was no work carried out as mentioned above. The male or head of the household responded to the questionnaire, even though it is the female of the household who goes to work under MGNREGA.

In general, the findings from both the Gram Panchayats revealed that the workforce was mostly women from the marginalised sections of the society. In addition, the findings at these Gram Panchayats tailored into some overall observations about MGNREGA. While it is recognised that one of the main objectives of the Act is to aid and empower marginalised sections of the society, which includes, among others, SC, ST and women, it has been seen that people from the upper castes, particularly those from the general category and Brahmins, do not work under MGNREGA. They consider that working with marginalised sections of the society may affect their social status. In accordance with this, men consider the work of MGNREGA to be meant for women only. This is one of the reasons behind the large percentage of female workers working under the scheme; the limited days of work and low wage rate under the Act being the other reason.

Rajasthan has been one of the states in India with a large percentage of women's work participation. As per the MoRD, the work participation rate of women

**Table 2.2** Household size of respondents in Jhalawar

| No. of household members | Frequency | % | Cumulative % |
|---|---|---|---|
| *Durgpura* | | | |
| 1–2 | 8 | 26.7 | 26.7 |
| 3–4 | 17 | 56.7 | 83.3 |
| 5–6 | 5 | 16.7 | 100 |
| *Total* | 30 | 100 | 0 |
| *Sunel* | | | |
| 1–2 | 3 | 10 | 10 |
| 3–4 | 10 | 33.3 | 43.3 |
| 5–6 | 10 | 33.3 | 76.7 |
| 7–8 | 1 | 3.3 | 80 |
| 9–10 | 3 | 10 | 90 |
| 10 and above | 3 | 10 | 100 |
| *Total* | 30 | 100 | 0 |

in December 2012 was 69.2 %. One of the reasons behind the large percentage of women's work participation rate is their male counterparts' preference to continue with their respective occupations.

One of the positive impacts of MGNREGA is that it has helped women in rural areas to come out of their closed shell. The women respondents said that the enactment of MGNREGA has been a fortunate thing for them. The wage from MGNREGA is an additional income for the family. It has a social impact as well on the lives of women. In rural areas, most women are treated as subordinates in a household. They do not have a say in the family. However, MGNREGA has changed their social status. They are taking active part in the decision making of the family.

## *Household Size*

The term 'household' in this chapter is defined as a nuclear family, comprising of mother, father and their children, and may include any person wholly or substantially dependent on the head of the family. Household will also mean a single-member family. The work under MGNREGA, as per the statute, is provided to those households whose adult members are willing to work as unskilled labour. The work is provided for 100 days in a financial year to every household. Thus, the size of the household assumes significant importance, because employment is provided to a household under MGNREGA. The average household size of Durgpura was three to four. The maximum number of members in a household was five to six, which is considered a small number as compared to other rural households (refer to Table 2.2).

The situation was different in Sunel, where there were families with more than ten members. A household with a large number of members has not benefitted much from the Act. The statute guarantees work to a household for 100 days only but does not address the needs of the entire family. The wage from MGNREGA in case of a large household, therefore, can only be an additional source of income for their livelihood.

**Table 2.3** Profile of sample respondent in Jhalawar

| Household income (monthly in INR) | BPL card holder | Landholding | | | | Total |
|---|---|---|---|---|---|---|
| | | Landless | 1–5 Bigha | 6–10 Bigha | 16–20 Bigha | |
| *Durgpura* | | | | | | |
| 500–1000 | Yes | 2(6.7) | 3(10.0) | 0 | 0 | 5(16.7) |
| | No | 0 | 2(6.7) | 0 | 0 | 2(6.7) |
| 1000–1500 | Yes | 3(10.0) | 0 | 0 | 0 | 3(10.0) |
| | No | 1(3.3) | 0 | 0 | 0 | 1(3.3) |
| 1500–2000 | Yes | 8(26.7) | 2(6.7) | 0 | 0 | 10(33.3) |
| | No | 1(3.3) | 0 | 0 | 0 | 1(3.3) |
| 2000–2500 | Yes | 1(3.3) | 1(3.3) | 0 | 1(3.3) | 3(10.0) |
| 2500–3000 | Yes | 1(3.3) | 1(3.3) | 1(3.3) | 0 | 3(10.0) |
| | No | 0 | 0 | 0 | 1(3.3) | 1(3.3) |
| 4000 and above | No | 0 | 0 | 0 | 1(3.3) | 1(3.3) |
| *Total* | | 17(56.6) | 9(30.0) | 1(3.3) | 3(10.0) | 30(100) |
| *Sunel* | | | | | | |
| 500–1000 | Yes | 5(16.7) | 1(3.3) | 1(3.3) | 0 | 7(23.3) |
| | No | 1(3.3) | 15(50.0) | 0 | 0 | 16(53.3) |
| 1000–1500 | Yes | 1(3.3) | 2(6.7) | 0 | 0 | 3(10.0) |
| | No | 1(3.3) | 0 | 0 | 1(3.3) | 2(6.7) |
| 1500–2000 | Yes | 1(3.3) | 0 | 0 | 0 | 1(3.3) |
| | No | 0 | 0 | 0 | 1(3.3) | 1(3.3) |
| *Total* | | 9(30.0) | 18(60.0) | 1(3.3) | 2(6.7) | 30(100) |

Figures in brackets indicate percentage

## *Profile of Sample Respondents*

Table 2.3 indicates the background of the respondents interviewed. Out of the 30 respondents in Durgpura, 24 had a below poverty line (BPL) card, translating into 80 % of the total sample (see Table 2.3). Half of the total sample, that is, 50 % of the respondents in Durgpura, comprises landless labourers. This means that they are dependent on earnings from work under MGNREGA for their livelihood, while those with landholdings cultivate on their land and seek MGNREGA employment during the lean season.

Unlike Durgpura, the number of people with BPL cards is less in Sunel. In addition, according to the findings of Paul et al. (2012), BPL cards are not a good measure of poverty as there are frequently fake cards, ghost or duplicate BPL cards detected. Only 13.3 % have a BPL card despite the fact that they fall under the BPL category. The optimistic aspect is that out of the 30 workers, 21 people have land from which they get a decent income for their survival. The household monthly income of most of the workers ranges between ₹ 500 and 1000.

It must also be remembered that MGNREGA is a self-targeted programme for the benefit of the poor. On the other hand, there is no specific criterion for identifying poor and needy households. Jha et al. (2010) describes targeting as one way to reduce disadvantaging of the poor by non-poor households. Having a demand-driven approach, the MGNREGA programme relies on the beneficiaries to select themselves. This ensures that the targeted population is benefitted. However, when there is a lack of work to gratify the demand for jobs under the scheme, it has been found that there are non-poor households who obstruct the employment of poor households at those times. This phenomenon has been described as "capture." Many studies have also reported that the benefits of the pro-poor policies are often captured by the non-poor. This has been cited as one of the major challenges in the effective implementation of policies like MGNREGA (Jha et al 2009).

## *Awareness Level*

While implementing a policy it is essential that the targeted population is aware of the policy. Unless and until the targeted population participates, the policy cannot be implemented effectively. Thus, spreading awareness regarding the policy is also an integral part of its implementation. The people of Rajasthan were well aware about MGNREGA, which they commonly called Narega or Job Card.

In both the panchayats, people were aware of MGNREGA but not of the provisions of the Act. Gram sabhas are the main decision-making and implementing agencies in MGNREGA. All the announcements and planning of the Act is done by the Gram sabha. It is also the responsibility of the Gram sabha to conduct social audit of the work taken up by the Gram Panchayat.

However, as can be seen from Table 2.4, only 30 % of the respondents in Durgpura and 6.6 % in Sunel were aware of the Gram sabha held in the villages. A majority of the population (26.6 %) in Durgpura said that the Gram sabha proceedings were confined among the panchayat members only, and the villagers as such were not involved in the process. In Sunel, 63.3 % said that no Gram sabha had been held since the time MGNREGA had come into force, and 16.6 % had no idea what a Gram sabha was.

In both the Gram Panchayats, the majority of the population got information about the Act from the panchayat members. It was found that no hoardings, padyatras, street plays, etc., were held to spread the awareness regarding the Act. In both Durgpura and Sunel, only posters were displayed in the offices of the Gram Panchayats to spread awareness.

In Durgpura, only 2 out of 30 persons had received a signed receipt after applying for the job. Similarly, in Sunel only one person had got a signed receipt after applying for the job. It was surprising to find that none of the respondents were

**Table 2.4** Awareness among the respondents about the provisions of the Act in Jhalawar

| Educational qualification | Gram sabha held | | | | Source of information about the Act | | Signed receipt after applying for job | | Unemployment allowance | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Yes | Yes (only panchayat members) | No | No idea | Villagers | Panchayat members | Yes | No | Yes | No |
| *Durgpura* | | | | | | | | | | |
| Illiterate | 7(23.3) | 7(23.3) | 4(6.6) | 9(30.0) | 9(30.0) | 18(60.0) | 2(6.6) | 25(83.3) | 0 | 27(90.0) |
| Class I–V | 0 | 1(3.3) | 0 | 0 | 0 | 1(3.3) | 0 | 1(3.3) | 0 | 1(3.3) |
| Class VI–VIII | 1(3.3) | 0 | 0 | 0 | 1(3.3) | 0 | 0 | 1(3.3) | 0 | 1(3.3) |
| Senior secondary | 1(3.3) | 0 | 0 | 0 | 0 | 1(3.3) | 0 | 1(3.3) | 0 | 1(3.3) |
| *Total* | 9(30.0) | 8(26.6) | 4(6.6) | 9(30.0) | 10(33.3) | 2(6.6) | 2(6.6) | 28(93.3) | 0 | 30(100) |
| *Sunel* | | | | | | | | | | |
| Illiterate | 1(3.3) | 0 | 9(30.0) | 2(6.6) | 0 | 12(40.0) | 0 | 7(23.3) | 0 | 7(23.3) |
| | 2(6.6) | 1(3.3) | 6(20.0) | 2(6.6) | 0 | 11(36.7) | 1(3.3) | 11(36.7) | 0 | 12(40.0) |
| | 1(3.3) | 1(3.3) | 4(6.6) | 1(3.3) | 0 | 7(23.3) | 0 | 11(36.7) | 0 | 11(36.7) |
| *Total* | 4(6.6) | 2(6.6) | 19(63.3) | 5(16.6) | 0 | 30(100) | 1(3.3) | 29(96.6) | 0 | 30(100) |

Figures in brackets indicate percentage

**Table 2.5** Duration of getting a job card and job after applying in Jhalawar

| Days | Durgpura | | Sunel | |
|---|---|---|---|---|
| | Duration of getting JC | On demand–job duration | Duration of getting JC | On demand–job duration |
| 10–15 days | 5(16.6) | 5(16.6) | 1(3.3) | 4(6.6) |
| 15–20 days | 1(3.3) | 0 | 3(10.0) | 1(3.3) |
| 25–30 days | 2(6.6) | 12(40.0) | 8(26.6) | 16(53.3) |
| 30 and above | 22(73.3) | 13(43.3) | 18(60.0) | 9(30.0) |
| *Total* | 30(100) | 30(100) | 30(100) | 30(100) |

Figures in brackets indicate percentage

aware of the unemployment allowances, which should be provided if work is not provided within 15 days of the demand for work. It was also found that there is always a delay in providing employment after applying for work. Hence, a lack of awareness about the Act is one of the major lacunae in the proper implementation of the Act.

## *Duration of Time Lapse Between Getting a Job Card and Job After Applying*

A JC is an identification that entitles a household to apply for a job under NREG schemes. After due verification by the Gram Panchayat the JC needs to be provided within 15 days. Once a JC is issued, the household can apply for employment for 100 days. A written application seeking work is to be made to the Gram Panchayat or Block Office, stating the time and duration for which work is sought. The Gram Panchayats have to issue a dated receipt of the written application for employment, against which the guarantee of providing employment within 15 days is accepted.

For practical purposes the duration of time spent between getting a JC after applying and getting a job after applying is usually more than a month in both the Gram Panchayats. Yet the respondents complained that they do not get a job for months after applying for it. They do not get any unemployment allowance either and they were unaware of such a provision in the scheme (refer to Table 2.5).

In Durgpura, 73.3 % of the total workers got a JC after a month from the date of registration. Only 16.6 % got a job within 15 days of applying and the remaining got a job only after 15 days. The situation in Sunel is also similar to Durgpura. In both cases they did not get employment on demand, while the approach of the policy is that of an on-demand job.

It was observed that there is a ‘localised’ networking system in place for getting a job. The sarpanch decides who will be given a job on the basis of the relationship the beneficiaries share with the panchayat members. Thus, jobs are provided on priority basis to those people who have cordial relations with the panchayat members. This is one of the main reasons why people do not complain. In case they complain,

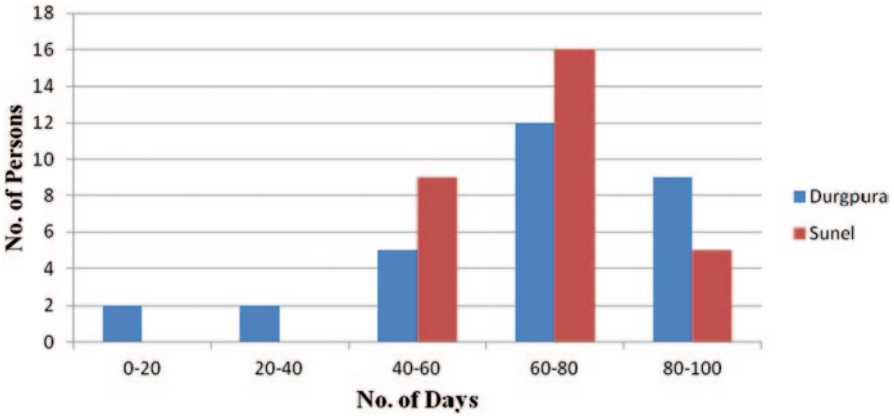


**Fig. 2.1** No of days worked by the respondents in financial year 2010–11 in Jhalawar

their future prospect of getting a job becomes leaner. On questioning about the issue, the panchayat secretary said that there was not enough work to gratify the demands of the beneficiary, so they were obliged to give jobs to those households who were economically poor.

## *Number of Days Worked by the Respondents in the Financial Year 2010–11*

Under MGNREGA, a household should be provided 100 days of guaranteed employment in a financial year. Work should be provided as and when demanded by any member of the household registered in the JC.

It has been found that there is lack of work in both the Gram Panchayats to address the demand for employment by the people. The graph shown in Fig. 2.1 indicates the number of days the workers have worked under the Act in the financial year 2010–2011.

In both the Gram Panchayats, the average number of days worked by the beneficiaries is 60–80 days. None of the respondents in Durgpura completed 100 days of guaranteed employment, whereas in Sunel only five (16.6 %) had completed 100 days. Since the enactment of MGNREGA, many sections of the society have been demanding an increase in the 100 days of employment. Yet, the guaranteed 100 days of work is also not provided to workers on demand. The sustainability of the Act to provide guaranteed work on demand is the big question.

The findings from the field show that workers are willing to work for more than 100 days. The issue is lack of work to meet the demand of the job seeker. The PRIs are unable to generate work for the people. The capacity of the PRI functionaries needs to be strengthened. It was also found that PRI functionaries are not trained adequately which is one of the reasons why they are unable to create enough work to address the demand for work.

**Table 2.6** Payment-related issues in Jhalawar

| Gram panchayat | Durgpura | Sunel |
|---|---|---|
| *Payment received per day (in ₹)* | | |
| 60–70 | 3(10) | 2(6.6) |
| 70–80 | 4(13.3) | 24(80) |
| 80–90 | 2(6.6) | 2(6.6) |
| 90–100 | 3(10) | 0 |
| 100 and above | 18(60) | 2(6.6) |
| *Total* | 30(100) | 30(100) |
| *Frequency of payment (in months)* | | |
| 15 days–1 month | 5(16.6) | 5(16.6) |
| 1–2 months | 19(63.3) | 23(76.6) |
| 2–3 months | 4(13.3) | 2(6.6) |
| 3–6 months | 2(6.6) | 0 |
| *Total* | 30(100) | 30(100) |

Figures in brackets indicate percentage

## *Payment-Related Issues*

Wages are to be paid as per state notified rates. The Government of India has notified MGNREGA wages. As per the Schedule of Rates (SoRs), wage has to be paid according to piece rate. The details of the productivity norms are listed in the SoRs. The SoRs are calculated through Work Time and Motion Studies. The SoRs, under the Act, have to be such that an average person working for 9 hours, with 1 hour of rest, is able to earn the notified MGNREGA minimum wage. Payment of wages has to be done on a weekly basis and not withheld beyond a fortnight in any circumstance. The payment of wages is mandatorily done through the individual/joint bank/post office beneficiary accounts. Exceptions are made to this if the state government has an exemption from Government of India (GoI), specifying a plausible reason. The issue of late payment and non-payment of stipulated wage has been of great concern in the implementation of the Act. The basic entitlements of the beneficiaries do not reach them.

There were issues of delay in payment in both the Gram Panchayats under review. Many villagers complained during the field visit that their payments were not made on time. The delay in payment and payment of lower than the stipulated wage has been one of the areas of concern in the implementation of MGNREGA.

Table 2.6 shows that in Durgpura the maximum number of respondents have received a payment of ₹ 100–110, whereas in Sunel only two (6.6 %) people received a payment of ₹ 100–110. There was no discrimination in the payment made to women. The issue is that payments are made through bank accounts, which are in the name of the male head of the household. Therefore, women who do the actual work are at times deprived of the financial benefits of their own hard labour.

In Sunel, most of the beneficiaries got only ₹ 70–80, which is less than what they have been assured. In both the Gram Panchayats, there was a major problem of delay in payment. From January 2011 to March 2011, beneficiaries did not receive

**Table 2.7** Worksite-related issues in Jhalawar

| Gram panchayats | Durgpura | Sunel |
|---|---|---|
| *Distance to worksite (in km)* | | |
| 1 | 1(3.3) | 0 |
| 2 | 5(16.7) | 9(30.0) |
| 3 | 6(20.0) | 11(36.7) |
| 4 | 4(13.3) | 0 |
| 5 | 9(30.0) | 6(20.0) |
| 6 | 5(16.7) | 4(13.3) |
| *Total* | 30(100) | 30(100) |
| *Worksite facilities* | | |
| Nothing | 10(33.3) | 1(3.3) |
| Shade | 12(40.0) | 4(13.3) |
| Water | 0 | 8(26.7) |
| Water and medical aid | 0 | 4(13.3) |
| Water and shade | 8(26.7) | 13(43.3) |
| *Total* | 30(100) | 30(100) |

Figures in brackets indicate percentage

their payment in Durgpura, whereas the officials claimed that payment was being made on time. Similarly, in Sunel people went to their bank that is 20–25 km from their villages, only to find that the money had not come. In Sunel, the panchayat secretary put the blame on the district and higher authorities who do not release funds on time. Thus the blame game goes on and on.

In both the Gram Panchayats, people refrained from filing any complaint against non-availability of work and delay in payment. They feared that if they filed any complaint, their future prospect of getting work would be doomed. Some beneficiaries have also complained that they are not paid full payment, though according to the panchayat secretary payments are made according to the work done.

## *Worksite-Related Issues*

Under the Act, work is to be provided within 5 km from the village. If work is not provided within 5 km, extra wages of 10 % are payable to meet additional transportation and living expenses. Nonetheless, Table 2.7 reveals a different story.

In Durgpura, 16.7 % of the population went to work beyond 5 km, which entitles them to an additional 10 % of the wage rate as transport and living allowance. However, in both the panchayats, no one was paid such an allowance. A large percentage (30.0) of the respondents came from a distance of 5 km. Similarly, in Sunel 13.3 % came from a distance of 6 km and in both cases the workers were unaware of the entitlement for transport. The majority of the respondents, that is, 40 %, in Durgpura said that only shade had been provided at the worksite. Out of the total workers, 33.3 % said that no worksite facilities were provided in Durgpura, while 26.7 % responded that shade and water were provided at the worksite. In Sunel, 43.3 %

responded that shade and water had been provided. Unlike Durgpura, 13.3 % workers indicated that water and medical aid were provided at the worksites in Sunel. However, it was observed during the visit to the worksite that crèche facility was missing despite the fact that the majority of the workers were women with young children.

### *Impact on Rural–Urban Migration*

The problem of migration in India has been on the rise, in particular internal migration. One of the main aims of MGNREGA was to provide employment opportunity to the rural household with the objective of checking rural–urban migration. Although studies have reported that MGNREGA was able to check migration from rural areas by providing work within the villages (Bhatia 2009; Drèze 2010), it has been observed that the Act has had barely any impact on migration in the two Gram Panchayats in Jhalawar.

The head of the household, always a man, still continues to work out of the village. The only transformation is that earlier it was the whole household that used to migrate, but now only the male or the earning members of the household continue to work outside the district or state. This has brought some stability to their family lives. The children are getting enrolled in schools. The education of children was earlier considered to be difficult because of their constant movement.

There are certain reasons that are responsible for the minimal impact of MGNREGA on migration. First, the wage paid under MGNREGA is less compared to what they can, or may earn, from their regular work. Second, employment is provided only for 100 out of 365 days. The limited duration of providing work under the scheme leads workers to continue with their earlier regular jobs, which are mostly outside the village. Third, it has been observed that the rural mindset of men being superior in the family affects the work participation. The men workers consider the work of MGNREGA as work for women, and working for lower wages tends to affect the self-esteem of men. Fourth, the income from MGNREGA is not sufficient to accommodate the needs of a family, more so with the constantly increasing price of essential commodities.

## Conclusion

Some of the policy implications that arise from the above findings are of serious concern. The first issue is identification of the needy households who should be given work on a priority basis. The generation of work is less and demand is more. Moreover, the distribution of work is not done evenly. There is need to redefine a criteria of getting employment so that those in need of income can get employment on a priority basis.

It is worth mentioning that most of the beneficiaries are illiterate, which is one of the primary reasons behind their lack of awareness of the statutory norms. The participation of beneficiaries in the implementation process of a policy is needed for its successful implementation. In this regard, we can say that educating MGNREGA workers can facilitate their ability to understand the scheme. The National Literacy Mission programme of the Government of India for spreading adult education can be supportive in this. It can help the workers become acquainted with their rights and benefits more clearly and voice their demands. This will also increase the accountability factor among the implementing agencies at the higher levels of government. MGNREGA can be linked with major policies of the Government of India that are being implemented in the rural areas. This can enhance effective implementation of other policies of the government.

There is also a positive impact of the Act on children's education. As proper facilities are not provided at the worksites and a majority of the workers are women, they send their children to nearby government schools. In government schools, they not only get educated but also get a mid-day meal (a policy initiative of the state government), which helps the women of the household to work. The young children (3–5 years) can also be sent to Anganwadi centres created under the Integrated Child Development Services (ICDS). It will also help in improving their health and nurture them for schooling.

Another important issue that arises is the sustainability of the programme. We have seen that the demands for work are not fulfilled because of paucity of work. Integrated approaches in the implementation of government policies can fill in the gaps to a certain extent.

Lastly, there is a need to strengthen the grievance redressal mechanism. There is also a need to encourage the beneficiaries to come up with their grievances. The fear psychosis that they will not get work if they complain needs to be broken. The politicisation of providing work under the scheme has to be curtailed. The higher implementing agency needs to be more responsive for ensuring an effective implementation of the Act.

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# Chapter 3
# 'Total Sanitation Campaign' Intervention for a Semiurban Village Through 'Public–People–Private' Partnership

**Manik N Dive and Anand B Rao**

## Introduction

Water, sanitation and health are interlinked sectors. Typically, the water and health sectors receive greater attention from the local, national or international agencies, whereas the sanitation sector often gets a low priority. Even today, 2.5 billion people (36%) lack access to improved sanitation worldwide, out of which 610 million people are in India. One of the targets set under the 'Millennium Development Goal' (MDG) set in 2000 is to halve (by 2015) the proportion of the population without sustainable access to safe drinking water and basic sanitation. At its present pace, India would take time till 2054 to meet its MDG 2015 on sanitation (Unicef and World Health Organisation 2012). This is a concern because poor public services in rural areas cause unchecked migration into urban areas.[1] Sridhar et al. (forthcoming)[2] find that the lower the level of education of the migrant, the greater the importance of the push factors which includes public services such as roads, public transport, water supply or sanitation.

[1] Rural–urban migration may not be a necessary evil. Sridhar and Reddy (2012, 2013) estimate the contribution made by the urban poor (who are usually migrants) to the city economies of Bangalore and Chennai and find that they contribute, respectively, 3% and 14% to these city economies.

[2] Sridhar, Kala Seetharam, A.V.Reddy and Pavan Srinath. Is it Push or Pull? Recent evidence from Migration into Bangalore, India, Journal of International Migration and Integration (Springer), forthcoming.

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In spite of the huge deficit in the sanitation services, only 3 % of the total outlay of the eleventh 5-year plan (2007–2012) of the Government of India was assigned to the 'Total Sanitation Campaign' (TSC) programme (Planning Commission 2011, 2002). As shown in Table 3.1, the investment in the sanitation sector is very low as compared to other development sectors.

The Government of India's sanitation programmes, namely, TSC and 'Nirmal Gram Puraskar (NGP) scheme', have helped in accelerating the progress in the sanitation coverage in rural India. As a result, more and more gram-panchayat are becoming free of open defecation. However, now it is necessary to address problems of solid and liquid waste management in rural areas, especially in the urbanising villages, in order to make them really clean and green. Sustainability of the sanitation services is also an issue in the villages.

Solid waste management is one of the components in TSC. As per the report of TSC in May 2012, only 29,917 villages in the country have taken up activities of solid and liquid waste management since 2001–2002 (www.tsc.gov.in, accessed 9 May 2012). In a rapidly urbanising village, referred to as 'semiurban village' in this chapter, the issue of the solid waste management needs to be addressed considering its growth features. Manchar is a rapidly urbanising village in Pune district of Maharashtra (India). The gram-panchayat of Manchar approached the Centre for Technology Alternatives for Rural Areas (CTARA), Indian Institute of Technology Bombay, Mumbai, with the issue of solid waste and liquid waste management in the village (A letter from the Gram Panchayat of Manchar to CTARA, IIT Bombay, Mumbai, 18 October 2011). Hence, in the further discussion, a case study of Manchar (Maharashtra) is presented.

The solid waste management is a crucial issue for the urbanised areas also. The Pune Municipal Corporation is tackling solid waste issue in Pune city with the help of a private service provider, 'SWaCH', an organisation working in solid waste management. The services include collection, resource recovery, recycling and end treatment of the solid waste. There is a need for such approach in the solid waste management in the semiurban villages as well. As a result of the TSC implementation, the community ('people') as well as the institutes ('public institutes') in the rural area have been mobilised and motivated to tackle the sanitation issues. The present study is focussed on the solid waste management in the semiurban villages.

The objectives of the chapter are to:

1. Identify the peculiar features of the semiurban villages;
2. Assess the sanitation situation in such villages with special reference to the solid waste management;
3. Identify the scope for improvements in the solid waste management by the gram-panchayat; and
4. Explore the potential areas in which the private service providers (through public–people–private (PPP) partnership) may help the Gram Panchayat to improve the services based on the analysis of the best practices followed in the other successful interventions.

**Table 3.1** Investments in different development sectors in the 10th and the 11th 5-year plans (2002–2007 and 2007–2012, respectively) (Planning Commission 2011, 2002)

| Sr. no. | Development sector | Development programme | 10th 5-year plan outlay for the programme (in billion rupees and percentage) | 11th 5-year plan outlay for the programme (in billion rupees and percentage) |
|---|---|---|---|---|
| 1. | Employment | Sampoorna Grameen Rojgar Yojana (SGRY)/Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) | 300 (*16%*) | 1,563 (*23%*) |
| 2. | Education | Sarv Shiksa Abhiyan (SSA) and Mid-day Meal Programme | 223 (*12%*) | 1,162 (*17%*) |
| 3. | Health | National Rural Health Mission (NRHM) and Integrated Child Development Scheme (ICDS) | 467 (*25%*) | 692 (*10%*) |
| 4. | Infrastructure | Pradhanmantri Gram Sadak Yojana (PMGSY) | 125 (*7%*) | 650 (*9%*) |
| 5. | Irrigation | Accelerated Irrigation Benefit Programme (AIBP) and other water resources programmes | 44 (*2%*) | 466 (*7%*) |
| 6. | Drinking water | National Rural Water Development Programme (NRDWP) | 132 (*7%*) | 308 (*4%*) |
| 7. | Sanitation | Total Sanitation Campaign (TSC) | 9.5 (0.5%) | 227 (*3%*) |

### *Overview*

This chapter is organised as follows. In the 'Introduction' section, the overall context and the objectives of the study are explained. Next, 'Literature Review' defines a 'semiurban village', and briefly discusses the history of the sanitation programmes in India and the role of various stakeholders. This is followed by a 'Case Study' of Manchar, a semiurban village, whose current solid waste management system has been compared to that of Pune city. Finally, the inferences from the comparison and the scope for PPP partnership in a semiurban village like Manchar have been outlined in 'Results'.

## Literature Review

### *Defining a 'Semiurban Village'*

Semiurban villages are the 'growth centres' in rural areas that are rapidly urbanising. They show both rural and urban characteristics such as economic linkage to agriculture, modern living conditions and changing social systems. Defining a

semiurban village based on the population size alone would not be adequate to understand the development challenges of the region (Caplan and Harvey 2010). The semiurban village is also characterised by larger community size, core trading centre and relatively scattered settlements around a densely populated area. The main source of income here is small trade followed by agro-based industries and farming. These areas attract people from surrounding rural areas. The presence of health, education and administrative centres may attract further in-migration (Mugabi and Njiru 2006). In India, such areas are defined as 'census towns', having a minimum population of 5,000, with at least 75 % of the male main workers engaged in non-agricultural activities and population density of at least 400/km$^2$ (www.censusindia.gov.in).

Due to such diverse characteristics, the typical rural approach such as community participation and mobilisation becomes less effective in addressing water- and sanitation-related challenges in a semiurban village. In view of the rapid unplanned growth and lack of economic resources, there is a need to blend various approaches for providing basic services of water and sanitation in these semiurban villages.

## *Sanitation Programmes in India*

Sanitation broadly includes provision of healthy living environment, namely, safe handling and environmentally sound disposal of human excreta (urine and faeces), solid waste and liquid waste disposal, vector-control and water drainage (Avvannavar and Monto 2008). Along with taking care of human health and environment, recovery of valuable resources from waste could be another important goal of a complete sanitation system (Nelson and Murray 2008). Open defecation and unimproved sanitation systems cause waterborne diseases like diarrhoea and cholera. About 88 % of the total disease load is due to the lack of clean water as well as that of improper solid and liquid waste management. On an average, 30 million persons in rural India suffer from sanitation-related diseases and more than half a million children die of diarrhoea annually (Sulabh ENVIS centre newsletter 2008).

As far as the sanitation sector in rural India is concerned, sanitation policies have evolved through different modes. The Government of India initiated several programmes to improve sanitation conditions and provide sanitation facilities to the people. India's first nationwide programme for rural sanitation, the 'Central Rural Sanitation Programme (CRSP)', was launched in 1986 with the objective of providing sanitation facilities and improving the quality of life of the rural people. The programme was supply driven and gave emphasis on toilet construction. Subsidy was provided on the hardware, i.e. for the construction of toilets. No parallel component of community participation was given any importance. This approach was not successful in meeting the intended outcomes as there was no perceived need for sanitation among the communities. Later, a demand-driven low-cost sanitation approach was adopted increasingly in some parts of India through a mass-level campaign. Based on the success of this community-led total sanitation approach, the

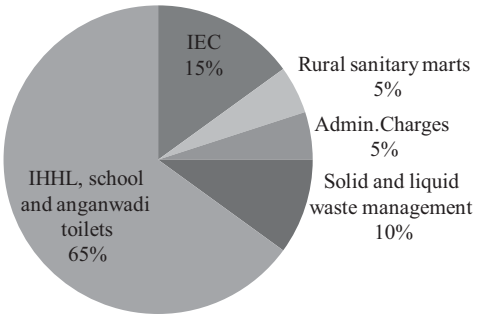


**Fig. 3.1** Distribution of funds for components in 'Total Sanitation Campaign' (TSC) (Guidelines of 'Central Rural Sanitation Programme' and 'Total Sanitation Campaign', July 2011, www.ddws.gov.in, accessed 23 May 2012)

TSC was launched in April 1999, giving emphasis on the people's involvement and on (information, education and communication (IEC) for generating demand for the sanitation facilities. Thus, there has been a shift in the strategy of implementing the sanitation programme to involve 'people' along with the 'public institutes' (Water and Sanitation Programme 2010).

## *TSC*

The TSC of the 'Rajiv Gandhi National Drinking Water Mission' (RGNDWM), Government of India, was launched in April 1999. The primary objectives of TSC are to cover all the rural household sanitation facilities and to promote hygienic behaviour for overall improvement of health of the rural population. The following components have been framed in the campaign:

a. Information, education and communication (IEC) activities,
b. Rural sanitary marts and production centres,
c. Construction of individual household latrines (IHHL),
d. Construction of community sanitary complex,
e. Cnstruction of institutional toilets (schools and anganwadis), and
f. Solid and liquid waste management.

Involvement of the 'Panchayati Raj Institutions' (PRIs) in scaling up the TSC was felt necessary for large-scale social mobilisation leading to behavioural change.

The funding pattern for different components of TSC is shown in Fig. 3.1.

As stated in the guidelines of TSC, one of the key objectives is to accelerate the sanitation coverage in rural areas so that there is access to toilets to all citizens by 2017. TSC also aims to motivate the communities and the PRIs to promote sustainable sanitation facilities through awareness creation and health education. The campaign also encourages cost-effective and appropriate technologies for ecologically safe and sustainable sanitation action to develop community-managed environmental sanitation systems focussing on solid and liquid waste management. The achievements of TSC, up to May 2012, are shown in Tables 3.2 and 3.3.

**Table 3.2** Physical progress of the various components in TSC (1999–2012) (www.tsc.gov.in, accessed 9 May 2012)

| Sr. No. | Component | Component-wise achievement: Physical (in thousands) | | |
|---|---|---|---|---|
| | | Target | Achievement | Percentage |
| 1 | IHHL total | 125,726 | 87,500 | 70 |
| 2 | Sanitary complex | 33.7 | 24.2 | 72 |
| 3 | School toilets | 1,375 | 1,262 | 92 |
| 4 | Anganwadi toilets | 535 | 413 | 77 |
| 5 | Rural sanitary marts | 4.5 | 4.46 | 99 |
| 6 | Solid and liquid waste management | 238.9 | 29.9 | 13 |

*IHHL* Individual household latrine

As shown in Table 3.3, the achievement of solid and liquid waste management component in TSC has been very less compared to the other components.

As shown in Tables 3.2 and 3.3, these approaches, based on 'public' (i.e. public institutes like PRIs) and 'people' (i.e. people's participation), were found to be successful in the achievement of individual toilet facility coverage, school toilets and sanitary marts. However, the objectives, to develop community-managed environmental sanitation systems of solid and liquid waste management as well as to encourage ecologically safe and sustainable technologies in sanitation, are not satisfactorily achieved. Solid waste management has not been initiated in most of the Gram Panchayats and, hence, dumping solid waste outside in the open space or by the roadside is a common practice followed by most of the rural households. The status of the liquid waste management is also poor. The maintenance of the community toilets is another major issue in the sustainability of this campaign. Even villages that are successful in the 'Nirmal Gram Puraskar (NGP)' scheme have not performed satisfactorily in these issues (TARU 2008).

Recently, the people's involvement and IEC has been emphasised on for demand generation of the sanitation facilities. The interventions were successful in achieving open-defecation-free status due to an increase in the use of toilets for the village. However, the solid and liquid waste management component of TSC needs to be strengthened (Pardeshi et al. 2008). Recently, the Department of Drinking Water Supply, Government of India, has made policy changes in TSC guidelines and incorporated this element as one of the important activities. It is estimated that the rural people in India are generating liquid waste (grey water) of the order of 15,000–18,000 million litres and 0.3–0.4 million metric tons of solid waste (organic/recyclable) per day. In the absence of proper disposal of solid and liquid waste (grey water and waste water from a hand pump), the people are vulnerable to vector-borne diseases such as diarrhoea, malaria, dengue, cholera and typhoid (Unicef 2010).

In rural areas, solid waste is generated mainly at the household level and then at a community level like market places and common streets. In order to manage the solid waste effectively, the focus must be on household level waste management. Only the solid waste, which cannot be managed at the household level and that col-

**Table 3.3** Financial progress of the various components in TSC (1999–2012) (www.tsc.gov.in, accessed 9 May 2012)

| Sr. No. | Component | Component-wise achievement: Financial (*amount in million rupees*) | | |
|---|---|---|---|---|
| | | Approved | Achieved | Percentage |
| 1 | IHHL total | 138,346 | 76,140 | 55 |
| 2 | Sanitary complex | 4,939 | 2,963 | 60 |
| 3 | School toilets | 32,821 | 23,975 | 73 |
| 4 | Anganwadi toilets | 3,340 | 2,177 | 65 |
| 5 | Rural sanitary marts | 1,590 | 576 | 36 |
| 6 | Solid and liquid waste management | 8,957 | 1,036 | 12 |

*IHHL* Individual household latrine

lected from a market place or common streets, should be handled at the community level. The rising population in villages, particularly in the semiurban villages, is leading to a very rapid growth in the rate of solid waste as well as liquid waste generation. In the semiurban village, a village administrative unit needs a more comprehensive strategy to tackle these issues. Many a time, it is seen that the local PRIs lack the necessary capacity as well as the financial resources to deal with these issues. Thus, specific efforts in capacity building and partnership with private organisations may be desirable.

## *Scope of the 'PPP' Partnership*

The sanitation sector poses a great challenge for the developing countries, especially in the fast growing rural and urban areas. As mentioned earlier, there is only a limited capacity and minimal budgetary allocation from the government. Thus, the private sector has an important role to play in solid and liquid waste handling in the urban and the semiurban areas. Also, the guidelines of TSC now focus on the role of non-governmental organisations (NGOs) and corporate bodies to help in achieving this objective. Small-scale independent providers (SSIPs) or private service providers (PSPs) are already quite active in many developing countries, specifically in waste collection and treatment. There are various opportunities for developing novel PPPs that hinge on resource recovery from these wastes. In Bangladesh, it was found that solid waste management and service delivery through PPP partnership is possible (Ahmed and Ali 2006). Developing country governments are increasingly looking to boost the private participation in solid and liquid waste management. These partnerships could help incentivise and even cofinance sanitation sector, while simultaneously promoting small- and medium-scale entrepreneurs. Along with the collection of waste, technologies for waste segregation, biogas recovery and compost production can be easily taken up and sustained if catalysed by participation of private entrepreneurs (Murray et al. 2011).

The absence of sufficient funds with the local authority to operate the solid waste management services properly further supports the argument for the private sector involvement (Obirih-Opareh and Post 2002). Recently, it has been found that the PPP strategy has helped in improving health sector functions in some parts of India. The success of such a scheme would, however, depend upon continued profitability of private enterprises and the collaborative working of public institutes and private parties on the various details pertaining to the activities to be performed. The private participation not only increases availability of resources through pooling of public and private funds for social purposes, but also shifts the responsibility of a state's welfare activity into a profit-making enterprise (Purohit 2001). It is estimated that more than US$150 billion will have to be invested over the next 5 years for the development of infrastructure, including sanitation and public health in India (Mahalingam 2010). There is a crucial role that PPP needs to play in the development of infrastructure in these sectors.

## *Stakeholders and Their Roles*

The local self-government authorities, people, private service provider and policy-making authority are stakeholders in this process. One of the major reasons stated by the local authorities in developing countries is the lack of financial resources and skills needed to cope with the fast increasing need for solid or liquid waste management. This raises the important issue of delivering quality service while facing financial and human resource constraints of the public sector authorities. It is necessary to search for alternatives to the traditional service delivery mechanism, to keep the urban and rural areas healthy and liveable in the developing countries. It is often proposed that the solution lies in the private sector participation in delivering the solid waste management services. There are various modes of public and private sector participation, prevalent especially in the health sector and the infrastructure sector.

There is a need for a core funding by the government as well as support by the people to make the PPP model successful (Mahalingam 2010).

Since sanitation sector belongs to the individual and community, 'people' component along with public and private component is very important. People can contribute significantly to service delivery in sanitation sector. They can support private sector participation with payment of service charges. Also, monitoring of the process by the people through local level committees would enhance the quality of service. Yet, more importantly, they can play an active role in improving the accountability and service quality of both the public and private sector. However, this radical shift in people's role, from passive service receivers to active service partners, may not occur within a community (Ahmed and Ali 2006).

## Case Study

A village named Manchar, located on Pune–Nasik Highway, was identified for the study.

Manchar is a village in Ambegaon Taluk, in Pune district, in Maharashtra State. It is located 11.4 km from its taluka main town—Ghodegaon, 64 km from Pune and 179 km from Mumbai. It is located on the Pune–Nasik Highway (state highway 50) and is an important commercial and educational centre in this region. Manchar is a village with a population of 24,000 and emerging as a residential hub. Its rapid growth is supported by availability of water from the Dimbhe Dam, proximity to an industrial area, special economic zone (SEZ), availability of educational infrastructure, accessibility to metro cities and developed agriculture market. Manchar can be considered as a semiurban village due to these characteristics. The Manchar Gram Panchayat is responsible for maintaining proper sanitation conditions in the village (The Maharashtra Gram Panchayat Act 1958). The Gram Panchayat has been implementing the TSC since 2001. At present, the Manchar Gram Panchayat is handling solid waste by collection and dumping on a nearby land. The process of solid waste management by the Gram Panchayat was studied. The data are collected by interaction with various stakeholders including the villagers, elected members and employees of the gram-panchayat, village officer, health workers and medical practitioners. Also studied were the sanitation arrangements under TSC. The economic details regarding the solid waste management are obtained from the Gram Panchayat records. Due to rapid growth of residential zone and population, lack of proper solid waste management in the village has now become a critical problem for the Gram Panchayat (Discussion with the sarpanch and the village development officer, Manchar, on December 22, 2011).

The 'SWaCH (Solid Waste Collection and Handling) Seva Sahakari Sanstha Maryadit, Pune' is India's first cooperative organisation owned by self-employed rag pickers, waste collectors and other urban poor. The organisation provides waste management services to the citizens of Pune, including a door-to-door waste collection service. The scope of work includes collection, resource recovery, trade and waste processing. At present, there are 2,150 members of SWaCH working in 15 municipal wards in Pune municipal corporation area (www.swachcoop.com, accessed 24 January 2013). The details regarding the working pattern of SWaCH were gathered from discussion with officials of the organisation (discussion with Smt. Malati Gadgil, Chief Executive Officer of SWaCH, 06 March 2012).

## Results

The Gram Panchayat of Manchar is implementing TSC since 2001. The achievement in TSC components with reference to the base line survey in 2001 is shown in Table 3.4.

**Table 3.4** Achievement in TSC components in Manchar (2001–2011) (Gram Panchayat Manchar NGP application 2011)

| Sr. No | Component | Component-wise physical achievement | | |
|---|---|---|---|---|
| | | Target (as per baseline survey in 2001) | Achievement in 2011 | Percentage |
| 1 | IHHL total | 3,109 | 3,109 | 100 |
| 2 | Sanitary complex | 1 | 1 | 100 |
| 3 | School toilets | 14 | 14 | 100 |
| 4 | Anganwadi toilets | 9 | 9 | 100 |
| 5 | Rural sanitary marts | NIL | NIL | 2 |
| 6 | Solid and liquid waste management | – | NIL | 3 |

*IHHL* Individual household latrine

In 2001, the number of households registered with Gram Panchayat was 4,445. At present (2012), there are 8,732 households registered in Manchar. The present practice of solid waste and liquid waste management at the household level is using soak pits and establishment of kitchen gardens near the house. Presently, there are 376 kitchen gardens, 72 solid waste collection concrete bins and 117 soak pits, which are not sufficient. There are 2,600-m-long open drains constructed to carry the collected sewage. It is discharged into the local natural drain without any treatment.

In order to deal with household-level solid waste as well as community-level solid waste, the Gram Panchayat has purchased two tractors and one small waste collection vehicle (Ghantagadi) and employed five people for the solid waste collection with a salary of ₹ 1,500 per worker per month. These employees are appointed on a contractual basis. These vehicles have been given three different routes to collect solid waste from places where people dump the waste into these vehicles. The agriculture produce market committee in the village also collects 1–1.5 tonnes of biodegradable waste and dump at the same location without any treatment. The solid waste is collected without any segregation. A total of 12–14 tonnes of solid waste is collected every day. The collected solid waste is then dumped on open land, 1.5 km away from the village and partially incinerated by the Gram Panchayat workers. The local waste pickers are not willing to go to the dump yard due to distance and non-segregated waste. There is no treatment applied for the remaining solid waste. This has led to the solid waste accumulation in the nearby water drainage as well as the spreading of the solid waste in the nearby agricultural fields. The Gram Panchayat is not charging any fees for the waste collection service. The nearby residents and an educational institute near the dumping site are victims of bad odour and flies. They frequently complain to the Gram Panchayat officials to solve the problem.

On the other hand, SWaCH has 2,150 self-employed waste pickers to cover doorstep collection of waste from 390,000 households in Pune city. The organisation is

linked with 550 scrap shops in Pune. For the collection of the solid waste, the households need to pay ₹ 20 per month to the waste picker. Typically, two waste pickers cover 400–500 houses every day. They earn about ₹ 8,000 –10,000 per month from the households and ₹ 3,000 per month from selling of recyclable material and scrap. The solid waste management services provided by SWaCH are summarised as follows:

a. *Door to door collection* (DTDC): Daily collection of dry and wet waste from households, hotels and shops. No common dumping point is constructed by the municipal corporation.
b. *V collect:* Collection of unwanted household material that cannot be thrown in the daily garbage (e.g. sanitary napkins and diapers).
c. *U drop:* Fixed drop-off points where any kind of unwanted household goods can be dumped on certain fixed days (Scrap material).
d. *V-Compost:* Creating and maintaining compost pits for decomposition of organic waste.
e. *E-Collect:* Collecting electronic waste from households/shops separately.

SWaCH is working for the Pune Municipal Corporation in an urban area. Here, the approach of solid waste management is considered in both scenarios. In terms of quantity of solid waste collected, both the approaches could not be compared directly. However, the comparison highlights certain areas of solid waste management in which private service providers can definitely assist the rural administration in achieving the objective of TSC. A brief comparison of the solid waste management systems in Manchar and Pune is shown in Table 3.5.

The comparison in Table 3.5 indicates the scope of areas in the present solid waste management system in the semiurban village, where private service providers can support the rural administration in the following components:

1. Training of the Gram Panchayat employees for effective solid waste management.
2. Treatment of solid waste: Designing and implementation of 'collection-segregation–reuse–treatment' process in the village. The quantum of solid waste generated in semiurban areas, unlike that in the urban areas, is economically unattractive for the private entrepreneurs. However, the private service provider may act as a nodal agency for a cluster or a group of such villages. A central processing unit for solid waste can be managed by the private service providers.
3. Empowerment of the people for effective solid waste management.

Solid waste management strategy in rural areas would be effective if it is based on the reuse and segregation of waste (Unicef 2010). Many reuse projects remain at the pilot scale, unless they are subsidised (TARU 2008). A financial model for this private partnership in rural areas can be worked out separately. Funds from the Gram Panchayat and TSC component will help to launch such initiatives.

**Table 3.5** Comparison of the solid waste management systems in Manchar and Pune

| Sr. No. | Component of solid waste management | Gram-panchayat, Manchar | Pune Municipal Corporation |
|---|---|---|---|
| 1. | Total quantity of the solid waste collected | 12–14 t per day | 1,300–1,400 t per day |
| 2. | Collection and segregation of the solid waste | No door-to-door collection but any segregation of the collected solid waste. | Door-to-door collection and segregation of the collected solid waste through citizens and waste pickers. |
| 3. | Scope of reuse and recycle of the waste | No reuse or recycle of the collected solid waste. Minimum at present. Efforts required at dumping site. | Due to segregation, it is possible at source and is practised by waste pickers. |
| 4. | End treatment | Open dumping on land and, partial incineration. | Recycling, composting and incineration. |
| 5. | People's participation | No fees charged to residents. Also people unaware about segregation of the solid waste. No contribution from people in the waste management. | People contribute through monthly service charge of ₹ 20 per month per family and participate in segregation of the waste process. |
| 6. | Training of solid waste handling and management to labourers | Unskilled labourers are employed in the solid waste management without any incentive except salary. | Trained waste pickers with incentives. |
| 7. | Financial support for the solid waste management and revenue generation | Gram Panchayat funds and funds received from the government. No revenue generation. | PMC support for initial infrastructure and supplementary grants; Revenue from fees, recycling and manure sale. |
| 8. | Financial sustainability | Burden on budget of the gram-panchayat. Sometimes development funds needs to be curtailed to provide operational cost. | Adequate PMC support and revenue generation. So, better chances of becoming financially sustainable. |

## Conclusion

The solid waste management is now a crucial issue for the Gram Panchayats of the semiurban villages. It is necessary to pay more attention to these rural areas, where there is a rapid growth in population and changes in lifestyle. Collection and disposal by dumping in open land or incineration are the usual methods adopted by the Gram Panchayats. A systematic approach, such as the one adopted by a private service provider like SWaCH for the solid waste management in Pune, would help in improving the solid waste management scenario in these villages. Better utilization of the solid waste can be achieved in rural areas through such initiatives. Such initiatives for improvement in sanitation situation in these villages may help in retaining rural migrants in their homes and also prevent haphazard migration into urban areas. The economic viability of this participatory approach may be enhanced by the private entrepreneur working in a cluster of villages for solid waste

management. Financial support to this private participation is essential at the village level. The role of private service providers in training and empowerment of existing workers in the Gram Panchayat is also critical in improving the present solid waste management systems of the gram-panchayat. Sanitation not only is a technology and policy issue but also involves greater challenges of behavioural change of the stakeholders. Ultimately, a combined effort involving an active participation from the villagers (waste segregation) and professional management, provided by the private service provider (waste collection, recycling and disposal) and facilitated by the local public administration could hold the key to the successful TSC and clean villages.

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# Chapter 4
# Making the Connection Between Informal Self-Employment and Temporary Migration: Lessons from the Cycle Rickshaw Sector

**Ashima Sood**

## Introduction

Nearly 12.5 million rural workers in 2007–2008 migrated to urban areas temporarily, staying "away from the village or town for a period of 30 days to six months" (Keshri and Bhagat 2012, p. 82). A slightly greater number—about 13 million—commuted out of rural areas for work in 2009–2010 (Chandrasekhar 2011; Chandrasekhar and Sharma 2012, p. 4). Although few city-level figures are available in India, the magnitudes of these mobile workforces are by all accounts the tip of an iceberg (Chandrasekhar and Sharma 2012; Deshingkar and Farrington 2009a). Evidence from field studies suggests that these national aggregates may substantially underestimate the size and impact of these labour flows, particularly at the city level. Indeed, one of the rare developing country studies of seasonal mobility impacts, Thailand's National Migration Survey, estimated a 9% difference in the wet-season and dry-season populations of Bangkok in the early 1990s (Chamratrithirong 1995).

With nearly 80% of urban workers engaged in various forms of informal employment (Chen and Raveendran 2011), a large proportion of these temporary and commuter migrants also find themselves engaged in these kinds of work, a fact also attested by existing field studies (Deshingkar and Farrington 2009a). Yet, even as short-duration migration has come to be recognised as an important and growing source of remittances and income diversification for the rural poor (Mosse et al. 2005; Deshingkar and Farrington 2009a), examinations of their impact on destination informal markets remain thin. While the role of such markets in accommodating migrants has been recognised since the 1970s (Fields 1975), little research has directly considered how they accommodate "multilocational livelihood strategies" (Deshingkar and Farrington 2009a). This applies especially to forms of informal self-employment in the cycle rickshaw or street vending sectors, to which researchers ascribe large temporary workforces (Deshingkar and Farrington 2009c).

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This is the disconnect that this chapter seeks to bridge. Located at the intersection of the literatures on self-employment in the informal services sector and on temporary forms of migration,[1] this chapter delineates a series of stylised facts offering a fine-grained look at how one informal market accommodates and is in turn shaped by these transient migration flows.

Drawing on a field study of the cycle rickshaw rental market in Bilaspur, Chhattisgarh, this chapter attempts to highlight the central role of such urban informal markets in supplying much-needed services to underserved seasonal and commuter migrant populations. The qualitative and quantitative evidence from the cycle rickshaw sector in Bilaspur argues for recognising the close interdependence of informal markets and mobile workers and offers a critical benchmark for evaluating policy interventions for both informal and multilocational workers in urban setting.

As the policies and evidence on the cycle rickshaw sector from my study site and other locations demonstrate, connecting the policy discourses on informal self-employment and rural-to-urban mobility is critical to framing appropriate policy, programmatic and regulatory responses to the most unprotected and invisible segments of the urban population (Sood 2010). This paper attempts to make the case for recognising three key channels for such a connection.

On the one hand, policy indifference and hostile local regulatory regimes can impede the ability of these informal markets to accommodate mobile workers. Equally important, policy and programmatic interventions for informal livelihoods, such as the cycle rickshaw sector, that do not account for the transient nature of their workforce may also prove to be inadequate. Finally, programmes to aid underserved temporary migrants should explore informal markets and institutions as an additional avenue for reaching mobile populations.

The cycle rickshaw sector serves as a particularly effective case for examining all three channels outlined here. The cycle rickshaw is a ubiquitous form of nonmotorised paratransit in many cities across South Asia. The driver either owns the rickshaw he drives[2] or, more commonly, rents it from an owner-contractor or a garage that owns anywhere from two to a hundred or more cycle rickshaws. After paying a periodic rental fees, the driver retains his earnings, whereas the garage pays for most maintenance and regulatory costs, including bribes to municipal and enforcement agents. It also pays for the storage of the cycle rickshaw. Data, where available, suggest that such rental arrangements supply cycle rickshaws to more than half of, and close to,all rickshaw drivers in most cities. The present field study found that about 80 % of the drivers rented their cycle rickshaws from garages in the city of Bilaspur in central India (Jain and Sood 2012).

[1] The focus here is on internal migration in the Indian context. International migration is beyond the scope of this chapter.

[2] The term “rickshaw driver” is used in preference to “rickshaw puller” in this chapter, both to foreground the skill and dignity of the work and to distinguish the cycle rickshaw driver from the hand-rickshaw puller of popular imagination (Sood 2012).

While activists have long noted the pervasive presence of short-duration migrants in this sector (Kishwar 2006), and scholars such as Deshingkar and Farrington (2009c) ascribe nearly its entire workforce of about 10 million to temporary migrants, calculating reliable numbers has proved to be challenging. In the following sections, I analyse some estimates of such mobile drivers in the sector.

However, accounting for such forms of mobility in fact highlights the range of services that the informal rickshaw owner-contractor provides as part of the rental contract. Further, in discussing findings, I draw on comparative evidence from other cities to highlight how local regulatory regimes shape market structure, bargaining power and the rental rates for the rickshaw.

The chapter is organised as follows: the next section identifies the niche in the literature on commuter and temporary forms of migration and the informal sector, particularly with regard to informal self-employment, which this study attempts to address. Section "Setting and Study" describes the study setting and design. Section "Migrants in the Cycle Rickshaw Rental Market" examines the evidence and data in more detail, delineating key patterns in how temporary and commuter migrants shape and are in turn accommodated by the cycle rickshaw rental market. Section "Lessons for Urban Policy and Regulation" analyses the implications for urban governance and outlines in greater detail three channels for making the policy connection suggested by these findings. Finally, the concluding section attempts to generalise and extend the implications of this case study to the wider issues of regulatory and policy regimes for the informal sector vis-à-vis temporary and commuter migrants.

## Informal Self-Employment and Temporary Migrants: Knowledge Bases and Gaps

Positioned at the intersection of the literature on circular forms of mobility and on informal self-employment, this section first outlines what is and is not understood about self-employed migrants, and then highlights gaps in current policy understanding and recommendations for reaching underserved mobile workers. The last strand of this review discusses the existing literature on the cycle rickshaw sector and the relevant regulatory framework and suggests some pathways for comparing and generalising the knowledge base across cities.

### *Rural Workers in Cities*

Although the majority of the papers in Deshingkar and Farrington's (2009a) seminal edited volume on circular migration in rural India draw evidence from village household surveys, these village studies offer enough clues to help piece together a composite picture that supports Deshingkar and Farrington's (2009b, p. 19) conten-

tion that "knowledge and experience gained over time may allow a migrant to move up the ladder from survival to accumulative migration", i.e. from migration that helps the poorest households "smooth consumption and manage risk" to the kind that allows "increase in assets".

The evidence further indicates the range of urban occupations that such migrants enter. These include migration streams from Andhra Pradesh (AP) villages to construction and earth digging works in Hyderabad and Bangalore (Deshingkar et al. 2009); from Madhya Pradesh (MP) to construction and factory work as well as a number of unskilled service jobs in the rickshaw sector, small hotels and restaurants, driving, kirana shops etc. (Sharma et al. 2009; Llewelyn 2009); from Southern Rajasthan to fabric processing in Surat, as well as ice cream vending, and to cities in Gujarat, Maharashtra and AP (Joshi and Khandelwal 2009). Migration to brick kilns is documented from several locations including Jharkhand, southern Madhya Pradesh and southern Rajasthan, amongst others (See Shah 2009). Even where they do not involve forms of debt bondage, many of the labour streams documented in these papers connect to wage employment at the destinations, often in casualised and informalised work settings through labour market intermediaries. In contrast, although Deshingkar and Farrington (2009c, p. 296) count street vending and cycle rickshaws among the employers of seasonal migrants, these forms of self-employment have received little sustained attention.

No wonder then that the dominant view of self-employment as a multilocational livelihood strategy has been similar to that of Breman (2004, p. 411) who argues that even forms of self-employment often conceal patterns of exploitation where the income risk is passed on to the worker.[3] This chapter argues that this view is not entirely incorrect but is incomplete. By focusing on the cycle rickshaw rental market, it attempts to expand understandings of urban end points beyond received ideas about exploitative wage–labour relations (Breman 1996; Singh 2002; Llewelyn 2009).

## *Seasonal Migrants and Urban Challenges*

As Deshingkar and Farrington (2009b, p. 24) note, alongside rural employment and natural resource management projects, urban development projects are one

[3] The excerpt from Breman (2004, p. 411) that sums up the picture of own-account work or self-employment in the informal sector is worth quoting in full: "What is portrayed as own-account work carried out at the risk of the producer is in fact a more or less camouflaged form of wage labour. There is a wide diversity of arrangements which actually show a great similarity with tenancy or sharecropping relationships in agriculture, where the principle of self-employment is so undermined in practice that the dependency on the landowner is scarcely different from that of a contract labourer. This is true for many actors operating in the informal sector such as the "hirers" of a bicycle or motor taxi who must hand over a considerable proportion of their daily earnings to the owner of the vehicle, or for the street vendors who are provided their wares early in the morning on credit or commission from a supplier and then in the evening, after returning the unsold remainder, learn if and what they have retained from their transactions".

of the major interventions that affect migrants. Yet, the implications of large-scale temporary worker movements for urban governance have received little attention. Similarly, discussions of multilocational livelihoods have contributed little to an understanding of how city-level regulation and urban policy impact these livelihoods.

Instead, wage discrimination, health and safety, child-related workers, access to benefits such as the public distribution system (PDS) at destinations, establishing personal identity, access to housing, skills upgradation, "migrant-friendly financial services" and improvements in transport and communication are the major issues identified by Deshingkar and Farrington (2009c, p. 304–308) as needing special attention. The authors argue especially for "portable" social protections that take account of the mobile livelihoods of India's workforce and tools of financial inclusion to support remittances and productive investment for mobile workers.

It is evident, however, that the often hostile local regulatory regimes as well as larger policy frameworks governing informal workers in urban areas no doubt affect migrants and commuters. A large emerging literature, both academic and advocacy-based, has argued that punitive regulations that restrict access to public space or raw materials serve to exclude large sections of the migrant poor from urban growth (Bhowmik 2009, 2010; Schindler et al. 2012; Sood 2012; Mitra 2002; Kishwar 2006).

It is not the aim of this chapter merely to reiterate these arguments, although it returns to urban governance issues in the context of temporary migration in the informal sector in a later section. Instead, the cycle rickshaw rental market in Bilaspur, Chhattisgarh, helps suggest how, by providing a range of services to migrants, informal markets can fill in the gaps in weak and often nonexistent support infrastructures for mobile populations.

## *The Cycle Rickshaw Sector*

While the earliest research and policy analyses of the cycle rickshaw sector in India drew on advocacy roots (Kishwar 2006; Mitra 2002),[4] a number of field studies have been conducted in recent years (see, for example, Nandhi 2011; Kurosaki 2012; Sood 2008). While Nandhi (2011) explores the financial behaviour of rickshaw drivers in Delhi, the pilot study by Kurosaki et al. (2007) and more recent studies (2012) in Delhi as well this author's research in Bilaspur have looked at both sides of the cycle rickshaw rental market.

These studies have employed different approaches to estimating temporary migration levels. Nandhi (2011, p. 5), for instance, found that in her sample of 176 drivers, only 18 % stayed in Delhi the entire year. Just about a third stayed in the city for 6 months or less. Kurosaki et al. (2012, p. 11), in contrast, looked at remittance behaviour and possession of key identity documents among rickshaw drivers in

[4] Note that there is a long and continuing literature on the sector dating back to Gallagher's comprehensive 1992 study in Bangladesh, which for reasons of space constraints, I do not review here (Gallagher 1992).

Delhi. In particular, they found that nearly 73 % of 1,320 drivers, sampled through an areal sampling approach, sent remittances to their villages.

This author's study employed a multidimensional measure for migrant status, including variables such as place of origin, years in Bilaspur city and annual visits to the place of origin, as well as number of months in a year the driver was engaged in the cycle rickshaw sector. Data from 821 drivers surveyed in two stages through an intercept sampling approach (see next section) revealed systematic differences between drivers who owned the cycle rickshaw they drove and those who did not. Although the vast majority, even of renters, reported driving over 11 months in a year, they made on average 28 visits to the place of origin (Jain and Sood 2012, p. 25).

However, local-level regulatory frameworks for the sector have rarely recognised these realities (Sood 2012). In line with the view propounded by Breman (1996, 2004), as mentioned earlier, the predominant stance has seen the cycle rickshaw rental market as essentially comparable with a labour market, with the garage owner being seen as an exploitative intermediary. It is not surprising then that municipal law in some Indian cities refuses to allow legal recognition to the garages and instead attempts to restrict rickshaw ownership to the drivers through the so-called owner–plier policy, described in greater detail subsequently (Sood 2012; also see Section "Migrants in the Cycle Rickshaw Rental Market" for more detail).

For policy and analytical purposes, however, it is important to note that the cycle rickshaw sector is best understood in terms of informal asset rental or capital markets, rather than labour markets per se. This study argues for considering the informal rental market, despite certain complicating features, as analogous to informal credit markets. In practical terms, such rental markets serve as a source of cheap credit for migrants, under conditions where such credit is not otherwise easily available.

The evidence presented in the following sections illustrates how the cycle rickshaw rental market does more than merely accommodate a mobile workforce. The market actively caters to the needs of this segment; moreover, its chief characteristics are shaped by and in response to these migration streams, as the discussion below shows.

## Setting and Study

### *The City*

Situated in the central Indian state of Chhattisgarh, which was carved out of the larger state of Madhya Pradesh in November 2000, Bilaspur had a population of nearly 200,000 according to the 2001 census. It was the second largest city in the state and the seat of the state's High Court, as well as headquarters of a district by the same name (Jain and Sood 2012). Bilaspur's relatively tractable size and its location proved to be useful in investigating the impact of migration in the cycle rickshaw rental market.

**Table 4.1** Garages in Bilaspur city. (Source: 2002–2003 data from the Officer-in-Charge of Rickshaws and Tongas, Municipal Corporation of Bilaspur, combined with survey data (Jain and Sood 2012))

| | |
|---|---|
| Total garage cycle rickshaws | 3,738 |
| Number of garages | 176 |
| Mean size | 21.2 |
| Largest | 130 |
| Median | 12 |
| Bottom quartile (size cut-off) | 7 |
| Top quartile (size cut-off) | 30.5 |

## *The Study*

Conducted over the winter of 2003–2004, the study included four components: (1) semi-structured interviews with garage owners and rickshaw drivers chosen through theoretical sampling, (2) focus group discussions with cycle rickshaw drivers in two major slum settlements in the city, (3) a garage study of rental transactions at a randomly selected sample of ten garages and (4) a survey administered to over 800 rickshaw drivers chosen through an intercept sampling approach.[5]

The central methodological innovation of this research, reported here, was a garage study of specific rental transactions in a random sample of ten garages, stratified by size. A listing of garages provided by the Municipal Corporation of Bilaspur (MCB) helped define four categories of garages: large (over 30 rickshaws), medium (16–30 rickshaws), small (less than 15 rickshaws) and an additional category of "hostel" garages which provide boarding and lodging to circular migrants. An independent census attempted to verify these data and found roughly a 1,000 additional rickshaws. The next section discusses data issues and what they tell us about the market. Table 4.1 describes the sampling frame used and the size distribution of garages.

Owners of small and medium garages often worked other jobs and proved difficult to reach. Also, often their rickshaws were either not taken or returned at irregular intervals so that the transaction could not be documented. The owner's availability and willingness to cooperate became a major factor. The final dataset consisted of transactions at ten garages: one hostel, four large, two medium and three small garages. Table 4.2 describes the characteristics of these garages in greater detail and is discussed in the next section.

Data from qualitative interviews of garage owners and focus groups of rickshaw drivers chosen through convenience sampling, as well as the intercept-based survey data, are used to supplement the findings. It is worth noting at the outset that several of these features such as the salience of commuting and seasonal migration patterns described below may have been missed in the absence of qualitative evidence. For instance, a household survey of slum settlements would have missed many temporary and commuter migrants, and an enterprise survey restricted to the off season would have failed to recognise the effect of seasonal fluctuations in demand on

[5] The advantages and disadvantages of this sampling approach are described in greater detail in Jain and Sood (2012).

**Table 4.2** Garage study sample. (Source: Study data (Sood 2008))

| Garage | Age (years) | Location | Size class | Size | Sample size (*N*) | Estimated uptake rate (%)(~) |
|---|---|---|---|---|---|---|
| A | 4 | | Large | 32 | 15 | 47 |
| B | 6 | Slum | Large | 45 | 20 | 45 |
| C | 23 | | Large | 77 | 22 | 29 |
| D | 1 | Slum | Large | 40 | 40 | 100 |
| E | 20 | | Large | 65 | 41 | 63 |
| F | 3 | | Medium | 16 | 9 | 56 |
| G | 2 | Slum | Medium | 17 | 17 | 100 |
| H | 6 | Outside municipal limits | Small | 13 | 10 | 77 |
| I | 2 | | Small | 13 | 11 | 85 |
| J | 20 | | Small | 12 | 3 | 25 |

garage operations. Qualitative interviews also helped elicit cost and market structure data from garages.

## Migrants in the Cycle Rickshaw Rental Market

This section examines data from the garage study as well as the other qualitative and quantitative data collected as part of this research project, to describe a series of stylised facts. Many of these features, it is argued, are critical to supporting self-employment by temporary and commuter migrants. Others emerge directly from the nature of these migration streams, i.e. their connection to agricultural season work cycles and the mobile nature of this workforce. As such, this evidence reinforces the argument that understanding, regulating and supporting informal markets such as the one under study helps reach an increasingly mobile urban informal workforce.

### *Rental Contract*

Although commentators such as Breman (2004) and others have criticised self-employment as often being disguised wage employment that passes the income risk to the worker, studies in the cycle rickshaw sector suggest a more nuanced relationship. Theoretically, it can easily be shown that the difficulty of observing labour effort under risk neutrality or risk aversion by the cycle rickshaw owner makes the rental contract optimal (Sood 2008, p. 27–31).

In practice, however, the question of bargaining and market power of the two parties and the possibility of exploitation is still open. Although rental rates in the cycle rickshaw sector in Bilaspur varied within a narrow range of ₹ 15–20, subject to a rebate (see Table 4.4), survey data on daily savings by cycle rickshaw drivers

(after rental payment) suggested that this amount could be 40% or more of drivers' gross earnings (Sood 2008).

Calculations using rental rates and purchase price estimates (obtained from interviews) also suggested that the purchase price of an average quality cycle rickshaw could be earned back by the garage owners within 1–2 years (Sood 2008). However, these numbers do not take account of the costs incurred by cycle rickshaw owners, such as high depreciation costs, repair and maintenance, storage costs for the cycle rickshaw and, in cities such as Delhi where regulatory enforcement has bite, regulatory risks and harassment costs (Sood 2012).

Land rental is a substantial cost, applicable to larger garages. Smaller garages often encroach on roadside pavements or other government land (Sood 2008). Also, the rates of return calculation do not take account of the risk of default, both on the cycle rickshaw and on the rental, which is described further later.

Indeed, these costs of asset ownership—repair and maintenance, storage as well as opportunity costs of attachment to the cycle rickshaw market—are what make the rental option attractive to migrant workers engaged in multilocational livelihoods—seasonal or other circular forms of mobility.

## *Regulation and Enforcement*

As in other Indian cities (Sood 2012), the applicable Madhya Pradesh Ordinance 20 of 1984 at the time of this study mandated that, subject to certain minor exceptions, "No person shall keep or ply or hire a cycle-rickshaw, unless he himself is the owner thereof". Even as this owner–plier provision rendered the cycle rickshaw rental market de jure illegal, its enforcement in Bilaspur was far from strict, unlike cities such as Delhi, where it is onerous (Kishwar 2006, 2012). All rickshaws must have a permit from the Office of Rickshaws and Tongas of the MCB, and thus, garage information is available to the Municipal Corporation and compiled in a limited manner. As described in the previous section, these data, after checking, were used as the basis of the sampling frame of this study.

However, the lax regulation also has important repercussions for the ease of entry on both sides of the market—the demand for rickshaws and its supply by garages—as the next sub-section shows.

## *Entry, Exit and Market Structure*

As mentioned, the MCB data were also checked using an independent census of garages as well as in the extensive garage survey. The significant under-reporting encountered suggests not only lax regulation but also significant turnover in the market, i.e. both entry and exit into the market. The fixed costs of entry into the rickshaw rental business seem minimal and, in fact, the study revealed tiny garages

in every nook and corner of Bilaspur city, many operated as a side business by individuals with day jobs.

Table 4.1 shows that the size distribution of garages is skewed to the left. Half of all garages own less than 12 rickshaws. The bottom third comprised garages with less than 8 rickshaws and the top third comprised garages with more than 22.4 rickshaws. Many of the garages, particularly the smaller and medium ones, on the original MCB-provided list were found to have gone out of business over the course of the year. It is also easier for smaller garages to avoid detection. On the other hand, one of the largest garages in the city sold a large fraction of its cycle rickshaw stock to another garage during the course of the study. The high turnover and observed rates of entry and exit suggest that in the absence of high capital requirements (see Sood 2008) or a strictly enforced regulatory apparatus, garages operate in near-competitive conditions.

These patterns can be contrasted to Delhi, where only 2.3 % of the 132 sampled "thekedars" or owner-contractors owned less than 11 rickshaws, and nearly half owned more than 40, with the average number of rickshaws per owner being 56. Additionally 6 % of the sampled thekedars owned more than 100 rickshaws (Kurosaki et al. 2012). A number of commentators have argued that regulatory costs, i.e. costs of harassment by municipal and police authorities, are borne more economically by larger garages (Kishwar 2006). The comparison between Bilaspur where the vast majority of garages remain quite small, and Delhi, where regulatory costs are far higher and average cycle rickshaw fleet far bigger, does not seal the argument. However it does lend credence to the hypothesis that high regulatory costs encourage concentration of ownership.

## *Price versus Non-price Competition*

In qualitative interviews, garage owners mentioned competitive conditions as a significant factor in pricing and operational decision-making. However, as Table 4.3 shows, these competitive conditions are also reflected in the relatively narrow range within which rental rates varied across sample garages.[6] Instead, garages are seen to compete against other dimensions.

The first of these—location—determined both the direct and derived demand for the garage's cycle rickshaw. Garages located in high population density areas were likely to have a bigger and different clientele from those in low-density areas. The least populated areas in Bilaspur were found to have no medium or large garages (Sood 2008). Interestingly, the area that contained the largest slum concentrations and had about a third of all garages has a size distribution of garages closest to the city-wide average. In particular, the distribution of locals versus migrants varied widely with location.

[6] It worth noting that a much larger cycle rickshaw rental variation is reported in studies from Delhi (Kurosaki 2012), where fleets are larger (Kurosaki et al. 2012) and it appears that conditions vest significant market power in the cycle rickshaw owner.

**Table 4.3** Rental rates and payment periods. (Source: Study data (Sood 2008))

| | Rental rate (half day) | Weekly rebate |
|---|---|---|
| A | 20 (10) | No |
| B | 20 (10) | Yes |
| C | 20 (10) | Yes |
| D | 20 (10) | Yes |
| E | 20 (10) | No |
| F | 15 (10) | No |
| G | 20 (10) | Yes |
| H | 15 (10) | No |
| I | 20 (10) | Yes |
| J | 15 (10) | No |

These patterns are more concretely seen in Table 4.2, where sample garages located near slums had nearly 100% uptake rates of rickshaws, i.e. all their cycle rickshaws were in hired for operation.

As shown in Table 4.4, location also affected the mix of local versus migrant drivers hiring from a garage. Garage owners also actively attempted to cater to migrant drivers, especially where they lacked local markets. Garage A in Table 4.4, for example, had a high proportion of commuter migrants. While a number of garages included in the garage study actively recruited commuter migrants, some of the smaller ones had poached drivers from neighbourhood competitors.

The emergence of residential or hostel garages was also explained by the owners of these garages in terms of the need to provide additional services to attract migrant drivers. Garage E, a hostel garage, provided basic living facilities in a central location in the city to batches of seasonal migrants from neighbouring districts and states.

It is worth noting that Kurosaki et al. (2012) also found rickshaw drivers who reported living arrangements in the thekedar's shed and others who had been assisted in finding accommodations by the thekedar.

## *Migration*

The role of temporary, seasonal and commuter migrants helped shape significant aspects of the market structure and operations, a facet revealed by the garage study in finer detail than the intercept sampling survey.

Like the intercept sampling survey, however, the garage study questionnaire attempted to gauge multiple dimensions of "migrant"-ness (Jain and Sood 2012). Other than place of origin and years in the city, annual visits home were key to identifying temporary and commuter migrants. As seen, garages A and E show especially large number of visits home and numbers of commuter migrants. Qualitative data also revealed some of the paths or chains that migrants followed (Banerjee 1983).

**Table 4.4** Migrants at study garages. (Source: Study data (Sood 2008))

| | Size | Bilaspur origin (%) | Years in Bilaspur | Annual visits home | Commuter migrants (%) |
|---|---|---|---|---|---|
| A | 32 | 13.33 | 3.26 | 18 | 53.34 |
| B | 45 | 35 | 25.15 | 8.6 | 5 |
| C | 77 | 22 | 16.31 | 2.89 | 13.63 |
| D | 40 | 25 | 21.94 | 3.78 | 0 |
| E | 65 | 29 | 13.76 | 22.23 | 24.39 |
| F | 16 | 22 | 23.69 | 3.67 | 0 |
| G | 17 | 47.05 | 19.36 | 6.6 | 5.88 |
| H | 13 | | | | 0 |
| I | 13 | 18 | 4.33 | 9.25 | 0 |
| J | 12 | 67 | 21.5 | 2 | 0 |

## *Seasonality and Excess Capacity*

One side effect of high levels of migrant participation is seasonal fluctuations in the demand for rickshaws. These fluctuations coincide with the agricultural season. According to garage owners, and drivers in the focus groups, the period of the present study, December–February, coinciding with the Rabi harvest, was a period of relatively low demand. Indeed, as Table 4.2 shows, our garage study also uncovered less than full uptake of cycle rickshaws during this period, particularly among garages that catered to commuter and seasonal migrants.

Conversely, the months of September–November, during the Dassehra–Dipawali season, see high level of demand for rickshaws. According to the interviewees, both the garage owners and rickshaw drivers, demand for rickshaw services is particularly high in these months because of festival traffic. In this period, many garages rent out rickshaws on day and night shifts. Even so, in focus group discussions, rickshaw drivers complained that they were unable to rent during this "high season" because of the massive increase in demand from seasonal migrants.

The period of our study was the agricultural Rabi season and many of the rickshaw drivers had returned to their respective villages. Thus, not only were a large number of rickshaws unhired, pointing to excess capacity, but also our sample was biased towards the more local drivers. Although we elicited some information about missing drivers, particularly from smaller garages, the missing drivers at the larger garages proved more difficult to document.

The time bounds on the present study made it difficult to document the seasonal pattern quantitatively. However, the rickshaw rental market appears to function with extended periods of market disequilibrium, of either excess demand or excess supply.

The numbers of rickshaws also showed some fluctuation from season to season and month to month, since many rickshaw parts are recycled on a regular basis. Nonetheless, the levels of excess capacity suggested by Table 4.2 in Bilaspur are broadly in accord with evidence from elsewhere. Kurosaki et al. (2012, p. 33) also reported an "average utilization rate" of only about 68 %.

## *Networks*

Various features of garage functioning suggest that garages have adapted to the disequilibrium and competitive market conditions by expanding the set of acceptable transactors to include renters from outside the community, including seasonal migrants. The predominance of seasonal migrants seems counterintuitive, particularly in light of the claim made by a number of nonmigrant rickshaw drivers in focus group discussions that during the high season, they were rationed instead of migrant drivers.

Other studies of the cycle rickshaw sector had suggested that the "guarantor", or "surety man" in linking the garage owner and the new rickshaw driver, serves as the mediator for these network effects (Kurosaki et al. 2012). The present study, however, discovered a far more complicated picture with regard to recruitment and contract enforcement mechanisms. While resident drivers rarely needed such guarantors, migrants were more likely to need a formal introduction. However, the role of the guarantor turned out to be merely putative. Not all migrants go through such a guarantor, or "introducer", and no legal liability is involved for the "introducer" if default occurs. Indeed, one garage owner pointed out that even in case of theft, the guarantor cannot be held responsible.

Although analysing these network effects is beyond the scope of the chapter, Jain and Sood (2012) show that even subject to the limitations of the quantitative data, migrants, and especially those who are more closely associated with their place of origin, are indeed incorporated into the rental market in higher proportions than local drivers.

## *Credit and Default*

The incorporation of migrant drivers gains special significance in comparing the cycle rickshaw rental to a form of credit/capital supply to temporary migrants. This supply must be juxtaposed against a large literature that documents credit rationing of migrants given "informational opaqueness" (BenYishay 2012). In this sense, the garage owners supply a key resource to temporary and commuter migrants.

Jain and Sood (2012) also show default, both theft of cycle rickshaw and default on rental payment, to be a major concern for garage owners. The garage study showed that upwards of a third of all drivers at some garages had defaulted on rental payment (Sood 2008). To return to the discussion at the beginning of this section then, it appears that the distribution of risk between rickshaw drivers and garage owners is not entirely one-sided. While rickshaw drivers do indeed bear income risk, owners bear risk of default.

Having thus considered the importance of the informal cycle rickshaw market to the livelihood of migrants, and the role of regulatory and market conditions to facilitating these services, the next section underlines the policy implications of these findings.

## Lessons for Urban Policy and Regulation

The introductory section delineated three channels through which informal markets and mobile workers are connected for policy purposes: (1) existing regulatory frameworks impact the livelihoods of temporary migrants, (2) interventions for informal livelihoods that do not account for mobile workforce limit their coverage and (3) programmes for temporary and commuter migrants can fruitfully learn from the informal markets that provide livelihoods how to reach these workers.

### *Local Regulation*

The previous section argues that asset ownership costs may be higher for temporary and commuter migrants. The rental market provides an accessible capital source for such self-employed migrants. Yet, as the previous section attempted to show, regulation and its enforcement affect market structure in the cycle rickshaw rental market. In cities such as Delhi where the regulatory costs of cycle rickshaw ownership and operations have been much higher till recently (Kishwar 2006, 2012), garage fleets have been found to be larger (Kurosaki et al. 2012); at the same time, garage/cycle rickshaw owners' market power is reflected in the larger dispersion in rental rates (Kurosaki 2012).

Although the owner–plier regulation in Delhi has been conclusively voided by recent judgements, it remains on the books in other states (Sood 2012). It is evident that punitive regulatory regimes of this nature affect mobile workers disproportionately.

### *Livelihood Interventions*

A recent scheme to provide free solar or electrical battery-powered cycle rickshaws to the 2.5 lakh registered rickshaw drivers in Uttar Pradesh (UP) provides an interesting test for the argument made in this chapter (Verma 2012). While a rigorous programme evaluation is beyond the scope of this chapter in the absence of data, the argument here does suggest a range of questions that such an intervention must consider.

While data on registration rates and patterns in UP are not known, similar data from other locations suggest that only a fraction of drivers are registered—in Bilaspur, no more than 26%. While ostensibly well intentioned, such a scheme runs the risk of shutting out large numbers of rickshaw drivers who remain "unregistered", especially those who combine livelihoods in two or more locations or activities, from the gains from technological diffusion and innovations. Compare this case to the rapid diffusion of lighter and technologically superior cycle rickshaw designs in Delhi through the aegis of cycle rickshaw owners/garages (Kurosaki 2012).

Equally, the evidence from Bilaspur suggests that cycle rickshaw drivers need a support infrastructure for repair, maintenance and storage purposes. Institutional alternatives to the rental market, such as early cooperatives in Delhi, may supply such services, but they must be factored into such an intervention (Sood 2012).

Finally, registration patterns in Delhi suggest that owner-contractors often control the registration process. The risk of unintended concentration in the hands of well-connected owner-contractors must be recognised.

### *Supporting Migrants*

While Deshingkar and Farrington (2009c) offer a range of initiatives necessary to support temporary migrants at destination points, locating and reaching these groups, especially the self-employed, in the city often remains a major challenge. The evidence presented in the last section suggest that migrants in the cycle rickshaw sector often cluster at garages that provide access to capital rentals as well to accommodations in some cases. These providers thus present a possible pathway to connect to these groups.

Further, while informal providers offer services at far from ideal terms, interventions in the sector must recognise the role of informal providers in credit access for migrants, especially when formal sources are not available. In particular, there is a call for the microfinance discourse to take more cognizance of informal capital sources for self-employed migrants. While an in-depth examination of this literature is beyond the scope of this paper, understanding the services offered by informal markets adds a crucial layer to understanding the needs of multilocational workers.

## Conclusions

The salience of migration dynamics in this sector and the difficulty in capturing these patterns suggest that perhaps studies of other informal sector markets may similarly fail to account for such mobility. However, recognising the intertwined fates of informal labour markets and migration flows is increasingly key to inclusive urban development. Three features of contemporary Indian growth render such a policy appreciation ever more urgent: first, the predicted expansions in these patterns of commuting and circular migration (Chandrasekhar and Sharma 2012); second, the continuing salience of informal employment not only in agricultural but also in urban, nonagricultural employment (Chen and Raveendran 2011) and, last but not least, the scenario of near jobless growth (Thomas 2012).[7]

[7] Recent studies also suggest the strong formal–informal linkages in growth hubs such as Chennai and Bangalore (Sridhar and Reddy 2012, 2013).

As long as similar regulatory frameworks characterise other informal activities, in street vending as well as other sectors (Sood 2012), the most vulnerable migrants will continue to be shut off from access to public space and the fruits of urban development. Equally, interventions for disadvantaged informal workers will remain less than effective.

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# Part II
# Urban Governance, Infrastructure and Service Delivery

# Chapter 5
# Benchmarking Cities: Evidence from India

**Kala Seetharam Sridhar and Nivedita Kashyap**

## Introduction

Cities and urban agglomerations are very high on the policy and political agenda internationally and in India. This interest coincides with the fact that since the year 2007, half of the world's population started living in urban areas. Consistent with the global trends, it is estimated that urban population in India will increase from 28 % in 2001 to nearly 50 % by 2020. While they contain less than one-third of the country's population, urban areas contribute to half of India's gross domestic product (GDP) highlighting their importance in achieving regional and national growth targets.

This chapter aims at providing an assessment of urban conditions in the four mega cities of India—Delhi, Mumbai, Kolkata, and Chennai. Key indicators for monitoring and evaluating these cities have been established through which cities can communicate experiences and share best practices in the delivery of urban services, policy development, and data management. As far as possible, all indicators have measured policy outcomes, and the database will allow comparisons among cities.

We compare the following thematic areas (the chosen indicators for each thematic area are indicated within parentheses) across these four cities:

- Governance (history, organizational features, elected bodies, and staffing)
- Sociodemographic dimensions (population, density patterns, labor force, literacy rate, and social composition)
- Economic and financial dimensions (economic base and credit disbursed)
- City finances (revenues, tax collections, and capital expenditures)
- Urban poverty (slums and access to sanitation)

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- Basic essential services (solid waste management, water supply, sanitation, and electricity)
- Public security and safety (crimes, such as murders, dacoity, theft, and others; those killed/injured in road accidents)
- Physical infrastructure (number of bank branches, road length, transport, streetlights, and vehicles)
- Quality of life (air quality and water quality)

This chapter is organized as follows: a brief literature review is followed by a description of the methodology we use to select and compile the data for the four cities. This is followed by the results section, categorized by the thematic areas listed above, where we summarize the important findings, compare data across the four cities, and highlight policy implications of the research.

The cities selected in this study are India's biggest economic centers and thousands flock to these cities every day in search of livelihoods. The state of basic service delivery and infrastructure development in these cities not only influences the lives of the millions of its inhabitants but also of countless others dependent on business and remittances from these cities. Consequently, these cities are among the most studied in India. We make an attempt in this chapter to compare the metropolitan cities on many common dimensions, which will enable comparison and sharing of best practices across these cities.

However, during the course of this study it was evident that these cities suffer from inadequate data and information. As summarized in Table 5.1, we found that across all cities data on several indicators of urban poverty, education, and health were either unavailable or not reliable. Data on some indicators of the cities' finances and infrastructure were not available for certain cities. The data on property tax and road length were not available for Delhi. The data on degree colleges and other institutions of higher education and the amount of solid waste collected by its municipality were not available for Mumbai. The data on Chennai's electricity supply and distribution infrastructure and air quality were not available. Further, we could have computed many innovative indicators such as traffic density (number of vehicles per kilometer of road length), had the relevant data been available. These should be read as caveats of the research.

**Table 5.1** Unavailable data from cities

| City | Data missing |
|---|---|
| Delhi | Data on property tax |
| | Total length of road |
| Mumbai | Amount of solid waste collected by municipality |
| | Number of institutions of higher education |
| Chennai | Data on electricity supply and distribution |
| | Data on air quality |
| Kolkata | Number of vehicles in Kolkata |

## *Review of Literature*

We have found that many countries and continents have now actively initiated "state of cities" reports. Some examples are the State of English Cities (UK Department of the Environment, Transport and the Regions 2000), State of Minnesota's Cities (League of Minnesota Cities 2008), and the State of African Cities (UN Habitat 2010). Besides, the World Bank has launched a Global City Indicators Program which is a decentralized, city-led initiative which enables cities to measure, report, and improve their quality of life and enable sharing of best practices (see Bhada and Hoornweg 2009). The UN Habitat's State of the World's Cities Report (SWCR 2012/2013) synthesizes information and knowledge on the state of the world's cities with a view to strengthening the ability of governments, local authorities, and key partners to gain access to and make use of information on urban conditions and trends and to formulate effective urban policies. The UN-Habitat's Global Urban Observatory has also advocated a Global Urban Indicators Database and a World Cities report, which form its key activities (see Hossain 2006).This chapter is an attempt to fill the gap in this literature for India's cities.

## *Methodology*

The required data to enable comparison of cities across various dimensions were gathered in several ways.

First, we obtained the secondary data for the four cities regarding various socio-demographic indicators from the census of India's Primary Census Abstract (PCA) and town directories. Second, we obtained data maintained by the respective state departments in a centralized manner (number of schools and colleges, hospitals, and air quality). Third, we travelled to each of the four cities and visited the relevant departments (city corporations, electricity supply companies, water boards, and city police headquarters) to collect information on the various indicators and thematic areas for which information was not available from the first two sources. We approached the Reserve Bank of India for specialized economic indicators like the credit disbursed by banks to cities and the number of bank branches in cities. For other specialized data needs such as flights and passenger movements, we consulted the Airports Authority of India. Finally, we used the Internet for information on the city's history and origins.

We collected information on governance and origins of the city from the websites of the concerned city corporation and from the Internet. Demographic data such as population, literacy rate, household size, sex ratio, density, and decadal growth patterns were taken from the 2011 Census. The sectoral composition of economic activity were obtained from the 2001 Census (PCA). City finance details, data on urban poverty, and on basic services such as waste, sewerage, streetlights, and roads, were obtained from the respective city corporations. In the case of Delhi and Chennai, water supply data were collected from their water boards. The data

on electricity were gathered from respective electricity supply companies. In case of Delhi and Mumbai, three electric supply companies share the task of distributing electricity to the cities and data have been collected from each one of them. Information on the number of medical colleges and engineering colleges was collected from the respective state higher education departments. Information on the number of vehicles in the cities was collected from the respective state transport department. Public safety and security data were collected from the respective cities' police departments. The data on air quality were collected from the cities' respective state pollution control board. We compare the respirable suspended particulate matter (RSPM) levels measured in different parts of the cities.

With the exception of governance and origins of the city, the data gathered were quantitative. The raw data gathered were processed to make them comparable across the four cities (such as liters per capita daily in the case of water supply). The final output was a fact sheet for each of the four cities which summarized the various indicators under the six thematic areas. In most cases, when available, we used 3-year averages of relevant data instead of data for a single year to avoid over-dependence on a single year.

## *Results*

The following sections compare the important findings for the four cities, summarize the findings, and highlight policy implications of the research.

## Governance

The three port cities, Chennai, Mumbai, and Kolkata, flourished with the arrival of the British East India Company which developed these cities as trading stations. Delhi, on the other hand, has a long history as a capital of various empires, and was taken over by the forces of the British East India Company only in 1857, and chosen to be the capital of India in 1911. The timeline of the establishment of bodies for civic administration of these cities reflects this (Fig. 5.1).

The Chennai Corporation was established on 29 September 1688 and is the oldest municipal corporation in India. The Kolkata Municipal Corporation (KMC) and the Municipal Corporation of Greater Mumbai (MCGM) were established in 1876 and 1888, respectively. Since their establishment, various laws and acts have been passed to make changes in the constitution and powers of these corporations. Delhi is an exception among the cities studied. It is governed by three different municipalities—the New Delhi Municipal Council (NDMC), the Delhi Cantonment Board (DCB), and the Municipal Corporation of Delhi (MCD). MCD is the largest among these three municipalities, administering more than 94% area of the entire city and more than 95% of total population of the municipal area in Delhi. At the time we

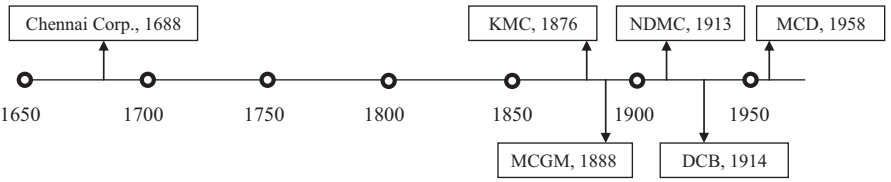


**Fig. 5.1** Timeline of establishment of local bodies in Chennai, Kolkata, Mumbai, and Delhi

finished writing this chapter, the MCD was split into three corporations—the East Delhi Municipal Corporation, North Delhi Municipal Corporation, and the South Delhi Corporation, for better governance. However, all our data are for the erstwhile MCD.

The corporation areas are divided into wards and zones (boroughs in the case of the KMC), with councilors elected from each ward whose term of office is 5 years and whose responsibility is to oversee their constituencies' civic infrastructure. The KMC discharges its function through the Mayor-in-Council, consisting of a mayor, assisted by a deputy mayor, and ten other elected members of the KMC. The mayor is responsible for the overall functioning of the KMC and has a 5-year tenure. However, the role of the mayor is largely a ceremonial post (with the exception of Kolkata) with limited duties in the MCD, the Chennai Corporation, and the MCGM. The administrative head of the corporations in the case of these (most) Indian cities is the Municipal Commissioner.

The number of employees in the city corporation (per lakh of its population) and the proportion of wages in the form of recurrent (revenue) expenditure (see Fig. 5.2) were examined. Delhi has the largest number of employees of all the cities in absolute terms and the largest number of employees per lakh population. It is also the city where the wages formed the highest proportion of revenue expenditure (nearly 54% of revenue expenditure).

In terms of the number of employees per lakh population, Delhi is followed by Mumbai (918 per lakh population), Kolkata (767 per lakh population), and Chennai (404 per lakh population). However, in terms of employee wages as a percent of revenue expenditure, Chennai spends a much higher proportion of its revenue expenditure as wages (48%) than Mumbai. Mumbai spends a modest 29% of its expenditure on wages and this is comparable to the expenditure on wages in smaller cities in Karnataka (Paul et al. 2012).

The extremely high number of employees per lakh population in the case of Delhi may simply be due to the lack of proper records. For instance, the MCD was recently involved in the "ghost employee scandal," where ongoing investigation revealed that 22,853 employees were nonexistent or 'ghost' employees on the civic agency's payrolls and salary had been drawn on their behalf.[1]

[1] http://www.indianexpress.com/news/ghost-employee-scandal-mcd-moves-against-55/929867/0.

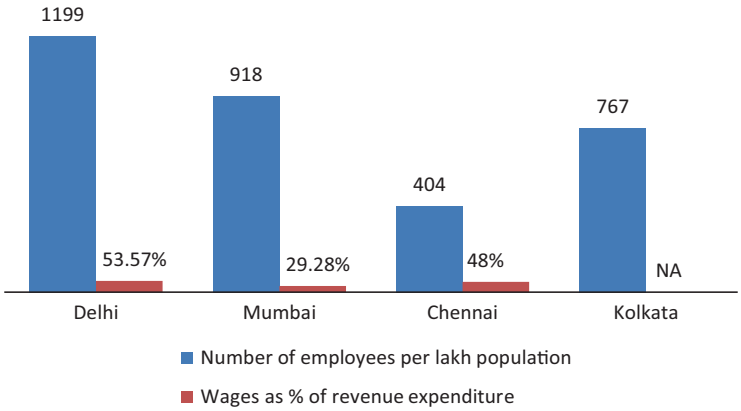


**Fig. 5.2** Comparison of number of municipal employees and wages as percentage of recurrent expenditure (average, 2007–2008 to 2009–2010) across India's mega cities

The existence of capital and revenue budgets in the cities and their public availability was also examined in this study. MCGM, NDMC, and the Chennai Corporation's budget documents with disaggregated revenue and capital budgets are accessible on their websites for the years 2007–2008 to 2010–2011, 2009–2010 to 2011–2012, and 2003–2004 to 2012–2013, respectively.[2]

It should be mentioned that there are no common standards for account maintenance at the local level (Sridhar and Reddy 2010) in India. The Comptroller and Auditor General (CAG) of India appointed a task force to recommend a system of accounting and budgeting for local bodies, following the recommendations of the Eleventh Finance Commission in this regard. The recommendations outlined in the task force's report have been generally agreed to be implemented by the states, but the pace of adoption of the recommendations has varied (Garg 2007).

## Sociodemographic Dimensions

The basic sociodemographic data for the cities (population from Census 2001 and Census 2011; see Fig. 5.3) show that the NCT of Delhi is the largest followed by Mumbai, Chennai, and Kolkata. As can be seen in Fig. 5.3, Kolkata's population in 2011 actually declined from what it was in 2001.[3] Mumbai's population increased from 11.9 million in 2001 to only 12.5 million in 2011, mainly due to a negative growth rate in the Mumbai city district during 2001–2011 (see Fig. 5.4). There is no

[2] The KMC's budget statements are available on their website for the years 2009–10 to 2012–13, but there is no disaggregation of KMC's budget into capital and revenue accounts. The MCD, however, does not make available its budget documents on its website.

[3] For a brief analysis of the dip in Kolkata's population see: http://www.livemint.com/2011/04/05224458/Kolkata-sees-dip-in-population.html

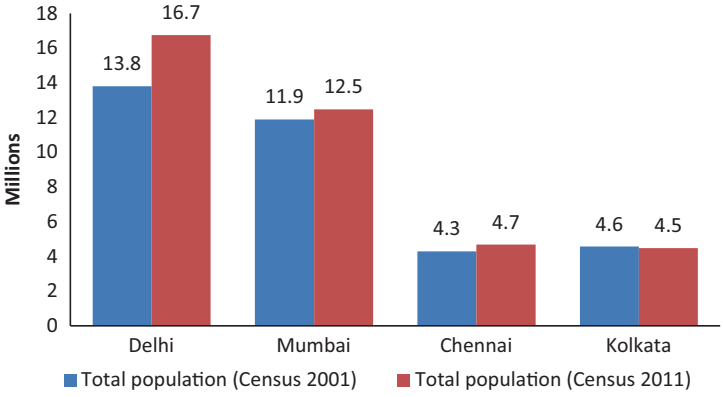


**Fig. 5.3** Comparison of population. (Census 2001 and Census 2011)

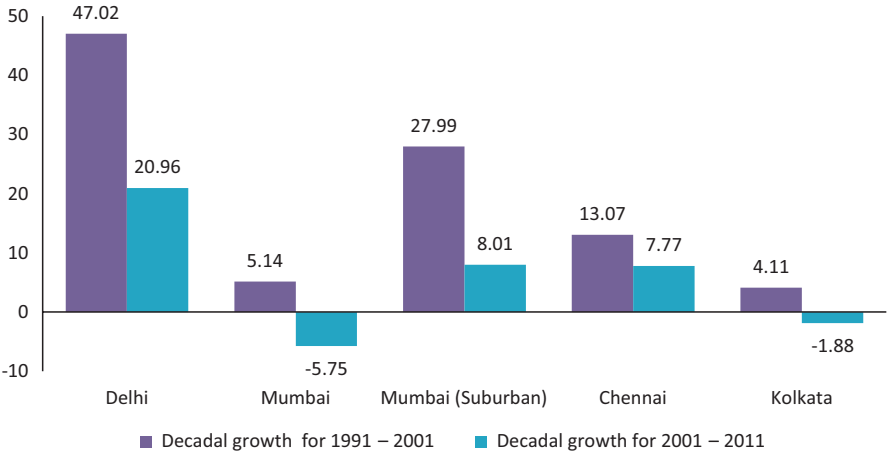


**Fig. 5.4** Comparison of decadal growth rate (1991–2001 and 2001–2011)

change in the census reference areas during 2001–2011. Some of the decline could be explained by migration. While we do have migration data at the city level until 2001 (they are called D3 tables), unfortunately for the 2011 Census, they are not yet published. Therefore, for the time period which is being discussed (2001–2011), natural growth and migration cannot be separated.

When the decadal growth rates of the four cities in 1991–2001 are compared with those of 2001–2011 (see Fig. 5.4), it is seen that the rate of population growth has slowed down in all four cities, showing that population growth has saturated in these cities. For a clearer picture of Mumbai, the graph shows the rate of growth disaggregated for Mumbai and Mumbai (suburban).[4] The population of Kolkata and Mumbai have shrunk in the past decade, indicating that people from the

[4] Mumbai suburban district was created in 1990.

city may have moved to the suburbs (see Sridhar 2007, 2010 for an overview of suburbanization of India's cities and their determinants). Delhi, which is the largest by area, had the highest growth rate in the last two decades, followed by Mumbai (suburban) and Chennai. According to data released by the Census 2011, two central districts of Delhi—New Delhi and Central—have had negative growth rates in the past decade (−25.35 and −10.48 %) and three districts bordering Uttar Pradesh and Haryana—South West, North West, and North East—have had much higher growth rates in the same period (30.62, 27.63, and 26.73 %).

The fall in growth of population in New Delhi was largely due to the steep fall in decadal growth rates of the two central districts in New Delhi as mentioned below. The Census 2011 release attributes this to the following two factors:

1. Since 2001, several slum clusters have been moved from the city center. This picked up pace in the run-up to the Commonwealth Games of 2010 which was hosted in New Delhi.
2. Another visible trend in practically all of the long-settled private residential areas is the tendency to convert the ground floor for commercial/office use and only keep, if at all, the upper floors residential.

The fall in decadal growth is Chennai is not as steep, and the fall is likely a result of falling birth rates which is confirmed by Paul and Sridhar (2013).

In all four cities, it is seen (see Fig. 5.5) that the growth rates have peaked and are falling since the last three decades. This is an indication that the major metropolitan cities of India are being saturated possibly due to congestion and high real estate costs (see Sridhar 2004). Hence, the future of urban growth in India will be in the fast developing mid-tier cities of India.

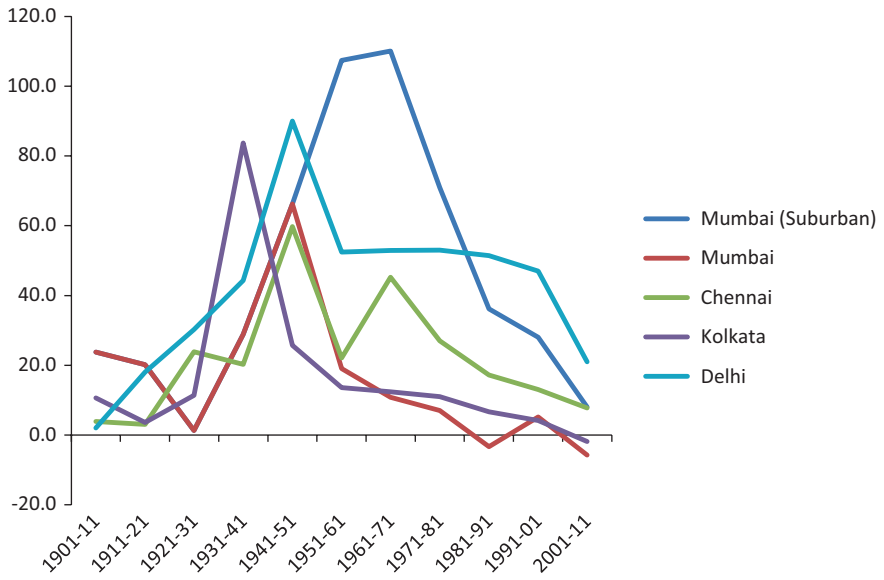


**Fig. 5.5** Decadal growth rate from 1901 to 2011

**Table 5.2** Comparison of city municipal limits and extended regions

| City | Municipal limits area ($km^2$) | Area of metropolitan region (as defined by the local planning area, defined as area of the respective urban development authority) ($km^2$) | Municipal area as % of metro area (%) |
|---|---|---|---|
| Delhi | 1,483 | 2,000* | 74.15 |
| Mumbai | 437.71 | 4,355** | 10.05 |
| Chennai | 174*** | 1,189 | 14.63 |
| Kolkata | 187.33 | 1,886.67 | 9.93 |

*This area is called the Central National Capital Region (CNCR) (Section 2.1, http://www.urban-india.nic.in/theministry/subordinateoff/tcpo/DMA_Report/CHAPTER_2.pdf). The total NCR region is a whopping 33,578 $km^2$ (NCT is 4.42% of the total NCR area)

**The MCGM shares this region with seven municipal corporations and 15 municipal councils. The entire area is overseen by the Mumbai Metropolitan Region Development Authority (MMRDA)

***The Chennai Corporation limit was expanded to 426 $km^2$ in 2011. The post-2011 percentage is 35.83%

In terms of population density (the number of persons living per square kilometer of city area), Chennai (24,963) and Kolkata (24,718) have the highest density followed by Mumbai (20,317) and Delhi (11,297). However, the density of population in Delhi varies widely in different parts of the city. The New Delhi district, in the center of Delhi, almost contiguous with NDMC, is the least dense with only 4,000 people per $km^2$ and the North East district of Delhi the densest with a whopping 37,000 people per $km^2$ according to the 2011 Census. In terms of geographical area, the largest is the NCT of Delhi (1,483 $km^2$) with an area more than three times the area of the second largest city of Mumbai (437.71 $km^2$). The city with the smallest area is Chennai at 174 $km^2$. In 2011, however, 42 small local bodies were merged with the Chennai Corporation increasing its area to 430 $km^2$, almost equal to the area administered by MCGM.

Finally, the proportion of scheduled castes (SC) and scheduled tribes (ST) provides information on the social composition of the city. In 2001, Delhi had the largest proportion of SC population, accounting for 16.92% of its population followed by Chennai with 13.77% (data on SC/ST composition were not made available by the 2011 Census as of this writing).

While we are primarily concerned about the cities' municipal limits, it may be useful to add some information about the metropolitan region as well. Planning definitions of the larger urban area which extends beyond the municipal limits and which is managed by the urban development authority in the respective cities were available for the four cities. A comparison of the area of these extended regions and the municipal limits in the case of the cities is summarized in Table 5.2.

Delhi has the maximum proportion of the local planning area (LPA) covered by the municipal area. All of the other cities have less than 15% of the LPA covered by the municipal limits. In the case of Chennai, the coverage of the municipal limits


**Fig. 5.6** Comparison of population per ward

in the LPA would increase to 35.83 % post 2011 because of the increase in Chennai Corporation's area due to the merging of surrounding municipalities. These changes will be implemented after the 2011 Census.

In the interests of understanding governance in the cities in a better manner, population per (electoral) ward in the cities of this study is reported (see Fig. 5.6). Delhi is the one with the maximum persons per ward, while Mumbai has the maximum number of wards (277), closely followed by Delhi (272). However, Mumbai has only 24 administrative wards, with each ward having its own ward office which administers its territory. In late 2011, the Union Home Ministry approved the proposed trifurcation of the largest municipal corporation of Delhi, MCD, into north, south, and east with the corporations of north and south having 104 wards each, and the east having 64 wards. The trifurcation is an attempt to split the MCD, India's largest civic agency in terms of the people and area it administers, into smaller bodies capable of addressing civic issues "expeditiously and effectively[5]."

## Economic and Financial Dimensions

In presenting the cities' economic dimensions, the sectoral composition of workers, which reflects its economic base and the credit disbursed per capita, is compared, all at city level (Figure 5.7). When the sectoral composition of employment is examined and compared across the cities, the proportion of workers affiliated with

[5] http://www.indianexpress.com/news/Trifurcation-of-MCD-will-help-in-providing-better-governance–L-G/897839/.

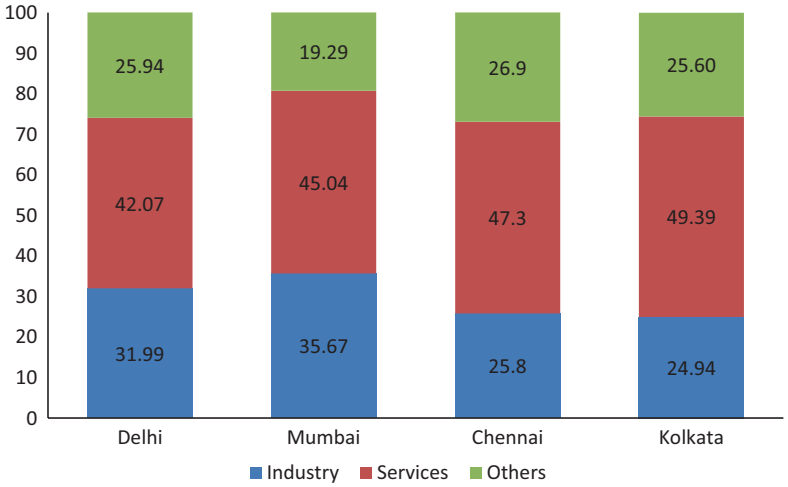


**Fig. 5.7** Economic dimensions: comparison of sectoral composition across the cities. (Census 2001)

service industries such as transport, storage, communications, hotels, restaurants, trade, commerce, financial and other services is the largest (see Fig. 5.7) in all cities. Kolkata is the one with the highest proportion of its workers in services (49%), followed by Chennai (47%) and Mumbai (45%). The highest percentage of workers in manufacturing (both household and nonhousehold) is in Mumbai at 36%. Kolkata has the smallest manufacturing base among the three cities with 25% of workers in manufacturing. The category 'others' includes agriculture, forestry, construction, and mining.

In terms of workforce participation, Kolkata has the highest percentage of workers (37.2%) and Chennai and Delhi have the least (34% each). Overall, the biggest sectoral employers in the four cities are nonhousehold industries, wholesale and retail trade, financial intermediation, real estate, renting and business activities followed by the manufacturing/industry sector (Fig. 5.8). The data on sectoral composition, which may have changed significantly in the last decade, had not been published by the 2011 Census as of this writing.

Credit disbursal is an important indicator of economic dynamism of the city. The data on city-level credit disbursed for the four cities in this study were obtained from the Reserve Bank of India (RBI). In the absence of other reliable measures at the city level, this could be an indicator of economic vitality, since only when economic/commercial/retail activity in a city is expanding that the need for credit would grow. Further, bank credit is given not only to units in the organized sector but also to units/small businesses in the unorganized sector. One might argue that credit disbursed might include credit for non-commercial purposes, such as those for consumer durables, and occasions, such as weddings; but even these reflect economic activity. Further, credit disbursal also includes all personal loans, housing

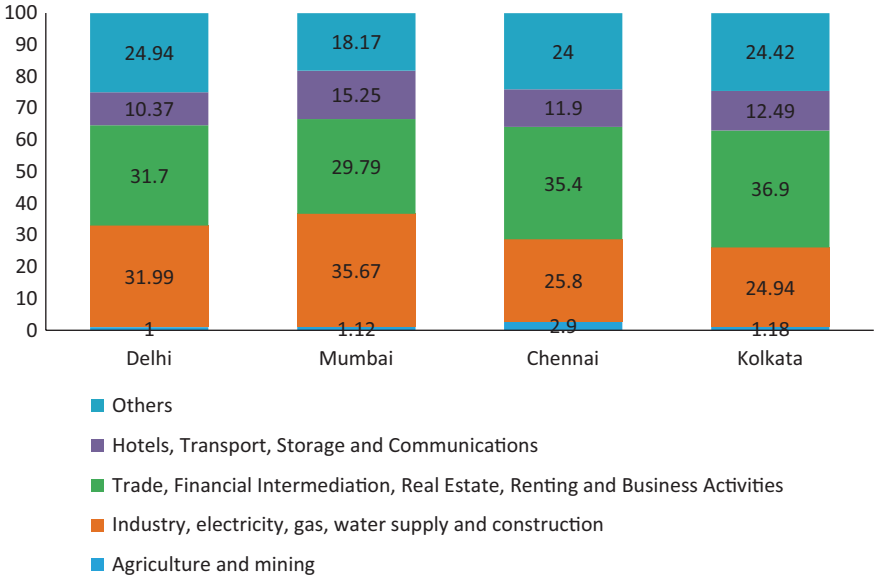


**Fig. 5.8** Disaggregated comparison of sectoral composition across the cities. (Census 2001)

loans, and auto loans, and hence it is a good overall indicator of economic activity and consumer confidence.

The disbursal of credit per capita, nearly ₹ 629,455 in Mumbai, is the highest among all four cities (and the highest in India), consistent with the view of Mumbai as the country's financial capital, and is followed by Chennai at ₹ 325,001, Kolkata at ₹ 241,569, and Delhi at ₹ 215,607. In absolute terms, however, the amount of credit disbursed in Delhi is second to Mumbai, followed by Chennai and Kolkata. When the rate of annual growth of gross bank credit is considered, this trend is reversed with Delhi having the highest growth in credit (averaged over 3 years 2007–2008 and 2009–2010) at 29.7%, followed by Chennai and Kolkata at 23.3%, and Mumbai trailing behind with 14.7%. During the global recession of 2008–2009, the more globally connected cities, Delhi and Mumbai, saw a bigger fall in annual bank credit growth at 25.7 percentage points and 19 percentage points, whereas Chennai and Kolkata saw a smaller drop at 11.9 percentage points and 6.6 percentage points, respectively.

It should be mentioned that a caveat of the bank credit data is that it refers primarily to the organized sector. Most of the informal sector activities are financed by informal sources such as family, social networks, and micro-finance institutions which are small in relation to the banks anyway, and there is no systematic data on these institutions regarding credit disbursal (Fig. 5.9).

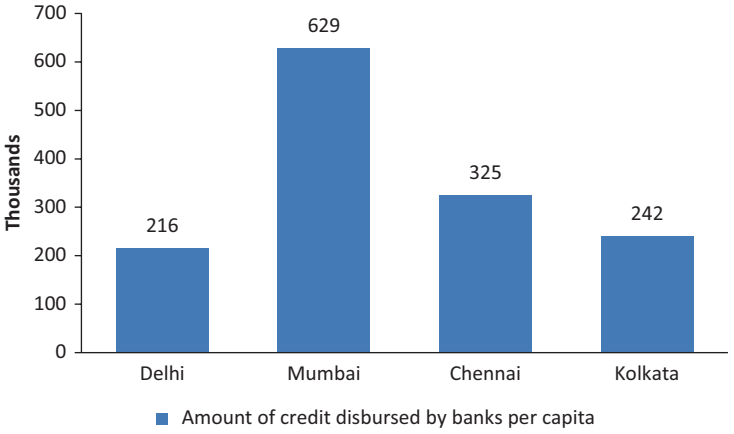


**Fig. 5.9** Comparison of credit disbursed by banks (3-year average 2007–08 to 2009–10)


**Fig. 5.10** Comparison of property tax collection as a proportion of demand (Average, 2007–2008 to 2009–2010 for Chennai and Kolkata, 2007–2008 for Mumbai)

## City Finances

The property tax contributes a major share to the Indian cities' revenue base. Given this, the actual collection of the property tax by the city, as a proportion of what was 'demanded' of property owners, is studied. As Fig. 5.10 shows, the collection of property taxes as a proportion of what is demanded (i.e., what is *estimated* to be collected) is highest in Mumbai (80%), followed by Chennai (73%) and Kolkata (63%). We did not get data on the property tax demanded by municipal corporations in Delhi. The Jawaharlal Nehru National Urban Renewal Mission (JNNURM) specifies that there should be an improvement in the cities' property tax collection efficiency to 90% by 2012, so none of these cities have made it up to the JNNURM norm. A data caveat is that we were unable to separate the collection of any arrears (carried over from previous years) from collection for that year. Figure 5.11 compares property tax as a percentage of total revenues collected in the city. Chennai's

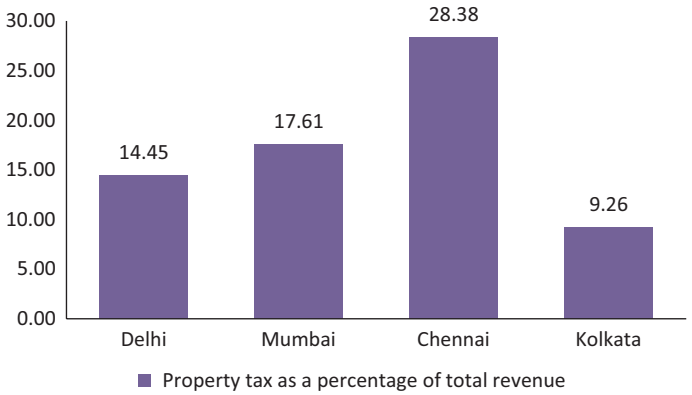


**Fig. 5.11** Comparison of property tax collected as a percentage of total revenue (Average, 2007–08 to 2009–10 for Delhi, Chennai and Kolkata and 2007–08 for Mumbai)

property tax collection makes up 28 % of the total revenue collected, the highest among the four cities. Kolkata's property tax collection as a share of its total revenue collections is the lowest among the four cities at 9 %.

Maharashtra is the only state in India in which municipal corporations levy the distortionary octroi[6], a tax on various goods brought into its municipal corporations for consumption or for sale. A network of check posts set up at entry points into the city viz. at highways, docks, the airport, and the railway station collect octroi. The octroi is considered to be highly distortionary since it creates delays at check posts which cause productivity losses, gives rise to corruption, entails a high cost of collection, and has the effect of increasing commodity prices. Because of this, all cities in India except Maharashtra have abolished this tax, while substituting it with other forms of entry tax. The octroi is the largest source of revenue for the MCGM. According to the MCGM's 2010–2011 budget estimates, revenues from octroi contributed to 36 % of MCGM's total revenue income (down from 38 % in 2009–2010) followed by revenues from its property tax, which contributed to 21 % of MCGM's revenue income.

In overall revenue collection, the per capita revenue receipts are the highest in Mumbai at ₹ 5,358 (due to the existence of the octroi), followed by Delhi at ₹ 1,508.79, and Chennai at ₹ 903. The lowest per capita receipts are in Kolkata at ₹ 816. Figure 5.12 confirms that Mumbai, being the financial capital of India, is the most self-reliant city as nearly 94 % of its income comes from its own sources and only 6 % of its revenues are from state and other external transfers. It remains to be seen, if in the event of octroi abolition, Mumbai will maintain its status in self-reliance. Chennai is the most dependent on state transfers among these four cities, with 36 % of its revenues being transfers from state and central governments, followed by Kolkata with almost 27 % of its revenues being transfers. A caveat of the data in

[6] http://articles.timesofindia.indiatimes.com/2011–12-18/nagpur/30531014_1_octroi-abolition-levy-octroi-municipal-corporations.

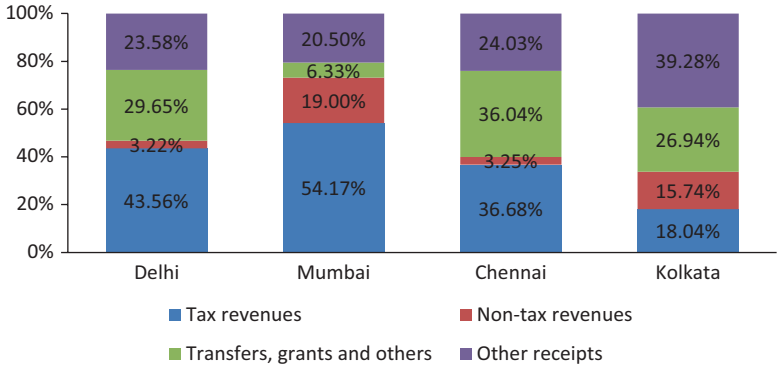


**Fig. 5.12** Comparison of own source revenues and transfers receipts (3-year average 2007–08 to 2009–10; Delhi numbers are only of MCD)

the case of Delhi and Chennai is that the per capita receipts do not include revenues from water charges (collected by Delhi Jal Board and Chennai Metropolitan Water Supply and Sewerage Board—CMWSSB—in Delhi and Chennai, respectively). This also testifies to the fact that the municipal corporations of Mumbai and Kolkata are more stressed in terms of expenditure responsibilities which include the provision of water supply, with which Delhi and Chennai city corporations are not saddled with.

Given the balanced budget required of local governments, it is interesting to examine whether high per capita receipts also translate into higher public expenditures per capita. Specifically, high capital expenditures translate into higher levels of various public services because capital expenditures represent investment in productive assets, although with a time lag. Figure 5.13 shows that the amount of capital expenditure by the cities correlates positively to the revenue incomes earned by them, except in the case of Kolkata, which, compared to other cities, spends very less on capital expenditures. Mumbai with the highest revenue income per capita also has the highest per capita capital expenditure at ₹ 3,433, followed by Delhi at ₹ 2,032, Chennai at ₹ 1,204, and Kolkata with only ₹ 671 in per capita expenditure (taking an average of spending from 2007–2008 to 2009–2010).

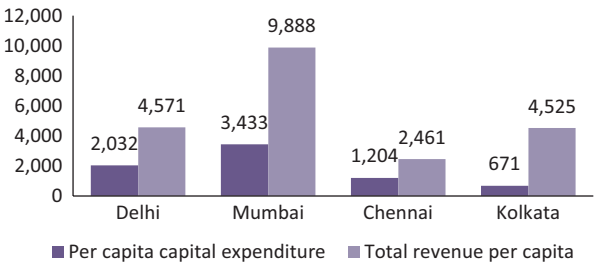


**Fig. 5.13** Comparison of capital expenditures (per capita) by cities on all services (including that on water supply and sewerage, 3-year average 2007–2008 to 2009–2010)

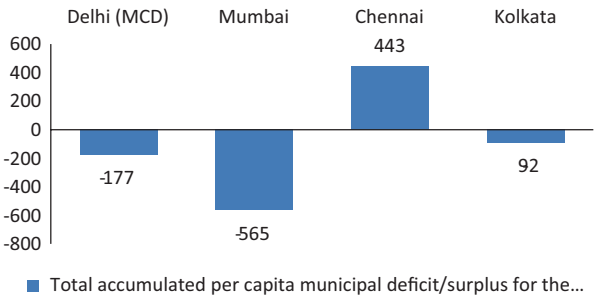


**Fig. 5.14** Comparison of total accumulated per capita municipal deficit/surplus for the years 2007–2008 to 2009–2010 by cities

Next, the extent of revenue deficit (or surplus) is compared for the four cities. Figure 5.14 shows the total per capita revenue deficit (or surplus) accumulated over 3 years (2007–2008 to 2009–2010). The Chennai Corporation performs the best among the four cities with the highest total revenue surplus per capita in the 3 years. One possible reason is that in Chennai the water is supplied not by the city, but by the CMWSSB. Mumbai (MCGM) has the highest accumulated deficit at ₹ 565 per capita, followed by MCD at ₹ 177 and Kolkata with a deficit of ₹ 92 per capita. One reason for Mumbai's highest deficit could be its expenditure responsibility of having to provide water supply, unlike in Chennai. However, if the deficit (or surplus) is disaggregated by the two municipalities, MCD and NDMC, in the case of Delhi, it is found that MCD has an accumulated per capita deficit even higher than that of MCGM at ₹ 723. The two largest municipalities in India have the highest revenue deficits in the period 2007–2008 to 2009–2010.

## Physical Infrastructure

Several indicators of physical and commercial infrastructure in the cities were compared—bank branches, roads, streetlights, public transport, and personal vehicles. These indicators are used to represent the accessibility of these services for the public. We compare our selected cities along these dimensions.

When the number of banks per lakh population is examined, Kolkata has the highest density of banks with 25 banks per lakh population, followed by Chennai with 22 and Mumbai and Delhi with only 15 and 14 banks per lakh population. It is possible that the ubiquity of automatic teller machines (ATMs) and the increasing popularity of net and mobile banking could compensate for the non-accessibility of bank branches in Mumbai and Delhi, assuming the objective of most bank customers would be cash withdrawal or other basic transactions (such as balance enquiry).

Figure 5.15 summarizes road length and public transport (city buses per lakh population). Kolkata has the highest road length both in terms of its land area and total length (4,607 km), followed by Chennai and Mumbai. For a city of its size, Mumbai has only 1,795 km of road which translates to only 4.1 km of roads per $km^2$ of its land area, based on data obtained from the MCGM.

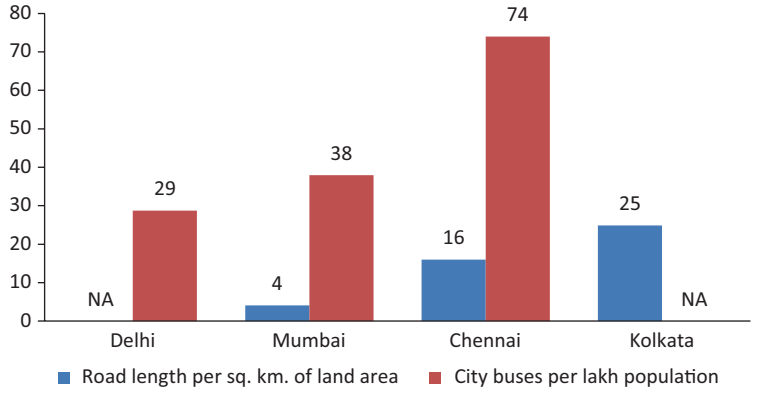


**Fig. 5.15** Physical infrastructure—comparison of road length and city buses per lakh population (2009–2010)

Coming to public transport, Chennai has the most number of public buses per lakh population (74), followed by Mumbai (38) and Delhi (29). When it comes to number of passengers who take these buses per day, Chennai again leads the pack with 47 lakh commuters using city buses every day, followed by Mumbai (43.71 lakhs) and Delhi (14.64 lakhs). Kolkata and Delhi also have a large number of buses run by private operators which may have come into existence due to a combination of conditions: high population density, poor public transit, private leeway to address public failings, and weak government oversight.[7]

All four cities also have heavily used rail transport systems. The Delhi Metro, run by the Delhi Metro Rail Corporation Ltd, is a world-class rapid transit system which serves the entire National Capital Region (NCR) and is one of the largest metro networks in the world. It takes a considerable amount of traffic off Delhi's roads. For a critique of the metro, see Tiwari and Mohan (1999). As of 2009–2010, 15 lakh people or 9% of the population use the Metro daily. Mumbai's suburban railway on the other hand was built by the British in India in the nineteenth century and is run by the Indian Railways. It has the highest passenger densities of any urban railway system in the world. It has a daily ridership of 69.4 lakhs,[8] which is more than one and a half times the number of daily passengers using Mumbai's bus service. Historical data released by the Mumbai Metropolitan Development Authority (MMRDA), show that while the suburban railways have peaked out capacity, the usage of buses run by Brihanmumbai Electric Supply and Transport (BEST) has been stagnant for the last 28 years.[9] Chennai's suburban railway system is also operated by the Indian Railways. As of 2011–2012, 14.6 lakh people use the suburban train services daily in Chennai.[10] We do not have data on passengers using Kolkata's metro and suburban railway system. It should be recognized that a full assessment

[7] http://www.nytimes.com/2010/06/10/nyregion/10vans.html?pagewanted=1&ref=nyregion.

[8] http://en.wikipedia.org/wiki/Mumbai_Metro.

[9] http://www.mesn.org/mumbai%20traffic%20stats.html#9.

[10] http://www.thehindu.com/news/cities/chennai/article3009933.ece.

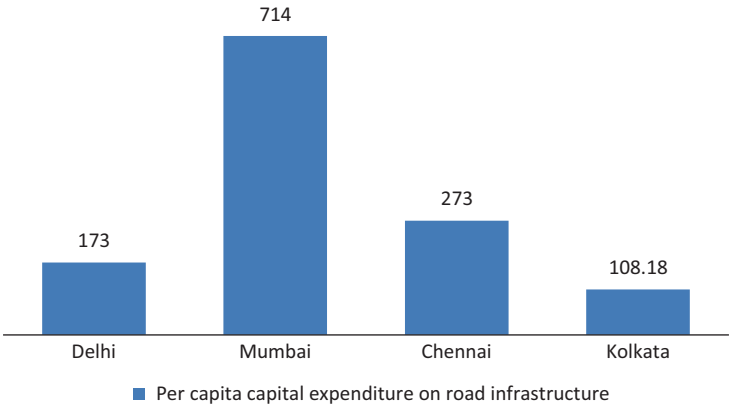


**Fig. 5.16** Per capita capital expenditure on road infrastructure (3-year average, 2007–2008 to 2009–2010)

of the effectiveness of public transport in these cities is not possible without taking into account these other modes for which we do not have full information.

At the time of completing this part of the study, all three cities, Mumbai, Chennai, and Kolkata, were in the process of building their own rapid transit metro systems.

Next, the number of streetlights per kilometer of road length is examined. Mumbai is the highest with 68 per km (or a streetlight for every 14 m), followed by Chennai (45 per km or a streetlight for every 22 m), and Kolkata (48 per km or a streetlight for every 20 m). The international norm is a streetlight for every 30 m; hence all these cities meet this international norm. We have data on the number of streetlights in Delhi only for the NDMC area (16 per km or a streetlight for every 63 m), which is not representative of the entire city (given that MCD is excluded). In absolute terms, Kolkata has the highest number of streetlights (2.25 lakhs) and Mumbai has the least (1.21 lakhs).

However, when it comes to capital expenditure, in spite of having the lowest road length both in terms of land area and total length, MCGM spends the highest per capita expenditure on road infrastructure at ₹ 714 per person, Chennai is a distant second at ₹ 273 spent per person, followed by Delhi (₹ 173 per capita) and Kolkata (₹ 108 per capita) (see figure 5.16).

In terms of total number of private motor vehicles (does not include nonmotorized modes such as bullock carts or bicycles) per lakh population across the cities of study, in 2009–2010, Chennai had about 665 vehicles per lakh population and Delhi had 392 per lakh population. Mumbai had only 131 per lakh population as on March 2008, and the Kolkata Metropolitan area had about 187 vehicles per lakh population as on March 2003. The number of vehicles per lakh population in these two cities may be low because of the availability of diverse public transportation (like auto rickshaws, taxis, and the overcrowded, albeit, fast suburban and metro rail systems in Mumbai and Kolkata, respectively). Further, the data on motor vehicles may include the surrounding areas, but the population is of the metropolitan area only. This might explain the variation in these numbers.

## Education

In education, information on literacy rate, the number of primary and secondary schools, and in higher education, engineering and medical colleges are captured and compared. In literacy rate, Chennai leads the pack with 90.33 %, with Mumbai and Kolkata behind the leader with 89.69 and 87.14 %, respectively, followed by Delhi with 86.34 %. All four cities have literacy rates above the urban literacy rate for the country (which was 84.98 % as of 2011). When the literacy rates of the four cities are compared across the 2001 and 2011 Census, it is seen that (see Fig. 5.17) Kolkata has seen the most improvement in literacy rates followed by Chennai, mainly because of convergence.

The number of schools per 1,000 school-going population in the four cities, the biggest in India, leaves much to be desired. In 2008, Kolkata and Chennai had a meager two schools per 1,000 school-going population and Delhi and Mumbai had only one school per 1,000 school-going population (see figure 5.18). These schools include all categories of schools—government, private aided, and unaided (primary, secondary, and high schools).[11]

Kolkata had the highest net enrollment ratio of 966 students enrolled per 1,000 school-going population in the primary and upper primary schools (as of April 2011) according to the data released by the West Bengal Sarva Shiksha Abhiyan (SSA). In 2009–2010, Delhi had 913 enrollments and Chennai had 741 enrollments per 1,000 school-going population. The international average primary school gross enrollment ratio (GER; according to data available from UNESCO in 2004) was 999 and the same average for South Asia was 941.

Kolkata had a very high pupil–teacher ratio of 125 in 2009–2010 which means that the number of teachers has to go up in Kolkata if it has to keep up with the number of enrollments and deliver good-quality education. Delhi had the lowest pupil–teacher ratio (only 7 according to data given to us by the NCT education department), followed by Chennai (30) and Mumbai (34 in schools run by MCGM only). Apart from Delhi, all cities have a pupil–teacher ratio higher than the international average of 24.6 (in 2006) in primary schools[12].

When we compare engineering colleges across the cities, Delhi has the maximum number of engineering colleges per lakh population in the 18–24 age group at 15 and Chennai has the least (1.4 colleges). We did not have data on colleges available for Mumbai. Delhi also had the highest number of medical colleges (8) and arts, science, and commerce colleges (73) per lakh population in the 18–24 age group.

[11] Source of data on schools, enrollment, and teachers: Delhi: Department of Education, Government of NCT; Mumbai: HDR Report, 2009; Chennai: Chennai district handbook; Kolkata: SSA, West Bengal. Source of school-going population is extrapolated Census 2001 data for the NCT of Delhi, area under MCGM, Chennai district, and Kolkata district.

[12] International Education Statistics analysis by Friedrich Huebler: http://huebler.blogspot.in/2008/10/ptr.html and http://huebler.blogspot.in/2005/04/primary-school-gross-and-net.html

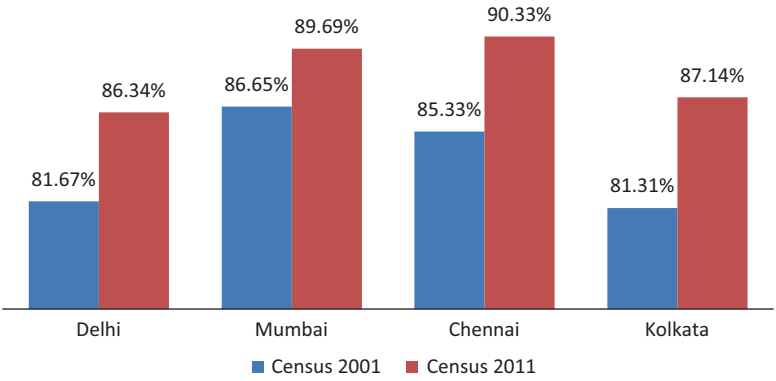


**Fig. 5.17** Literacy rate, 2001 and 2011

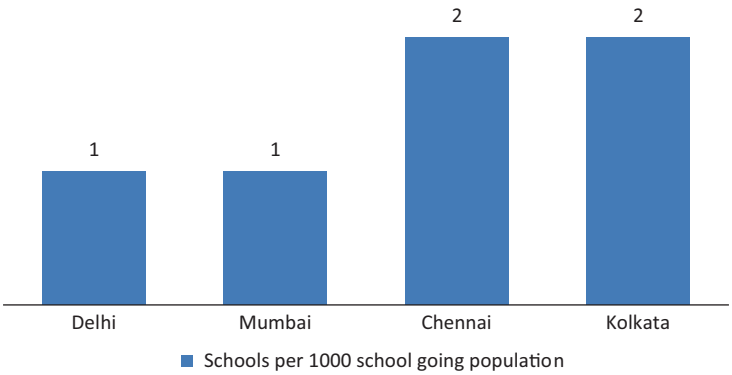


**Fig. 5.18** Comparison of number of primary and secondary schools per 1,000 school-going population (2008)

## Basic Services: Water Supply, Sewerage, and Solid Waste

Figure 5.19 shows the availability of water (in liters per capita daily (LPCD); net of leakages) in the four cities. Mumbai has the highest availability of water at 262 LPCD, followed by Delhi at 201 LPCD and Kolkata at 135 LPCD, all above (or equal to) the standard recommended by the National Commission on Urbanization (which is 135 LPCD). Chennai with 120 LPCD is below the standard recommended by the National Commission on Urbanization.

When it comes to the coverage of water supply, 95% of all households have water supply coverage according to data given to us by the CMWSSB (averaged over 2007–2008 to 2009–2010). In Mumbai, on the other hand, the proportion of those with piped water in their dwelling is high at 92% in nonslum homes, but it

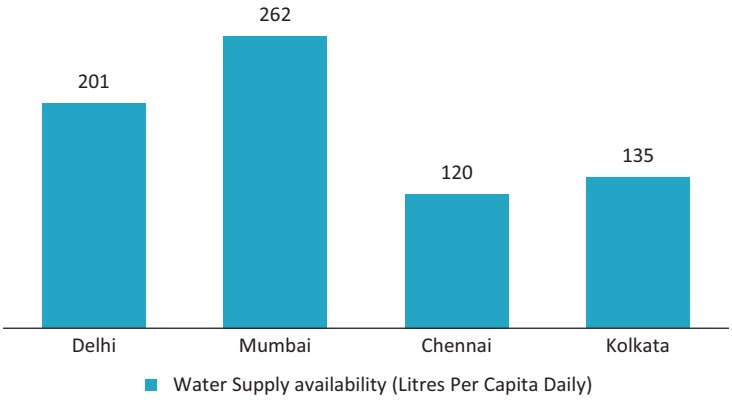


**Fig. 5.19** Basic public services—comparison of water supply availability (3-year average, 2007–2008 to 2009–2010)

is substantially low in slums.[13] In Kolkata, only about 27 % of the households have municipal water supply coverage. In terms of coverage of city with sewerage, Chennai is again the city with the best coverage at 99 % of total households covered by sewerage, followed by Kolkata at 83 %, Delhi at 52 %, and Mumbai at only 42 %.

While we are unable to explain variations across cities in terms of these services, there is some sharing and learning of best practices from the better performing to the less performing cities. It is possible that the best performing cities on this count have been able to accomplish greater coverage with public–private partnerships or by having a quid pro quo relationship between the beneficiary and service provider. It should be remembered, however, that this is not a study meant to explain these variations. It is an effort primarily at putting together such data for all cities in a single place to see how they compare, in the first attempt of its kind. However, this should be an ongoing effort periodically since such an approach will permit us to compare public service delivery changes, if any, across and within cities over time.

When the capital expenditures on water supply by cities are examined, it is found that Mumbai had the highest per capita expenditure at ₹ 1,094.21 per capita, closely followed by Delhi at ₹ 977.77 per capita. Chennai spent ₹ 304 per capita and Kolkata spent the least at ₹ 128.63 per capita, which is surprising considering its low coverage of the city with water supply networks. Per capita capital expenditure on sewerage was highest in Mumbai at ₹ 295.54 and lowest in Kolkata at ₹ 97.29.

Coming to solid waste collection, Chennai has a 100 % coverage with door-to-door collection (according to data given to us by the CMWSSB) and Kolkata has 61 % of its households covered by door-to-door waste collection. Solid waste collection efficiency is the highest in Chennai, with 97 % of garbage generated being collected, followed by Kolkata and Delhi at 94 %. However, these data do not cer-

[13] Mumbai human development report 2009, "Access to water supply," Page 71.

tainly imply that Chennai is the cleanest of all the cities! It is just an artifact of the data that the data on solid waste collection and generation were the same (see also Paul et al. 2012). We did not get this data from the MCGM. The fact sheets for the four cities indicate that the amount of garbage generated by Kolkata, Chennai, and Delhi are all higher than the 500 g that is the average nationally. Kolkata generated the highest amount of garbage at 940 g per capita daily and Mumbai the least at 470 g per capita daily. Methods of solid waste disposal in our cities are quite antiquated, with Mumbai and Kolkata dumping or burning in the open 100% of its garbage and Chennai and Delhi disposing 100 and 95%, respectively, of their waste in sanitary landfills. According to a study by Da Zhu et al. (2008) of the World Bank, the composition of Indian waste is such that close to 55% is organic and can be converted into compost and another 15% is recyclable.[14]

Given this state of waste generation, the state of capital spending on this service is abysmal in the cities of study—Chennai spent an average of only ₹ 6 per capita, Kolkata spent about ₹ 16 per capita, and Mumbai spent ₹ 64 per capita over the years 2007–2008 and 2009–2010. Overall, Chennai has performed the best in the percentage of city covered by water supply, sewerage, and solid waste collection even with its capital spending being among the lowest in the four cities on all three. Perhaps Chennai should increase its expenditures on updating its solid waste management to adopt more scientific ways of solid waste disposal methods. As Kaushal (2012) points out, modern waste-to-energy plants in other countries have been providing sustainable means of waste management, with minimum side effects on the environment.[15] She quotes the example of Southeastern Massachusetts Resource Recovery Facility (SEMASS), a waste-to-energy facility in Massachusetts, in the USA, which uses 1 million tonnes of municipal solid waste to generate 600 million kilowatt-hours of electricity every year and recycles 40,000 t of metals. The annual toxic emission is less than half a gram annually. This seems like a win–win situation for everyone, which Indian cities should more proactively adopt.

## Electricity

Table 5.3 summarizes the electricity providers in the cities of study. In the case of Delhi and Mumbai, three different electricity providers supply electricity to different parts of the cities. The data from each of the three providers in both cities have been considered in this study to get a full picture of the quality of service. With regard to electricity, the proportion of household connections with respect to other

[14] Zhu, Da., P.U.Asnani, Chris Zurbrug, Sebastian Anapolsky, Shyamala Mani (2008) Improving solid waste management in India: Source book for policy makers and practitioners, World Bank Institute, Washington, DC.

[15] Kaushal, Neeraj (2012) Growth vs garbage: Can we have efficient disposal mechanism? The Economic Times, April 26.

**Table 5.3** Cities and their electricity distribution companies

| City | Electricity supply company/companies | Average urban T&D losses by electricity supply company (%) |
|---|---|---|
| Delhi | BSES Yamuna Power Limited (BYPL) | 27.44 |
| | BSES Rajdhani Power Limited (BRPL) | 23.85 |
| | North Delhi Power Limited (NDPL) | 18.59 |
| Mumbai | Brihanmumbai Electric Supply and Transport (BEST) | 9.67 |
| | Reliance Energy Limited (REL) | 15.13 |
| | Tata Power | 0.68 |
| Kolkata | Calcutta Electric Supply Corporation (CESC) | 13.3 |

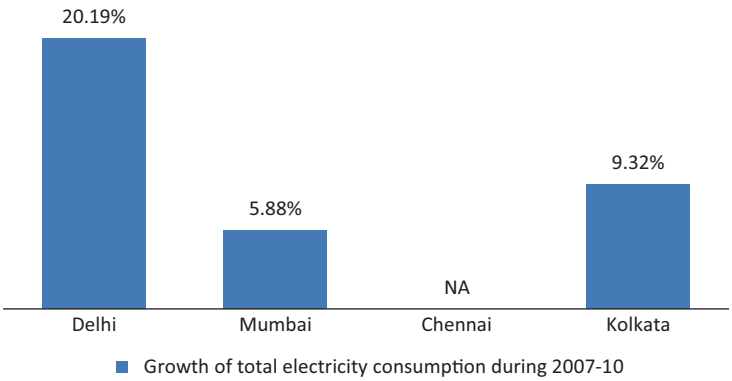


**Fig. 5.20** Comparison of rate of growth of total electricity consumption during 2007–2010

connections, growth of electricity consumption (Fig. 5.20), and transmission and distribution (T&D) losses are examined (Fig. 5.21).

The city with the maximum proportion of household connections, taking a 3-year average from 2007–2008 to 2009–2010, is Kolkata with about 84 % (a percentage of total connections), followed closely by Mumbai (83 %) and Delhi (80 %). We do not have data on the number of connections in Chennai from Tamil Nadu Electricity Board (TNEB).

Figure 5.20 shows that Delhi had the highest growth (about 20 %) in total electricity consumption during the years 2007–2010, followed by Mumbai and Kolkata. We do not have data on consumption for Chennai for this time period. When growth of electricity consumption in Delhi is disaggregated, it is found that household consumption rates grew the fastest in the 3-year period (nearly 28 %), followed by the growth in commercial consumption of electricity (nearly 14 %).

When total electricity consumption is compared, Chennai is the largest consumer of electricity at nearly 1,850 kWh per capita (in 2005–2006), followed by Kolkata at 1,610, Mumbai at 1,198 kWh per capita, and Delhi at 992 (data on consumption for Mumbai, Kolkata, and Delhi are a 3-year average (2007–2008 to 2009–2010 based

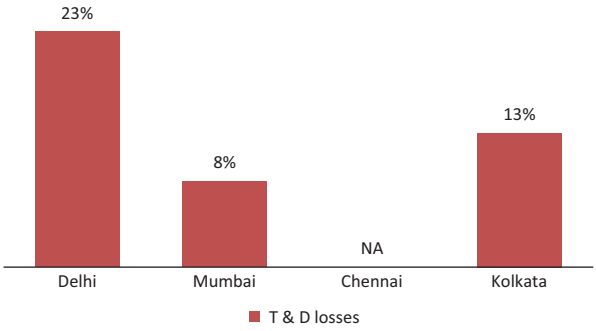


**Fig. 5.21** Transmission and distribution losses by city (average of 2007–08 to 2009–10)

on annual consumption). The average per capita consumption of electricity in India is estimated to be 704 kWh during 2008–2009.[16]

The extent of T&D losses is the highest in Delhi at 23 %, followed by Chennai at 18 %. Mumbai is the most efficient at only 8 % T&D losses, followed by Kolkata at 13 %. This implies that the three providers of Mumbai are relatively more efficient when compared with those in other cities. Table 5.3 in addition to summarizing the electricity providers in the cities of study, also shows the T&D losses by provider. Tata Power is the most efficient, with only 0.68 % losses (3-year average, 2007–2008 to 2009–2010), followed by BEST, another provider in Mumbai. Both providers also reported zero scheduled power shutdowns during the 3 years which means that the parts of Mumbai which are supplied electricity by these two companies enjoyed uninterrupted power supply. NDPL (North Delhi Power Limited), which is one of the electricity providers in Delhi, is a joint venture between Tata Power Company and the Government of NCT of Delhi with the majority stake being held by Tata Power. NDPL is more efficient compared to the other two providers but still has a long way to go to achieve the efficiency of Tata Power (Fig. 5.21).

## Urban Poverty

There are several measures of urban poverty which are chosen—slums and access to services such as public toilets in slums.

When the number of slums in the city per 100 $km^2$ is calculated, it is found that Kolkata had the highest density of slums at 668 slums per 100 $km^2$ in 2009–2010 followed by Chennai at 464. Delhi is the largest city among those studied here in terms of land area and has the least density of slums among the three cities at 56 slums per 100 $km^2$ even though in absolute terms it has more number of slums than Chennai. In 2001, Mumbai had 448 slums per 100 $km^2$; unfortunately, we do not have data on the number of slums for later years for the city, but according to data given to us by the MCGM a staggering 41% of Mumbai's households, as per Census 2011, are slum households.

[16] http://www.kpmg.de/docs/PowerSector_2010.pdf.

According to the 2011 Census, a major reason for the fall in decadal growth rate in Delhi is the wide-ranging removal of slum (*jhuggi jhonpri* in Hindi) clusters from various parts of the city since 2001. Major clusters were removed in the mid-2000s along the Yamuna riverbed and from several districts of Delhi. Many more have been removed during the run up to the Commonwealth Games in 2010. The removal of slum clusters existing within the NDMC area has caused a 25% fall in population in New Delhi district (a district in the center of Delhi) vis-à-vis 2001.[17]

As far as public toilets in slums are concerned, Mumbai had five toilets per slum in 2001. Delhi had only one toilet per slum, and Chennai and Kolkata did not even have one toilet per slum in 2009–2010. Given the reality that many households in slums depend on public toilets, the inadequacy of such a basic service is startling. Even the existing toilets may not be built at a convenient distance from existing settlements of the poor. According to research by Transparent Chennai, which studied public toilets in a zone in North Chennai with a considerable population of slum dwellers, more than half the toilets were barely used by residents, including women and children, because they were not located in areas of greatest need or were in a state of disrepair.[18]

## Public Security and Safety

Several measures of public safety and security are chosen—cognizable cases (registered under the Indian Penal Code), persons killed and/or injured in road accidents, and the number of policemen and traffic policemen in the cities.

Cognizable cases registered under the Indian Penal Code include murders, dacoity/theft, kidnapping, attempt to murder, fake note, molestation, forgery, mob, assault, cheating, and deceit. Delhi had the maximum number of such cognizable cases per lakh population (322 per year, average over 2007–2010), followed by Kolkata at 305 cases per lakh population. In absolute numbers, Delhi had the highest at 51,889, much higher than Mumbai, which came second with 31,810 cases. Figure 5.22 also compares the number of policemen per lakh population. Kolkata has the maximum number of policemen per lakh population at 628.

When data on the number of persons killed and injured in the accidents are compared, Chennai has the maximum number of accidents at 112 per lakh population, double the number of accidents per lakh capita in Kolkata (56 per lakh population). Chennai also has the maximum number of vehicles per capita and the highest proportion of traffic police. The Chennai metro project scheduled to be completed by 2014–2015 will take some stress off the roads of Chennai. Mumbai has relatively safer roads and has 35 accidents per lakh population (Fig. 5.23).

[17] "Events influencing major demographic changes 2001–2011", Census 2011.

[18] http://www.thehindu.com/opinion/op-ed/article3357356.ece.

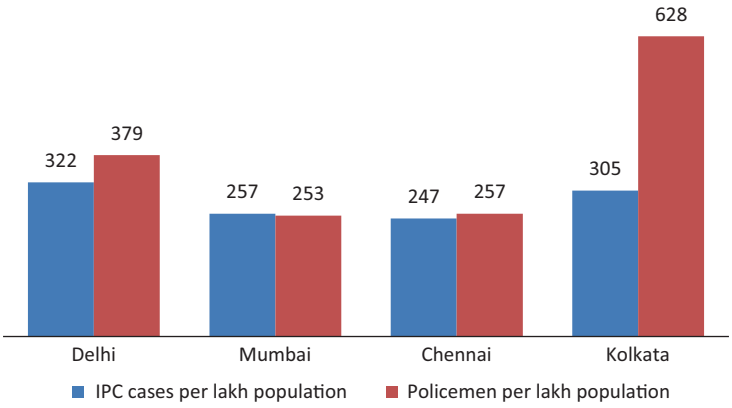


**Fig. 5.22** Security and public safety—comparison of IPC cases and policemen per lakh population (3-year average, 2007–08 to 2009–10)

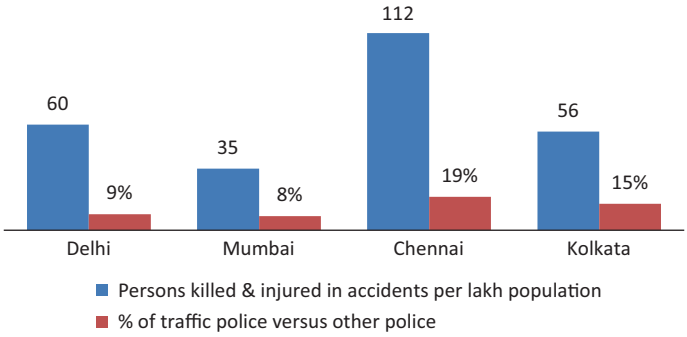


**Fig. 5.23** Persons killed and injured in accidents per lakh population and proportion of traffic police versus other police (3-year average, 2007–08 to 2009–10)

## Quality of Life

Indicators capturing air and water quality and recreational facilities (parks and playgrounds) are compared to capture the quality of life across the four cities.

Air quality is measured by RSPM (respirate suspended particulate matter), for which standards are set by the Central Pollution Control Board. The actual RSPM in the city is compared with the standard set by the board (using the annual average standard[19]). The percentage increases in the extent to which the actual levels are above the acceptable levels are reported. Figure 5.24 summarizes the extent of violation of the RSPM standards. The lower the extent of violation, the better is the

[19] National Ambient Air Quality Standards (NAAQS), 2009: http://cpcb.nic.in/upload/Latest/Latest_49_MoEF_Notification.pdf.

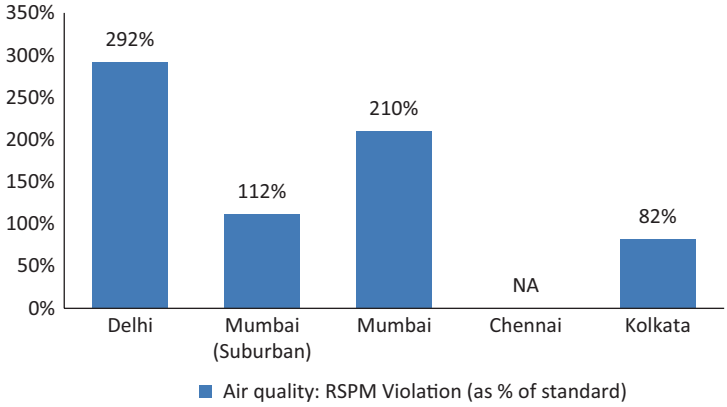


**Fig. 5.24** Comparison of air quality across cities

air quality in any given city. Delhi is the highest nonconforming city to acceptable standards of the RSPM, closely followed by Mumbai.

Delhi, Mumbai, and Kolkata have information on RSPM levels available on the websites of their respective pollution control boards but this is not true in the case of Chennai.

Coming to water quality, we have information on turbidity of water only for Chennai and Kolkata. Chennai had a higher turbidity (4.1) compared to Kolkata (1.15), on a scale of 1–9 NTU (Nephelometric turbidity units) and both are within acceptable limits.

Next, amenities such as parks and playgrounds are compared. Unfortunately, we got these data only from the MCGM and Chennai Corporation and we did not have data on the area of parks in cities. Chennai has 5.5 parks and 2.4 playgrounds per lakh population; Mumbai which is less dense than Chennai in terms of population has only 1.7 parks and 1.1 playgrounds per lakh population.

## Conclusions

While we find the population growth rates of all the four metropolitan areas to have fallen during 2001–2011, Kolkata and Chennai are comparatively smaller in size than Mumbai and Delhi with their municipal corporations serving about 4.5 million people each.

Mumbai's economic preeminence is reflected in several indicators presented in this chapter. Per capita credit disbursed by banks in Mumbai, an indicator of the magnitude of economic activity, is almost twice as high as the second city on the list, Chennai. Its municipal corporation leads in total revenue receipts (₹ 5,385 per capita) and capital expenditure, including that for water supply (₹ 3,433). When it

comes to quality of services, however, the higher per capita expenditure by Mumbai does not translate to any significant improvement in its quality of service.

Chennai's civic agencies have performed the best when it comes to providing its citizens basic service delivery in terms of coverage of the city's households with water supply, sewerage, and solid waste management. However, Chennai still needs to improve in providing better sanitation for its urban poor. All cities need to gather better data on their public services periodically, especially on solid waste management, since our observations are conditional upon the data supplied.

As Paul et al. (2012) point out, everything said and done, this study will, to the beginner and the profound, look like a bunch of data put together without detailed analyses, analytical frameworks, or comparison with any nationally or internationally accepted norms and/or benchmarks. However, this work, similar to what Paul et al. (2012) perform for Karnataka, is a pioneering attempt at putting together tremendous amount of data at the city level for the four major metropolitan cities of India. This has enabled comparisons among these cities and with benchmarks/norms. This should encourage sharing of best practices, ensure competition among cities for residents and firms, facilitate better policymaking, and promote further research. Again, we emphasize that this effort is not meant to be one time, but has to continue on an ongoing basis, periodically, to track city-level performance.

Across all cities, we found that data on several indicators of urban poverty, education, and health were either unavailable or not reliable.

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Any errors remain ours.

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# Chapter 6
# Central and State Urban Infrastructure Programs in Karnataka: What Do We Learn?

**Kala Seetharam Sridhar and A. Venugopala Reddy**

## Introduction, Objectives, and Methodology

The world population is expected to become two-third urban by 2025. While the urbanization phenomenon is widely accepted as being an inevitable by-product of development, there are many undesirable outcomes that have resulted from urbanization. With rapid increases in urban population and demand for urban infrastructure services, the capacities (both human and financial resources) of local governments in many countries are overburdened. While the Jawaharlal Nehru National Urban Renewal Mission for the 63 largest and important cities was initiated by the Government of India in 2005, there is a move away from the largest cities towards the smaller and medium towns (see evidence from the saturated growth of population in the largest metropolitan areas of the country in this volume by Sridhar and Kashyap; also see Sridhar (2004), which quotes evidence of business process outsourcing (BPO) firms in India classifying various cities in the country (including mid-tier and smaller cities) based on how much training of labor force is needed in every city category). Some urban infrastructure and poverty alleviation programs such as the Urban Infrastructure Scheme for Small and Medium Towns (UIDSSMT) exist for the smaller and medium towns in India. In the south Indian state of Karnataka there is the flagship program for urban areas of the state, called the Mukhyamantrigala Nagarothana Yojana consisting of two components—the special 100 crore program for the seven city corporations in the state and the Chief Minister's Small and Medium Towns Development Program (CMSMTDP). However, little is known about the functioning and effectiveness of these programs. Hence, there is a need to evaluate the performance of urban development programs in terms of their cost effectiveness and timely completion in the smaller and medium towns of India.

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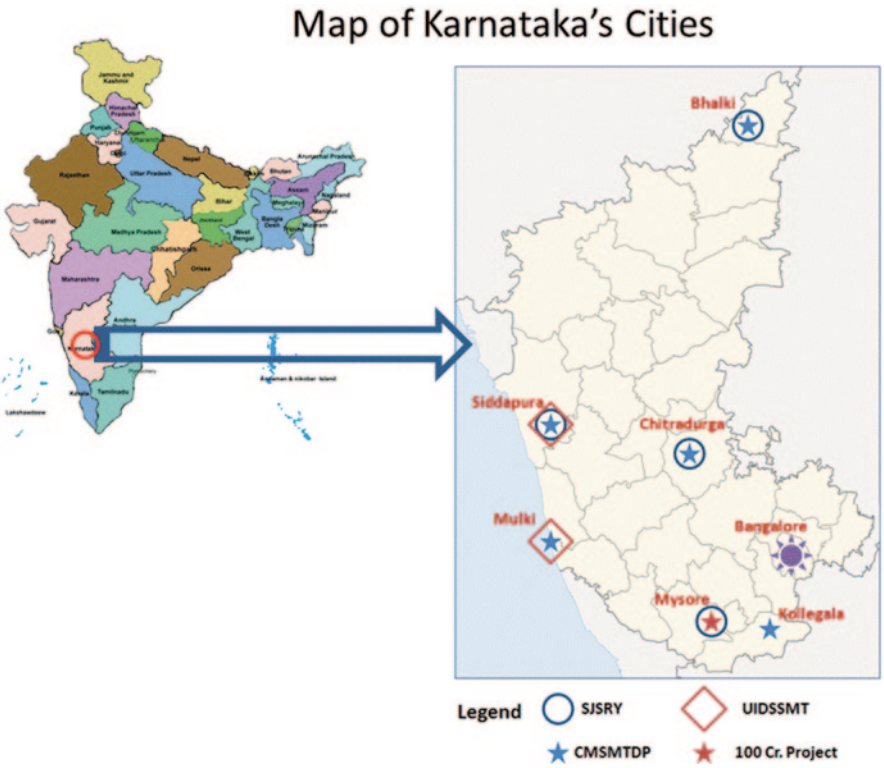
We studied the above programs and their components in the south Indian state of Karnataka taking the cases of Mysore city corporation (for the special ₹ 100-crore package program), the cases of Bhalki (northern part of the state), Kollegal (southern part of the state), Chitradurga (eastern part of the state), Siddapura (western part of the state), and Mulki (western part of the state) for the Chief Minister's Small and Medium Town Development Program (CMSMTDP) and UIDSSMT (in the case of Mulki and Siddapura). The sample of cities/towns we have chosen is representative of all geographic regions of the state. A map of India and that of Karnataka shows the selected cities/towns in the state.




In this chapter, we study two urban infrastructure programs, i.e., UIDSSMT, which is a centrally (Government of India) sponsored program to boost infrastructure in small and medium towns of the country, and a state-sponsored (Government of Karnataka, GoK) program, the Mukhyamanthrigala Nagarothana Yojane (MNY).

## *Objectives*

The objectives of this chapter are as follows:

1. Conduct expenditure analysis of the above-mentioned programs. It covers the following aspects:

a. Budget analysis of various heads of expenditure, including an analysis of the process of determining unit cost of various activities under a project.
b. Utilization of expenditure—we examine outputs to study if there are output measures of schemes chosen and if yes, whether they are adequate, whether systems for effective monitoring of outcomes are in place.
c. We study what norms, if any, are used in allocating and monitoring expenditure.

2. We map the processes that can be used to make the expenditures efficient and cost effective and suggest measures to fill the gaps in this regard.

a. We study the processes and/or mechanisms for implementing the programs under the selected schemes.
b. We study the mechanisms for monitoring the way implementation of programs occurs in the field.

## *Methodology*

We studied a sample of projects taken up under each of these schemes in a sample of cities. We chose completed projects for each of the programs which have been completed or were nearing completion to examine the issues mentioned above. We studied the above programs and their components taking the cases of Mysore city corporation (for the special ₹ 100-crore package program), the cases of Bhalki (northern part of the state), Kollegal (southern part of the state), Chitradurga (eastern part of the state), Siddapura (western part of the state), and Mulki (western part of the state) for the CMSMTDP and UIDSSMT (in the case of Mulki and Siddapura). The sample of cities/towns we have chosen is representative of all geographic regions of the state of Karnataka. Within each of the programs, we reviewed the full list of ongoing and completed projects we obtained from the Directorate of Municipal Administration (DMA) and the Urban Local Body (ULB), and chose a sample of completed works based on their sector (roads, drains, subway, grave yard, street lights, or solid waste management), and monetary value of the estimated cost of the works.

We visited each of the above cities/towns to evaluate the programs. First, we visited various departments and officials in the DMA (for the MNY) and Karnataka Urban Water Supply and Drainage Board (KUWSDB) (for the UIDSSMT) to understand the process of fund flows for each of the programs so that it gave us some idea of the offices in the cities with whom we needed to meet. We developed detailed questionnaires for each of the programs to enable us to assess various aspects of the terms of reference for the study and sent them to the respective cities/towns before our visit to each of the cities/towns.[1] In addition to the city officials who were our primary liaison and helped us to obtain the information, we also talked to stakeholders (the public) who were directly impacted by the program, randomly. Further, we had a chance to talk to the contractors who implemented the works.

[1] These questionnaires are available upon request.

## Literature Review

India's high-powered expert committee on urban infrastructure recently estimated that ₹ 30,981 billion (at 2009–2010 prices) of capital expenditure over a 20-year period, i.e., 2012–2031, would be needed to bridge gaps in urban infrastructure. Without roping in the private sector, there is no way to bridge such telling gaps. When projects are efficiently implemented, the capital requirements to complete them are also less when compared to one in which cost and time overruns occur. Cost and time overruns decrease the efficiency of projects and increase the cost of implementation. Given this, how can we reduce cost and time overruns in projects? Despite the importance of this question, there are few estimates of cost and time overruns in infrastructure projects. Even rarer are the studies based on completed projects in the Indian context save one by Singh (2009) and a preliberalization one by Morris (1990).

The study by Singh (2009) investigates the various issues related to delays and cost overruns in publically funded infrastructure projects. The following questions are posed and answered: How common and how large are the time and the cost overruns? What are the essential causes behind these delays and cost overruns? Are the underlying causes statistically significant? Are contractual and institutional failures among the significant causes? What are the policy implications for planning, development, and implementation of infrastructure projects? That study is based on, by far, the largest data set of 894 projects from 17 infrastructure sectors. Among other results, it showed that the contractual and the institutional failures are economically and statistically significant causes behind cost and time overruns.

The preliberalization study by Morris (1990) arrives at rough estimates of the delays and cost overruns, and the opportunity cost in terms of the extra "capital X time" that is used up. The study finds that cost overruns (at 80 %) and the extra "capital X time" incurred (about 190 %) are very large, even after removing the increase due to inflation. The reasons for the same are also identified and rated. Factors internal to the public sector system and government largely account for the delays and cost overruns: poor project design and implementation, inadequate funding of projects, bureaucratic indecision, and the lack of coordination between enterprises.

This chapter adds value and depth to this literature by studying the institutional processes of program implementation and computes cost and time overruns in infrastructure programs, taking the case of different levels of government. It also makes a number of policy recommendations based on its findings. What we found is interesting and has implications for the cost-effectiveness and timeliness of infrastructure projects in India.

## *Overview of Chapter*

This chapter is organized as follows: first, we describe the program which is state (i.e., Government of Karnataka) sponsored and state centric in its focus, the MNY (Section 3), followed by a study of the centrally (Government of India) sponsored

UIDSSMT (Section 4). Then we compare the two programs across various parameters (Section 5). Our summary of findings and related policy recommendations for the respective programs is covered in each of the sections at the end.

## The Case of Mukhyamantrigala Nagarothana Yojana (MNY)

In Karnataka, apart from Bangalore, there are seven city corporations, 44 city municipal councils, 68 town municipal councils, and 94 town panchayats. The rapid pace of urbanization in Karnataka has left a huge "infrastructural deficit" in all the cities/towns. To address these gaps, focus upon the all-round development of cities/towns, create and expand municipal services, and for the benefit of the smaller towns and cities in the state, the government of Karnataka started the MNY in its budget for 2008–2009 (continued in 2009–2010 and 2010–2011). It was decided to provide ₹ 600 crores under this scheme for specific development programs such as drinking water, sewerage system, and road development. Thus, while the UIDSSMT is centrally sponsored (with state share), but is state centric in its focus, the MNY is state sponsored and state centric in its focus. Although the MNY was announced in 2008–2009, it is a combination of several existing special schemes which had been in existence for some time, which entail construction of roads, bridges, and tourism complexes within city limits. The MNY has two components: one is the special ₹ 100-crore package program for the seven city corporations in the state (apart from Bangalore) and the other one is the CMSMTDP. Thus far, about 1,370 works have been undertaken under the ₹ 100-crore program for each of the seven City Corporations. Under the CMSMTDP, as of January 2011, 21 district headquarter ULBs (City Municipal Councils—CMCs) got ₹ 15 crores each, 148 taluk headquarter ULBs got ₹ 5 crores each and the remaining ULBs (42 in number) managed to get ₹ 2 crores each. As of end-January 2011, a total allocation of ₹ 1,454 crores had been made for this program, with 8,087 works approved, out of which 2,645 works covering road and drainage, water supply, welfare of minorities such as the scheduled castes and scheduled tribes (SC & STs), and improving infrastructure facilities in slum areas being completed as part of the CMSMTDP. Both these components of the MNY are evaluated in this section.

### *Progress in the Special ₹ 100-Crore Program*

Table 6.1 summarizes the progress under this program for all the municipal corporations in the state.

The utilization of funds under this program in some cities such as Bellary is greater than 100% indicating that they were able to leverage their own funds with those received under the special ₹ 100-crore program. Apart from Bellary, the utilization of funds is in the range of 75% (Belgaum) to 95% (Davanagere). This utilization is especially encouraging because it shows that the funds were much needed for projects which were likely neglected in the cities earlier.

**Table 6.1** Summary of financial progress, special ₹ 100-crore program, all city corporations, February 2011. (Source: Karnataka Directorate of Municipal Administration)

| Number | Municipal corporation | Released funds (in lakhs of ₹) | Utilized funds (in lakhs of ₹) | % Utilization | % of works completed |
|---|---|---|---|---|---|
| 1 | Davanagere | 9,100 | 8,600 | 94.5 | 91 |
| 2 | Bellary | 9,000 | 9,032.61 | 100.3 | 82 |
| 3 | Mangalore | 8,600 | 7,575.62 | 88.1 | 65 |
| 4 | Hubli–Dharwad | 8,800 | 7,474.6 | 84.93 | 69 |
| 5 | Gulbarga | 7,100 | 6,100 | 85.9 | 52 |
| 6 | Mysore | 7,100 | 5,776.28 | 81.35 | 88 |
| 7 | Belgaum | 5,500 | 4,102.46 | 74.5 | 47 |
| | *Total* | *55,200* | *48,661.57* | *88.15* | *73* |

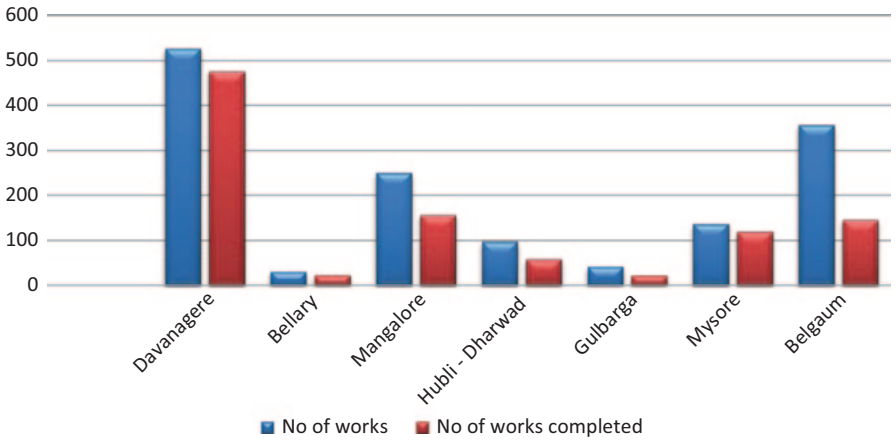



**Fig. 6.1** Number of works approved and completed, special ₹ 100-crore program, all city corporations, Karnataka, February 2011

As of February 2011, while the highest number of works approved was in Davanagere, the city corporations in which a majority of the works had been completed are Bellary, Gulbarga, and Mysore (see Fig. 6.1). In Belgaum, we note a steep deviation in the number of works approved and those that were completed. We are unable to explain this since we did not study that city for this program.

Figures 6.2 and 6.3, respectively, show the sectoral allocation of funds deployed as part of the special ₹ 100-crore program in the state (seven city corporations) and in Mysore, the city that was chosen for study of the program due to its proximity to Bangalore. As is evident, the bulk (69%) of the spending at the state level (taking into account the seven city corporations) in this program is on roads and drains, followed by others (consisting of street lights, aquarium, traffic signals, and Kala Bhavan). Mysore also follows this allocation of sectoral spending quite closely, spending the largest proportion (56%) of its funds on roads and drains, but spending a little more on others (18%) and gardens (12%).

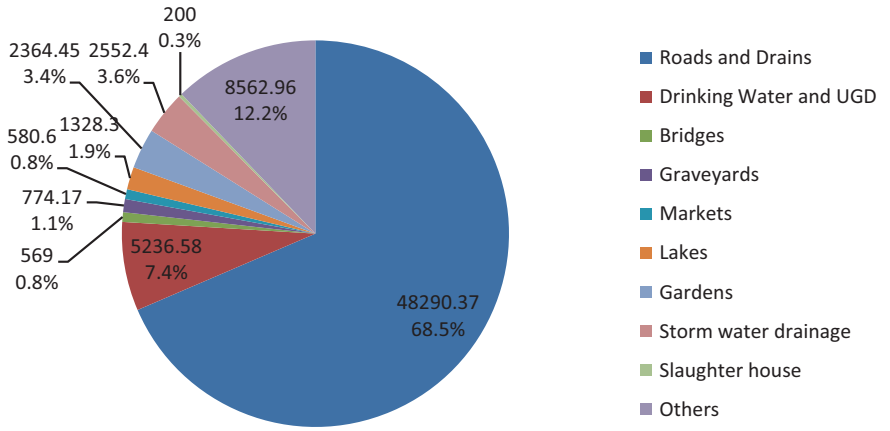



**Fig. 6.2** All city corporations, Karnataka, sectoral spending, ₹ 100-crore program, February 2011

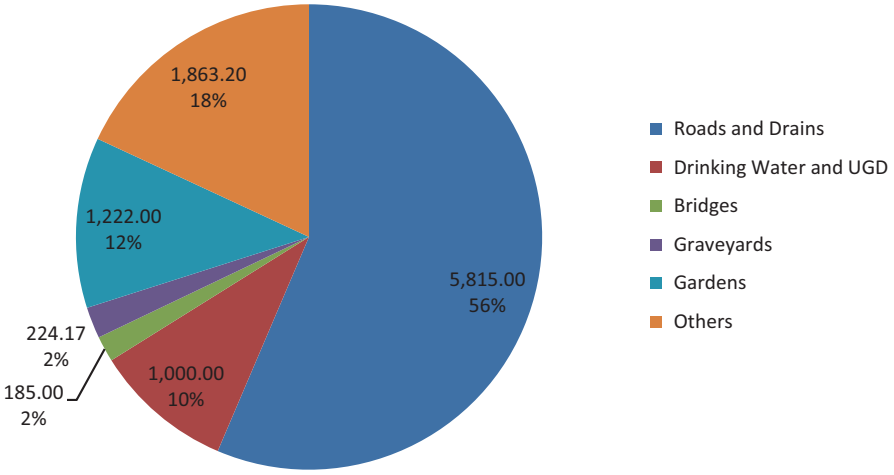



**Fig. 6.3** Mysore, sectoral spending, ₹ 100-crore program, February 2011

We observed in the case of the Mysore special ₹ 100-crore program that the estimated costs for non-road projects (which include a combined road and drain work and a pedestrian subway) are much higher than they are for road projects (Table 6.2).

We make this comparison understanding that costs and technical specifications across sectors vary widely. We observed that the tender amounts for all works (irrespective of the sector) are higher than the estimated cost from the action plan. On average, while the estimated cost from the action plan for the selected works is only ₹ 48.75 lakhs, the approved tender cost is ₹ 51.55 lakhs (Table 6.2), accounting for a 5 % cost overrun. The maximum cost overrun was 9 % and at the minimum the cost

**Table 6.2** Summary of selected works, Mysore, special ₹ 100-crore program

| Sector | Name of work | Estimated cost from action plan (in lakhs ₹) | Tender cost (in lakhs ₹) | % Cost overruns |
|---|---|---|---|---|
| Roads and drains | Constructing a drain and providing asphalting to Seetharama Rao Road in Ward No. 3 | 10 | 10.4 | 4 |
| Roads | Improvement of Road Arunodaya ITI College, right side cross road from 11th to 13th cross at Jantha Nagar Ward No. 24 | 10 | 10.27 | 2.7 |
| Walkways | Construction of a pedestrian subway at Sayyaji Rao Road—near BATA | 100 | 103.9 | 3.9 |
| Roads | Improvements to Pulikeshi Main Road in Mysore City | 75 | 81.64 | 8.85 |
| Average, road projects | | 42.5 | 45.96 | 5.78 |
| Average, nonroad projects | | 55 | 57.15 | 3.95 |
| Average, all projects | | 48.75 | 51.55 | 4.86 |

overrun was 2.7% (again another road project). We discuss later how Mysore compares with other cities in the special ₹ 100-crore program regarding cost overruns.

Based on our discussions with the Mysore city corporation officials, we found that whenever works required excavation (just as in the case of a pedestrian subway), land acquisition, or felling of trees, there was uncertainty regarding the time frame and the budget.

Overall, on average, for both the road projects in Mysore completed under the special ₹ 100-crore program, we found that the total time taken from submitting the "action plan" to the tender agreement was 75 days (or 2.5 months). Interestingly, the work with the maximum cost overrun was the one with the minimum time delay and was completed (1.5 months) ahead of schedule.

The city makes the payment to the contractor only after a third party inspection that certifies satisfactory completion of the work.[2] We did look at all the third party inspection reports which provide a detailed technical assessment (with engineering specifications).

We recommend that intermediate reports (including instances when the third party finds fault with the works completed, see footnote 3) be made part of the documentation for every work so that the contractors' quality of work can be tracked. Further, the current completion reports are comprehensive in the sense that they refer to the technical quality of all materials used. We recommend that the summary of an overall assessment be provided by the third party independent consultant.

[2] We found that all third party inspection reports certify satisfactory completion of the work for the various components (iron, steel, cement, jelly, and so forth). This sounded too good to be true to us. Hence, when we probed further into this, we found that there are certain intermediate steps in which when the third party finds some fault with the work or the quality of material used, they convey that informally to the city and the contractor who then rectifies the work and a final satisfactory completion report is issued.

Such an overall assessment should consist of norms, specifications, standards, and their compliance. The assessment should ideally also mention whether the outputs were delivered on time within the cost agreed upon, the reasons for delays, if any, and any action taken against undue delays, if applicable. We did not find such an overall assessment or summary check as a completion report for any project/work which we selected.

Further, we recommend that there should be a penalty to the contractor for not completing works on time.

## *Progress of the CMSMTDP in All Towns of Karnataka*

Table 6.3 summarizes the allocation of funds to towns of various sizes in the state, under the CMSMTDP.

Figure 6.4 shows that a majority (44%) of funds in the CMSMTDP, is spent on roads and drains, followed by "others" similar to what we find in the special ₹ 100-crore program.

In addition, we also obtained from the DMA data which enabled us to examine sectoral allocation of funds in the selected cities of our study. Figures 6.5, 6.6, 6.7, 6.8, and 6.9 summarize the sectoral allocation of funds in the five selected cities—Kollegal, Siddapura, Mulki, Bhalki, and Chitradurga in Karnataka.

**Table 6.3** Allocation of funds to towns in CMSMTDP

| | Numbers | Amount per town (in ₹ crores) | Total amount (in ₹ crores) |
|---|---|---|---|
| District head quarters having CMCs | 20 | 30 | 600 |
| ULBs in taluka headquarters/nondistrict headquarter CMCs | 143 | 5 | 715 |
| ULBs in small towns | 48 | 2 | 96 |
| *Total* | 211 | – | 1,411 |

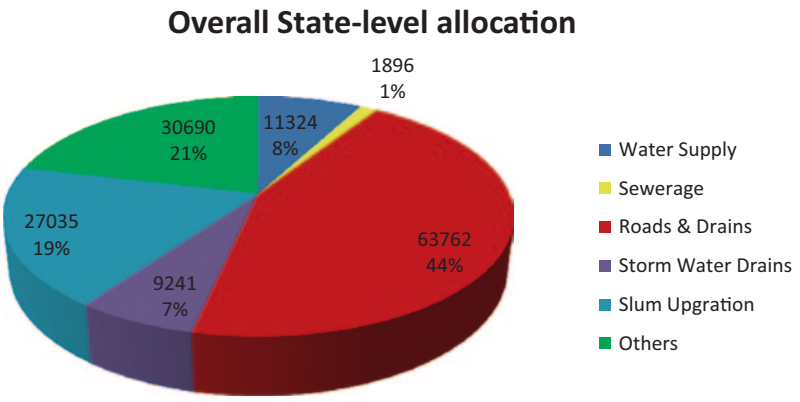



**Fig. 6.4** Sectoral allocation of funds under the CMSMTDP, all towns in the state

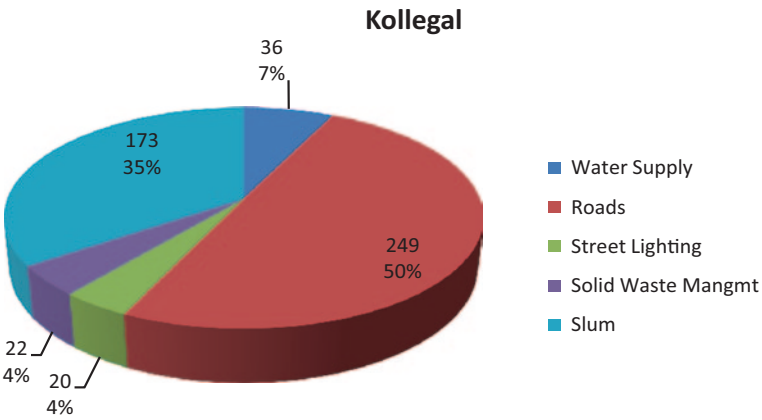



**Fig. 6.5** Sectoral allocation of funds under the CMSMTDP, Kollegal

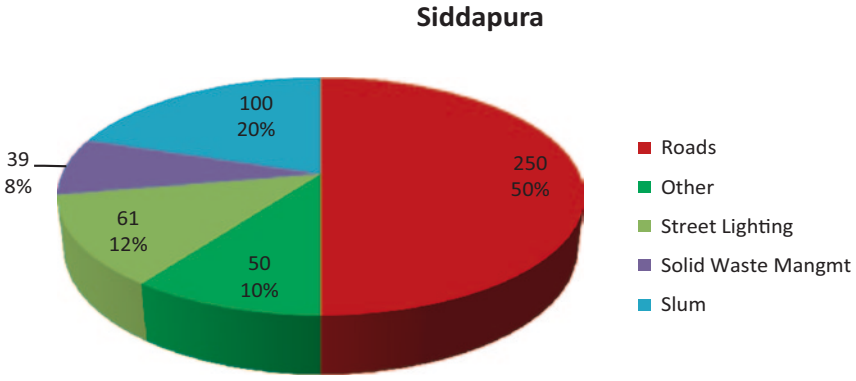



**Fig. 6.6** Sectoral allocation of funds under the CMSMTDP, Siddapura

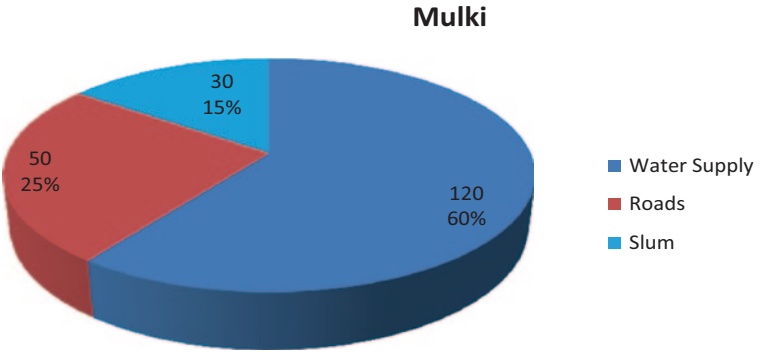



**Fig. 6.7** Sectoral allocation of funds under the CMSMTDP, Mulki

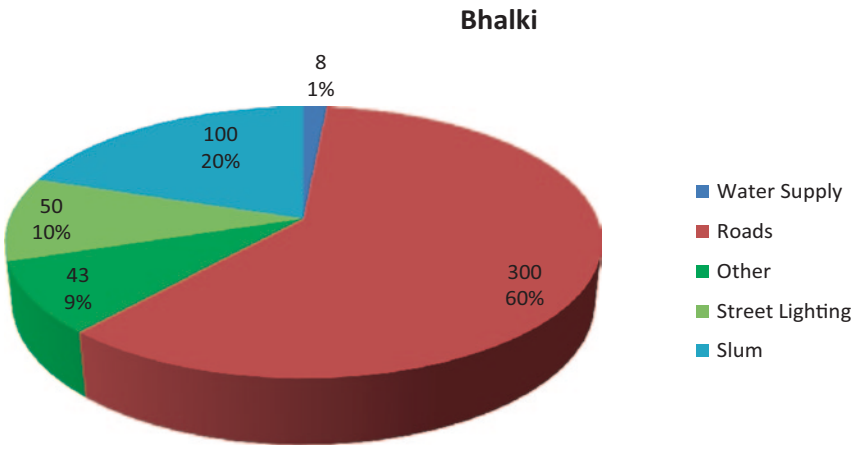



**Fig. 6.8** Sectoral allocation of funds under the CMSMTDP, Bhalki

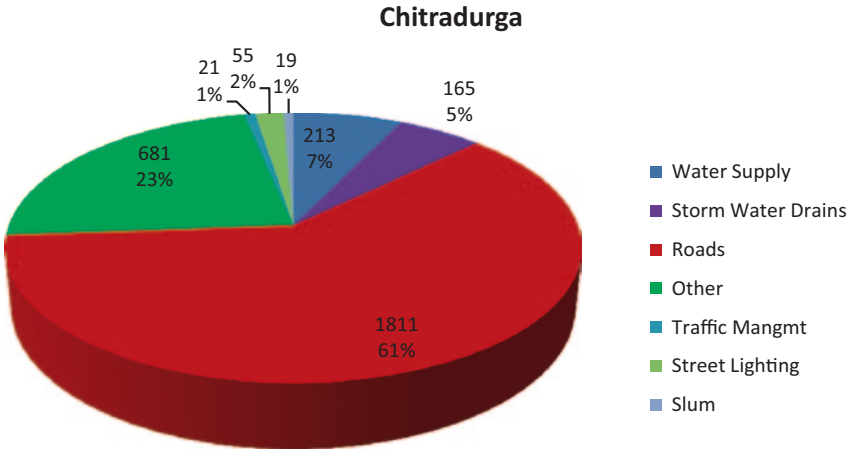



**Fig. 6.9** Sectoral allocation of funds under the CMSMTDP, Chitradurga

Figures 6.5, 6.6, 6.7, 6.8, and 6.9 show that in nearly all our selected cities (with the exception of Mulki)—Kollegal, Siddapura, Bhalki, and Chitradurga—50% or more of the CMSMTDP funds were spent on roads, with the other major proportions going towards water supply or slum development. Mulki was an exception in that a majority of CMSMTDP funds there were used for water supply, followed by that on roads and slum development, similar to the other cities. This shows that the need of the hour in most cities is to improve roads and mobility.

## *Cost and Time Overruns in MNY*

We had enough information to determine the extent of cost overruns in the various projects/works which we selected. The cost overrun was calculated as the difference between the estimated cost in the action plan and the approved tender cost.[3] We computed cost and time overruns in the case of four selected works (or projects) under the special ₹ 100-crore program. All the works had cost overruns with the maximum cost overrun (of 8.9%) being in a project of size of ₹ 81 lakhs (the road project discussed above). The least cost overrun (of 2.7%) was in a project of ₹ 10 lakhs value (again a road project). The average cost overrun over all projects was 5%. There was no difference between the cost overrun of a combined road and drain project (which was 4%) and a walkway (3.9%).

We examined time overruns by studying the difference between the due date for completion of work and the actual date of work completion based on the tender agreement. Of the four works we selected, one (the pedestrian walkway project 3, Table 6.2) was completed on time and one was completed ahead of time (a road project—project 4, see Table 6.2). The project with the maximum time overrun was a road work which was supposed to be completed in April but which was completed only in August 2009. The delay was due to pipeline work which was in progress and had to be resumed and completed after the completion of the pipeline work. Interestingly, we found the delay (by a month) in the other project (the first project in Table 6.2, which is a combined road and drain project) was also due to shifting of a pipeline. This is consistent with evidence presented by Singh (2010)[4] who examines causes of time and cost overruns in 894 infrastructure projects in 17 different sectors (most of which were publicly funded and managed projects, with only a few road projects being public–private partnerships, PPPs) in the country and finds that road projects were most likely delayed due to problems with land/property acquisition, shifting of power lines, water lines, sewer lines, and approval of underpasses.

[3] Generally, cost overrun is worked out with reference to project cost (as per the detailed project report (DPR) or the final bid price) and the actual cost. Cost overrun normally follows time overrun and consequent escalation in costs due to delays in implementation. There could also be cost overruns due to revision of the schedule of rates (SRs). In the case of the UIDSSMT in the following section, we also observed cost overruns due to the lack of adherence to mandatory reforms, which does not apply in this case. Further, in a study of this nature, when the ToR (terms of reference) is given, it is assumed that they can be addressed subject to the availability of certain data. Until we got to the field, we did not know that many projects had not attained financial closure and contractors were not paid their final installments, with the result that we were not able to get data on final expenditures; hence, we could not define the cost overrun to be the difference between the estimated cost and actual cost.

[4] Singh, Ram (2010) "Delays and cost overruns in infrastructure projects: Extent, causes and remedies," *Economic and Political Weekly*, 45 (21), May 22: 43–54.

When we compared the estimated cost of a project from the action plan with that of the approved tender cost in the case of CMSMTDP, on average, we found a cost overrun of 2.5% when we examined works completed in all sectors, less than what we found in the special ₹ 100-crore program (where the time overrun was 5%—in the case of all projects—and 6% in the case of road projects). There were indeed works in which the tender costs were lower than the estimated project cost (by about 5.9%) approved as part of the action plan (which was a road work in Bhalki). The maximum cost overrun was 8.9% in a Siddapura road project. Interestingly, this was a project with a 10% time overrun. Given that this is an asphalting project, petroleum is the core input. Since petroleum prices have been continuously rising in line with the global trends, the tender cost was higher than the estimated cost in the action plan. We noted that the action plans for these projects were submitted in July 2010, but were approved only in October. Once the action plan is approved, the city calls for tenders, contractors respond, and the responses have to be assessed by the city before making a final decision after negotiations. The work starts only after the finalization of the negotiation, choice of the contractor and an agreement in place. Hence, these time delays in processes explain cost overruns.

When we examine time overruns, on average, taking into account all projects, there is a 91% time overrun. The maximum time delay of 600% occurred in Mulki in the case of two road projects, where both the projects were delayed by nearly 6 months. Incessant rains, rituals related to a temple (which had to pass via those roads), and land acquisition problems were responsible for these delays. However, there were a number of projects which were completed ahead of schedule. There were a couple of road projects in Bhalki which were completed a month earlier than their expected completion date.

## *Budget Analysis of Heads of Expenditure in MNY*

Since all the ULBs outsource the works to contractors, we could obtain a disaggregated analysis of the budgets only from the contractors who implement the work. We were able to get this information only from contractors whom we were able to contact. Based on information from the contractors to whom the various works were outsourced, we examined expenditure on various heads by them. This is summarized in Table 6.4.[5]

[5] These are not based on ledgers of account or audited financial statements with the contractors, but they are based on approximate percentages provided to us by them. Hence, it is possible to work backward and arrive at expenditure figures. It might be relevant to note the ToR for the ERC read as follows: "..conduct budget analysis of various heads of expenditure, including analysis of process of determining unit cost of various activities under a project…" This applies to all works under the MNY and the UIDSSMT, where contractors were involved.

**Table 6.4** Analysis of various heads of expenditure, selected projects, special ₹ 100-crore program, Mysore

| Sr. No. | Sector | Name of work | Salaries and wages | Materials |
|---|---|---|---|---|
| | | | (% of expenditure) | (% of expenditure) |
| 1 | Road and drain | Construction of drain and providing asphalting to Seetharama Rao Road in Ward No. 3 | 35.38 | 60.67 |
| 2 | Road | Improvement of Road Arunodaya ITI College, right side cross road from 11th to 13th cross at Jantha Nagar Ward No. 24 | 38.95 | 58.13 |
| 3 | Walkway | Construction of pedestrian subway at Sayyaji Rao Road—near BATA | 19.25 | 73.15 |
| 4 | Road | Improvements to Pulikeshi Main Road | 27.63 | 72.26 |
| | Average, all projects | | 30.3 | 66.05 |
| | Average, road projects | | 33 | 65 |

We divided the expenditure on the project by the contractor into three parts: salaries and wages, materials, and equipment. On average, materials (or inputs such as cement or steel) constitute nearly two-thirds of expenditure on all projects, with the walkway project spending the most there (73.15%). Typically, we find salaries and wages constitute slightly less than one-third of their expenditure on all projects, with capital equipment (such as tractors or other paraphernalia) accounting for only 4% of the total expenditure. It seems that the walkway project spent the least proportion (less than 20%) on salaries and wages and the most (73.15%) on materials, given that prefabricated structures were used. On the other hand, all road projects spent about 30% of their total expenditure on salaries and wages. On average, the non-road projects (including the combined road and drain project) spent even less on salaries and wages (27%) than those on road projects; hence, there is every reason to believe that these projects were executed in a cost-effective manner.

Based on our analysis (see Table 6.5), on average, taking into all projects under the CMSMTDP, more than half (58%) of the expenditure was on material (such as steel, petroleum, iron, jelly, stones, and so forth).

More than one-fifth of the expenditure (21%) was on equipment such as mixers and tractors. Less than one-fifth (18%) of the contractors' total expenditure on the project was on salaries. This does mean that the contractors do squeeze their resources to execute their project, similar to what we find in the special ₹ 100-crore component of the MNY. The maximum proportion of expenditure spent on salaries was 35% in a work in Siddapura. There was no cost overrun in this project, which means that projects were being implemented in the predetermined way (as proposed in the action plan). The works are also outsourced by cities in a competitive manner, through calling for tenders.

**Table 6.5** Budget analysis of various heads of expenditure, CMSMTDP

| Town | Work completed | % Expenditure on labor | % Expenditure on materials | % Expenditure on equipment |
|---|---|---|---|---|
| Siddapura | Construction of compound wall at western side of compost yard in Hosur village Sy.No-205 | 35 | 55 | 10 |
| Siddapura | Construction of steel grill container for collection of plastics in compost yard | 20 | 70 | 10 |
| Siddapura | Construction of compost pit for collection of biomedical wastes in compost yard | 10 | 25 | 65 |
| Siddapura | Construction of engineering landfill site in compost yard | 10 | 25 | 65 |
| Mulki | Improvement of road from Chitrap Kalsanka to Gajani | 15 | 60 | 25 |
| Bhalki | Improvements and asphalting of road from: (1) Balaji Temple to Baswehshwar Chowk and (2) Dr. Ambedkar Chowk to Base in Bhalki Town | 20 | 60 | 20 |
| Bhalki | Improvements and asphalting of road from Subash Chowk to Railway Station in Bhalki Town | 20 | 60 | 20 |
| Bhalki | Improvements of road from Seventh Day School to Railway Gate in Bhalki Town | 20 | 60 | 20 |
| Bhalki | Improvements of road from Math Mallikarjun House to Saidapurwadi Cross in Bhalki Town | 20 | 60 | 20 |
| Kollegal | Granular base for Rajiveenagar 1st cross road | 19 | 68 | 4 |
| Kollegal | Construction of drain on the right side of Rajiveenagar 1st cross road | 24 | 59 | 9.5 |
| Kollegal | Construction of drain on the left side of Rajiveenagar 1st cross road | 24 | 58 | 9.5 |
| Kollegal | BT road from RMC to Forest Office | 10 | 70 | 12 |
| Kollegal | BT road from Lingannapura to Siddappaji temple | 12 | 70 | 10 |
| Kollegal | BT road from RMC to Agastin colony cross | 10 | 70 | 12 |
| *Average* | | *17.93* | *58* | *20.8* |
| *Maximum* | | *35* | *70* | *65* |
| *Minimum* | | *10* | *25* | *4* |

## *Unit Costs in MNY*

Unit costs are the costs incurred in building one unit of the infrastructure (road, streetlight, and so forth). We computed unit costs of completing all projects we studied, comparing them across programs, with a view to understanding their relative cost-effectiveness, given different levels of government are involved. When we discuss unit costs, a few conceptual differences between what we observe and what

we need are in order. What we observe in the city's or service providers' budgets is actual *expenditure* on the selected services, whereas what we are actually interested in is the *cost* of providing them, as pointed out by Chernick and Reschovsky (2004). There are several reasons why we may expect it to be a methodological challenge to separate out costs from expenditures. Expenditures could differ across local governments due to exogenous factors such as topography. The cost of providing water in elevated areas (such as Bangalore, which is 930 meters above sea level) would be higher than that they would be in low-lying areas (see Sridhar and Mathur 2009). Further, the relative dryness or wetness of an area (rainfall) is a determinant of expenditure on various urban services (especially water supply). Finally, the vector of relevant input prices a city is faced with also determines the cost of providing services (for instance, the costs of electricity to pump up water from a low-lying source, relative to the location of the city).

Thus, actual spending (or expenditure) on a public service by a city could be due to a number of different reasons, of which cost is just one. The costs of providing public services are determined by the price of inputs and exogenous factors, such as topography, which aggravate or reduce the costs of providing services, as highlighted above.

Actual *spending* on public services is determined by other factors in addition to costs. Spending on local public goods is determined by their *desired* level, likely to be different for different income groups. See de Bartolome and Ross (2003)[6] for an analytical framework that describes why this would be true. In general, this is also well known from Tiebout (1956)[7]. Specifically, we expect willingness to pay for local public goods such as water to increase with income and/or education.

Further, some local governments that are more efficient spend less for every unit of the public service delivered, when compared to less efficient ones. The size of the local economy could be a factor in determining scale economies for certain services. Other factors determining the efficiency of service provision are the degree of privatization in service delivery. Typically, private provision of services is known to have cut costs in many Indian cities. This is because public recruitment of personnel is expensive, and there is no explicit performance appraisal, making public provision of services inefficient.

Naturally, a big methodological challenge is to separate out that part of *expenditure* attributable to *preferences*, and that because of *costs* (this includes input prices, topography, and inefficiencies). Technical considerations sometimes prevented us from comparing unit costs across projects within the same city and certainly across cities. Thus, while expenditure (or spending) is a function of cost, household preferences, and (in) efficiency, we use the terms cost and expenditure interchangeably here.

[6] De Bartolome, Charles A.M and S.L.Ross. 2003. "Equilibrium with local governments and commuting: income sorting versus income mixing," *Journal of Urban Economics* 54 (2003): 1–20.

[7] Tiebout, Charles. 1956. "A Pure Theory of Local Expenditures," *Journal of Political Economy* 94: 416–424.

For the two road projects we studied in Mysore under the special ₹ 100-crore program, the unit (tender) cost of constructing one square meter of road turned out to be ₹ 697 on average. We noted that the size of the two road projects varied greatly even on the basis of their action plans. One road project's estimated cost was only ₹ 10 lakhs (for improving 1,687 square meters of a road) whereas the other one was ₹ 81 lakhs (for making improvements to 10,400 square meters of road). However, there is no reason to believe that the unit costs would be different within the city (excepting technical specifications). In fact, we expected the unit cost in the larger project to be lower, given scale economies. Interestingly, however, in the larger project of the two (in terms of physical target), the improvements to a road (10,400 square meters) cost more than the average, being ₹ 785 per square meter, whereas the smaller road project involving improvements to a road (for 1,687 square meters of road in ward number 24) cost only ₹ 609 per square meter. This defies the assumption that scale economies exist in large projects. Incidentally, we noted that the one with the higher unit cost (larger project) was also the project which was completed ahead of schedule. It is possible that such efficient projects have a cost premium. There can also be a host of other factors affecting costs and completion timetable. The cost overrun (the difference between the tender cost and the original estimated cost in the action plan) was greater than 8% in this larger project compared with only a 3% overrun in the case of the other road project (which had a lower unit cost but was delayed by 4 months).

We were interested in examining what projects are more cost-effective within the CMSMTDP, understanding that topographical constraints and technical considerations play an important role there when comparing these costs across cities. In general, we found road projects to be less expensive when compared with other projects such as those in solid waste management, with the unit (tender) cost of a road project (per square meter of road completed) being only ₹ 619 when compared with ₹ 57,463 per unit of the work when all projects (street lights and solid waste management) are taken into account. However, in terms of unit cost, the least cost project was not a road project (at ₹ 190 per unit for constructing an engineering landfill site in a compost yard (Siddapura)). The least cost road project in terms of unit cost was a (Kollegal) road improvement project at ₹ 223 (see Table 6.6). While the maximum road project cost only ₹ 1,640 per square meter of road improved or built, the maximum "other" category project cost ₹ 460,000 per kilometer of shifting and erection of electrical poles (in Siddapura).

**Table 6.6** Unit costs of road projects under CMSMTDP

| Town | Average unit cost (in ₹) per square meter of road | Maximum unit cost (in ₹) per square meter of road | Minimum unit cost (in ₹) per square meter of road | Number of completed road works selected |
|---|---|---|---|---|
| Siddapura | 563.19 | 774.32 | 360.42 | 3 |
| Mulki | 270.67 | 270.67 | 270.67 | 1 |
| Chitradurga | 1,275.41 | 1,640.83 | 909.99 | 1 |
| Bhalki | 608.11 | 779.63 | 462.34 | 4 |
| Kollegal | 430.03 | 606.06 | 223.21 | 4 |
| *Average, all* | *629.48* | *950.21* | *445.33* | *13* |

We chose four cities to study works completed under the CMSMTDP—Siddapura, Mulki, Bhalki, Chitradurga, and Kollegal. In our analysis of unit costs, we looked at works completed sector-wise. First, we take the instance of roads. Even here, as in the earlier cases, we choose the approved tender cost as our estimate since if projects have not attained financial closure, the actual expenditure to date will be misleading as a measure of costs. Overall, the unit cost to build a square meter of road under the CMSMTDP (taking into account all cities) is roughly ₹ 619. Table 6.6 summarizes the variations across the various cities in terms of unit cost for completed road works along with various summary statistics.

Understanding that unit costs are determined by a number of considerations including topography (and not just by efficiency), we find that as far as road works are concerned, in terms of average unit cost, Chitradurga is the highest (at ₹ 1,275 per square meter of road and a culvert). The road project involved upgradation of 880 square meters of road and a culvert. The lowest unit cost summarized in Table 6.6 is in Kollegal (₹ 223.21 per square meter of road), where the work involved improvement of 4,480 square meters of road. Thus, here economies of scale seem to have an effect on reducing the unit cost, whereas we found that in the case of the special ₹ 100-crore program, scale economies did not have an impact in reducing the unit cost.

We also compared the CMSMTDP unit costs to those under the special ₹ 100-crore package program. While the average unit cost of the road projects in the special-₹ 100 crore program is ₹ 697 per square meter, the unit cost of the road projects under the CMSMTDP is only ₹ 619 per square meter of road constructed. Given the CMSMTDP is in smaller cities, labor and other inputs could be cheaper. It should also be remembered that the average unit cost for CMSMTDP road projects is based on nearly 15 works completed in the various cities chosen for this study, whereas the unit costs for the ₹ 100-crore program are based on two road works completed in Mysore. However, it should be mentioned that even in the CMSMTDP (as with the ₹ 100-crore program), financial closure was not attained in many projects with the result that the local government was still expecting funds from the state government, and the contractor had completed the work using some part of his own funds. Hence, we decided to use the tender cost (rather than the actual expenditure or the estimated cost from the action plan to determine unit costs).

Overall, between the special ₹ 100-crore program and the CMSMTDP, we found that the special ₹ 100-crore program costs more per unit (₹ 697 per square meter) of roads than the CMSMTDP. We are not making attempts to explain these variations here. It could well be the case that topographical constraints make it more difficult to implement certain projects more than others.

We found that financial closure was not attained in many projects under the ₹ 100-crore program (as with the other programs) with the result that the ULB was still expecting funds from the state government, and the contractor had completed the work using some part of his own funds. Hence, we decided to use the tender cost (rather than the actual expenditure or the estimated cost from the action plan) to determine unit costs.

The above discussion regarding variations in unit costs should be read with caution because technical specifications of different projects/works might vary widely (with some having more foundation depth and so forth). Since we do not have detailed technical information regarding these projects, we are unable to remove their confounding effects on the costs.

## Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT)

UIDSSMT was launched on 3 December 2005 as one of the subcomponents of the Government of India's flagship urban renewal program, Jawaharlal Nehru National Urban Renewal Mission (JNNURM). This program is sponsored by the Ministry of Urban Development, Government of India. UIDSSMT subsumed the existing schemes of Integrated Development of Small and Medium Towns (IDSMT) and Accelerated Urban Water Supply Programme (AUWSP). The UIDSSMT scheme is implemented in 30 ULBs in Karnataka. The sectors covered under these ULBs are water supply, sewerage, storm water drains, and roads.

### *Progress in the UIDSSMT Program in Karnataka*

Table 6.7 shows the sector-wise release status of the UIDSSMT scheme as on 31 Aug 2010. Overall, in 26 ULBs one project each was implemented, whereas in the case of Hubli–Dharwad (water supply and roads) and Ramanagar (roads and storm water drain) two projects each were implemented. However, in the case of Davangere and Holenarasipura all the four projects were implemented.

The total cost approved by the state level sanctioning committee (SLSC) for 38 works in 30 ULBs is ₹ 68,249.4 lakhs. As per the guidelines SLSC may sanction additional central grants up to 1.5% as an incentive to the implementing agencies for preparation of the detailed project report (DPR). At the time of writing this chapter,

**Table 6.7** Sector wise release status of projects under UIDSSMT in Karnataka as on 31 August 2010 (amounts in lakhs ₹). (Source: Directorate of Municipal Administration—Project Cell, Government of Karnataka)

| Projects | Number of works | Cost approved by SLSC | 1.5% incentive for DPR | Releases to SLNA (state level nodal agency) | | | Expenditure |
|---|---|---|---|---|---|---|---|
| | | | | Central | State | Total | |
| Water supply | 17 | 41,806.1 | 627.1 | 26,690.3 | 3,312.3 | 30,002.5 | 25,034.5 |
| Sewerage | 10 | 7,808.1 | 117.1 | 4,496.0 | 552.6 | 5,048.6 | 4,453.3 |
| SWD | 3 | 7,320.3 | 109.8 | 3,037.9 | 370.3 | 3,408.2 | 3,608.0 |
| Roads | 8 | 11,314.9 | 169.7 | 5,972.5 | 733.6 | 6,706.1 | 4,234.0 |
| *Total* | *38* | *68,249.4* | *1,023.8* | *40,196.7* | *4,968.7* | *45,165.4* | *37,329.8* |

₹ 1,023.8 lakhs had been sanctioned as an incentive to implementing agencies in Karnataka. Sector wise, more priority is given to the water supply in Karnataka and more than 60 % of the total approval cost is allocated for water supply works. However, the total release to SLNA is ₹ 45,165 lakhs and the total utilization of the funds by the implementing agencies is ₹ 37,329.8 lakhs and the percentage of utilization is 82.65 % against release made till 31 Aug 2010.

## *Cost and Time Overruns in UIDSSMT*

Under UIDSSMT, Mulki completed six road works under four packages. We selected all the road works for the study. Table 6.8 shows the summary of road works undertaken in Mulki town panchayat.

The estimated cost as per the action plan for all the works is ₹ 213.9 lakhs. Due to discrepancies in the estimated cost, the ULB was asked to revise further as per the Public works Department revised schedule of rates. The revised action plan was resubmitted and approved. The cost as per the revised estimation is ₹ 252.15 lakhs, taking all works into account. We have calculated the percentage of cost overrun due to delay in the process of executing the works. We found that the average cost overrun between the estimated and revised estimated cost is 15 %. We also calculated the cost overrun between the estimated cost (approved as part of the action plan) and the finally approved tender cost.

We had enough information to determine the extent of time overruns in the various works which we selected. When we examine the time overrun for road works in Mulki we observed the maximum delay in various stages of the work implementation in UIDSSMT projects. We found that there was delay of about a year and 6 months between submission of the action plan and approval of it, the longest of any case we have studied. This, based on our discussions, is due to discrepancies in the estimated cost and the ULB was asked to revise it further. Even after the approval it was further delayed about 9 months to call for the tender.

Table 6.9 shows the time overrun of the road works in Mulki under UIDSSMT, on average, taking into account all works, there is a 300 % time overrun. The maximum time delay of 786 % occurred in the case of upgradations, where both the projects were delayed by nearly 2 years. We found that incessant rains, rituals related to a temple (which had to pass via those roads), and land acquisition problems for which the public created a problem were responsible for these delays.

The average cost overrun between revised estimated cost and tender cost is 11.5 %. However, the total cost overrun from action plan to tender call is around 28.5 %. We noted that once the action plan is approved, the city calls for tenders, contractors respond, and the responses have to be assessed by the city before making a final decision after negotiations. The work starts only after the finalization of the negotiation, choice of the contractor, and an agreement in place. Hence, these time delays in processes explain cost overruns, consistent with what we find with the MNY. There are also other sources of cost overruns in UIDSSMT projects. One

**Table 6.8** Summary of road works undertaken in Mulki Town panchayat

| Name of work | Estimated cost from action plan (lakh ₹) | Revised estimated cost | Tender cost (lakh ₹) | Cost overrun between estimated and revised cost (%) | Cost overrun between revised estimate and tender cost (%) | Total cost overrun (%) |
|---|---|---|---|---|---|---|
| Upgradation of existing Karnadu Sadashiva Naga long and cross road | 99.9 | 121.4873 | 130.9754 | 21.61 | 7.81 | 31.11 |
| Upgradation of existing Guttu Road and Beach Road and construction of slab culverts | 18 | 21.34149 | 24.52137 | 18.56 | 14.9 | 36.23 |
| Upgradation of existing Chitrapu Gajani Road | 23.5 | 27.37947 | 31.45901 | 16.51 | 14.9 | 33.87 |
| Upgradation of existing Chandra Shanubhagara Kudru Road | 18 | 21.32282 | 24.49992 | 18.46 | 14.9 | 36.11 |
| Upgradation of existing Chetana Nursing Home to TP boundary Via Kempugudde (from By-Pass) | 40.5 | 46.5712 | 53.51031 | 14.99 | 14.9 | 32.12 |
| Improvement of Karnadu Padubail Road | 14 | 14.05072 | 14.26289 | 0.36 | 1.51 | 1.88 |
| *Averages* | *35.65* | *42.03* | *46.54* | *15.08* | *11.49* | *28.55* |
| *Standard deviation* | *32.84* | *40.47* | *43.40* | *7.55* | *5.65* | *13.23* |
| *Maximum* | *99.9* | *121.49* | *130.98* | *21.61* | *14.9* | *36.23* |
| *Minimum* | *14* | *14.05* | *14.26* | *0.36* | *1.51* | *1.88* |

**Table 6.9** Time overrun of the road works in Mulki under UIDSSMT

| Name of work | Allotted time to complete physical implementation (number of days) | Time overrun during physical implementation (number of days) | % Overrun |
|---|---|---|---|
| Upgradation of existing Karnadu Sadashiva Naga long and cross road | 51 | 65 | 127.45 |
| Upgradation of existing Guttu Road and Beach Road and construction of slab culverts | 51 | 33 | 64.71 |
| Upgradation of existing Chitrapu Gajani Road | 51 | 401 | 786.27 |
| Upgradation of existing Chandra Shanubhagara Kudru Road | 51 | 30 | 58.82 |
| Upgradation of existing Chetana Nursing Home to TP boundary Via Kempugudde (from bypass) | 51 | 22 | 43.14 |
| Improvement of Karnadu Padubail Road | 51 | 367 | 719.61 |
| *Averages* | *51* | *153* | *300.00* |
| *Standard Deviation* | *0* | *179.85* | *352.65* |
| *Maximum* | – | *401* | *786.27* |
| *Minimum* | – | *22* | *43.14* |

is that the standard schedule of rates (SRs) is revised every 6 months. The other reason is that physical and financial progress can halt due to nonconformity to mandatory reforms, as described earlier. The final reason is the tender premiums that result from the process of outsourcing to contractors, as described above.[8]

Table 6.10 summarizes the water supply project in Siddapur under UIDSSMT. The total estimated cost for the civil work is ₹ 251.96 lakhs and the tender cost for the same work is ₹ 373.69 lakhs. The total cost overrun for civil work is 48.3%. It was due to the nonavailability of the ductile iron (DI) pipes that the work was delayed and the cost of the pipes increased. Further, the pipelines were built within the town limit and road cutting was carried out. Hence, extra cost has been incurred to restore the roads.

The estimated cost for the pumping machinery is ₹ 36.75 lakhs and the tender cost is ₹ 41.68 lakhs. The cost overrun is 13.41%. This cost overrun is due to the extra work which was carried out.[9] In the case of distribution work the estimated cost was ₹ 10.9 lakhs, whereas the tender cost was ₹ 10.49. The cost overrun is negative being −3.81%. This is because the contractor wanted to undercut himself and had quoted a rate 3.81% lower than the estimated costs of the project. The contractor might have wished to build an initial reputation for himself by implementing projects more cost-effectively than other, existing large-scale contractors.

[8] The above are based on discussions with Mr. Anjum Parwez, then Commissioner, Municipal Administration.

[9] The extra work involved construction of the reinforced cement concrete (RCC) platform with column frames for transformers substation at jack well.

**Table 6.10** Summary of the water supply project in Siddapur under UIDSSMT

| Name of work | Estimated cost from action plan (lakh ₹) | Tender cost (lakh ₹) | Total cost overrun (%) |
|---|---|---|---|
| Civil works | 251.96 | 373.69 | 48.31 |
| Pumping machinery | 36.75 | 41.68 | 13.41 |
| Distribution network | 10.9 | 10.49 | −3.81 |
| *Average* | *99.87* | *192.09* | *19.32* |
| *Standard deviation* | *132.35* | *256.82* | *26.54* |
| *Maximum* | *251.96* | *373.69* | *48.31* |
| *Minimum* | *10.9* | *10.49* | *−3.81* |

**Table 6.11** Time overrun of the water supply project in Siddapur under UIDSSMT

| Name of work | Allotted time to complete physical implementation (number of days) | Time overrun during physical implementation (number of days) | % Overrun |
|---|---|---|---|
| Civil works | 540 | 462 | 85.56 |
| Pumping machinery | 120 | 189 | 157.50 |
| Distribution network | 120 | 0 | 0.00 |
| *Average* | *260* | *217* | *81* |
| *Standard deviation* | *242* | *232* | *79* |

Table 6.11 shows the time overrun of all the three water supply works in Siddapur. On average, taking into account all works, there is an 81% time overrun. The maximum time delay of 157.5% occurred in the case of pumping machinery work, where the work was delayed by nearly 1 year and 3 months. We enquired with relevant officials and found that the agency has carried out extra work other than what was specified in the tender; hence, the agency could not complete the work within the tender period. We also found 86% time overrun in the civil work. The delay was primarily due to the nonavailability of 250 mm diameter and 200 mm diameter DI pipes and while laying the pipeline, a PWD and municipal asphalt road cutting was being carried out; hence, to restore those roads by putting asphalt it took a lot more time than expected. Interestingly, in the case of distribution work, the work was completed within the allotted time.

## *Budget Analysis of Various Heads of Expenditure in UIDSSMT*

Since all the works are outsourced to contractors, we could obtain a disaggregated analysis of the budgets only from the contractors who implement the work. We were able to get this information only from contractors whom we were able to contact. Based on our analysis, on average, taking into all the road works in the Mulki under UIDSSMT, more than half (55%) of the expenditure was on material (such as steel, petroleum, iron, jelly, and so forth). More than one-third expenditure (35%) was on equipment such as mixers, tippers, and tractors. Around 10% of the contractors'

total expenditure on the project was on salaries. This means that contractors are lean and mean. They are not lavish in their payment of salaries to workers and squeeze their resources to execute their project in a cost-effective way.

In the case of the water supply project in Siddapur under UIDSSMT, we found that around three-fourths (75%) of the expenditure was on labor and the remaining one-fourth expenditure (25%) was on equipment such as mixers, tippers, and tractors. This is quite a different composition from what we observe earlier; hence, the projects which we have selected are different with varying degrees of capital and labor intensity, which is desirable.

Since the KUWSDB provided all the material such as polyvinyl chloride pipes (PVC) pipes, valves, and dia pipes the contractor did not incur any expenditure on materials.

## *Unit Costs in UIDSSMT*

We solicited information from the cities regarding the physical targets (kilometers of road or the length and width of the road to be constructed) which were supposed to be achieved against each of the expenditures with the result that we were able to compute unit costs for most works. While physical completion had been attained, financial closure was not attained in many projects with the result that the ULB was still expecting funds from the state government, and the contractor had completed the work using some part of his own funds. Hence, we decided to use the tender cost (rather than the actual expenditure or the estimated cost from the action plan to determine unit costs).

Table 6.12 summarizes the unit cost of the road works in Mulki under UIDSSMT. For the six road works we studied in Mulki under the UIDSSMT, the unit (tender) cost of constructing one square meter of road turned out to be ₹ 703 on average. We

**Table 6.12** Unit cost of the road works in Mulki under UIDSSMT

| Name of work | Unit cost (in ₹ per square meter) |
|---|---|
| Upgradation to existing Karnadu Sadashiva Nagar long and cross road | 970.2 |
| Upgradation of existing Guttu Road and Beach Road and construction of slab culverts | 784.4 |
| Upgradation to existing Chitrapu Gajani Road | 582.9 |
| Upgradation to existing Chandra Shanubhagara Kudru Road | 816.7 |
| Upgradation of existing Chetana Nursing Home to TP boundary Via Kempugudde (from bypass) | 632.8 |
| Improvement of Karnadu Padubail Road | 428.3 |
| *Averages* | *702.6* |
| *Standard deviation* | *192.7* |
| *Maximum* | *970.2* |
| *Minimum* | *428.3* |

expected the unit cost in the larger work (for ₹ 99.9 lakhs) to be lower, given scale economies. Interestingly, however, the larger work of the six (in terms of physical target), the upgradation to a road (13,500 square meters) cost more than the average, being ₹ 970 per square meter, whereas the other smaller project involving improvements to a road (for 3,330 square meters of road) cost only ₹ 428 per square meter. Here we should also consider the fact that technical specifications such as width and depth vary from work to work. Even some of the road works represent upgradation and some just improvement. Topography and condition of land might also differ. Therefore, unit cost will vary with all these considerations. For an understanding of the impact of topography on costs of water supply, see Sridhar and Mathur (2009).

We also compared the UIDSSMT unit cost to those under CMSMTDP unit costs and the special ₹ 100-crore package program. While the average unit cost of the road projects under the CMSMTDP is only ₹ 379 per square meter and the unit cost of the road projects in the special ₹ 100-crore program in Mysore City is ₹ 657 per square meter of road constructed. Further, we also chose two road works completed under CMSMTDP in Mulki for the study and we found that the average unit cost is only ₹ 270.67 per square meter, where the work involved improvement of 1,911 square meters of road. Thus, we find the unit costs of constructing a square meter of road in the UIDSSMT to be higher than that of the MNY (both components). However, we are not making attempts to explain these variations here. It could well be the case that topographical constraints make it more difficult to implement certain projects more than others.

## Comparisons Across Programs

In this section, we compare all the four programs across a number of parameters required (see Table 6.13). We also compare the various programs on a variety of issues reflecting on possible causes of ineffectiveness in public expenditure and service delivery. Following this, we present some overall conclusions.

Surprisingly, as far as infrastructure programs are concerned, state-run programs such as the MNY (both the special ₹ 100-crore program and the CMSMTDP) have less cost and time overruns than centrally sponsored programs such as the UIDSSMT. In terms of both cost and time overruns, the CMSMTDP is the least, hence the best.

When we examine delays in payment to contractors, we find the UIDSSMT (road work which we studied, no delays with respect to the UIDSSMT water supply project we studied) lags way (at an average of 15 months) behind that of the state-run programs such as the special ₹ 100-crore program and the CMSMTDP, where the average payment delay to contractors is only about 3.7 months with a maximum of 7 months.

**Table 6.13** Summary of parameters in various programs studied

| Parameter | ₹ 100-crore program | CMSMTDP | UIDSSMT |
|---|---|---|---|
| Average cost overruns (in %) | 4.86 | 2.55 | 25.48 |
| Average time overruns (in %) | 75.66 | 66.67 | 227.01 |
| ICT | Training for conducting auctions online might help | Intensive training needed | Training given on e-tendering and e-payment for KUWSDB officials and contractors. Training needed for ULB officials |
| Average delay in payment to contractor | No delays as of our field visit | 3.7 months | 15 months (road work) |
| Beneficiary assessment | Positive | Positive | Positive |
| Sector: Roads | Beneficiary assessment: Positive | Beneficiary assessment: Positive | Beneficiary assessment: Positive |
| Water supply | Not applicable since no water supply works were selected | Not applicable since no water supply works were selected | Beneficiary assessment: Not very positive |
| Others (SWM, street lighting, and drains) | Positive | Positive | Positive |

## Conclusions

1. A comparison of the two programs we have studied yields several important lessons that can aid policy makers in improving the design and implementation of development strategies and expenditure control. The evidence presented in the preceding sections shows that the primary focus of the programs has been on inputs (funds, processes, personnel, and other inputs), and much less on the outputs, outcomes, and effectiveness. Road and water supply projects (infrastructure programs such as the MNY and the UIDSSMT) have performed somewhat better in this regard. In general, civil works tend to define costs and other inputs more clearly than projects that assist the poor or address social issues. But even in civil works, when the criteria for selecting projects are not explicit (such as high -traffic roads and water for poorer areas), it is possible for those with influence to divert the benefits to the less deserving.
2. When the criteria for road selection are known to the public, they are likely to monitor the selection actively. Information asymmetries of this kind tend to subvert the effectiveness of programs and intensify the principal–agent problem. With respect to information asymmetries at the citizen level, we actually found that the citizens were not as ignorant as we expected of them. Contrary to this, we found that they were, in some cases, quite aware of the expected benefits from the implementation of a project (e.g., enhanced water supply due

to the implementation of the water supply project as part of the UIDSSMT in Siddapura).

3. Capacity constraints have surfaced as a barrier to effective implementation in all the programs we have examined. The degree of severity of this problem is not the same in all cases. The smaller ULBs are faced with capacity constraints, whereas the larger ULBs (for instance as with the special ₹ 100-crore program) do not have capacity constraints to the same degree as their smaller counterparts. Even in terms of the use of ICT, we found the smaller ULBs need much training to enable them to carry out their functions and implement projects more effectively when compared with their larger counterparts.

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Any errors that remain are ours.

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# Chapter 7
# Risk Allocation in Concession Agreements for PPP Road Projects in India

**Debopam Roy, Satyanarayana Kalidindi and A. Soundararajan**

## Introduction

Road transport plays a very important role in the economic development and social integration of the country. The roads carry about 65% of freight and 80% passenger traffic in India. National highways (NHs)/expressways, which constitute barely 2% of the road network, carry nearly 40% of the traffic and state highways, which account for 4% of the network, carry another 40% (NHAI 2012). The kilometre length of highways in India is 0.07 per 1,000 population, whereas the ratio is 21 in the USA and 15 in France. The road network suffers heavily from critical inefficiencies like congestions (in nearly 25% of the total highways); low lane capacity (7,000 km four lane road against 34,000 km in China); low average speed (30–40 km/hr, against global average of 60–80 km/hr); and increased cost of surface freight (US$ 0.07/km, against US$ 0.037 in Japan). It is estimated that these inefficiencies and bottlenecks in transportation hinder India's gross domestic product (GDP) growth by 1–2% (KPMG 2010). Therefore, the criticality of upgrading our road network very fast, especially the highways, cannot be overemphasized.

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Over the last decade, public–private partnership (PPP) mode of delivery has become very popular in Indian transportation infrastructure sector. It was decided in 2005 that for various phases of the ongoing National Highway Development Programme (NHDP), the preferred mode of delivery will be toll-based Build Operate Transfer (BOT) concessions, with up to 40% grant, and other modes of delivery will be considered only if the bid exceeds the cap of 40% (NHDP 2006).

A PPP contract can be best defined as a risk and responsibility sharing relationship. The high degree of risk exposure and complexity of risk-sharing relation in a PPP, make a well-designed risk management plan an essential and critical criterion for the successful implementation of PPP projects. The inexperience of Indian infrastructure development companies in managing risks of PPP projects has created problems in quite a few projects in the recent past, and may prevent efficient delivery of projects through this mode under the ongoing and upcoming infrastructure development programmes in the country. Addressing this potential roadblock to India's target infrastructure growth had been the motivation to undertake a scientific study to investigate the allocation of risks in PPP projects.

The objective of this chapter is to study the evolution of contractual allocation of critical risks for PPP road projects, in different generations of concession agreements (CAs), for national and state highways in India. In the following section, literature on risk allocation of PPP projects in various parts of the world has been reviewed to understand the risk allocation mechanism with special emphasis on an Indian study to identify critical risks in Indian build–operate–transfer (BOT) road projects and preferential allocation of these risks. Subsequently, in the methodology section, the risks in various stages of the project have been explained, along with the mechanism to categorise their criticality, and the mechanism to analyse the allocation of those risks in the four CAs selected for the study. The results and analysis section first plots the risks in the criticality matrix to identify the most critical risks. The instances of occurrence of the risks in various projects have been discussed, followed by the analysis of allocation of these risks in the CAs. The chapter concludes with a discussion on the evolution of allocation practice for the critical risks, over the years.

## Review of Literature

There have been research works on risk allocation of PPP projects in different countries. Akintoye et al. (2004) studied the risk allocation preferences in PPP/private finance initiative (PFI) construction projects in the UK through a questionnaire survey. Loosemore (2006) presented a case study of the controversial US$ 920-million New Southern Railway project in Sydney, Australia. He analysed the rationale behind decisions on risk distributions between public and private sectors and their consequences through interviews and documentary analysis. Finally, there is a series of recommendations for better risk allocation in such projects. Zhang and Kumaraswamy (2001) studied the experience and lessons gained

from formulating and managing BOT projects in Hong Kong since the late 1960s, through documentary analysis and interviews. They summarised the essential elements of risk management and the other important tools that have been developed for this purpose in Hong Kong. Based on the experience and lessons learned, a support framework for the procurement of PPP infrastructure projects is also proposed. Ming-Teh and Hui-Yu (2003) conducted multiple case studies to recognize risk allocation by contract clauses and to analyse the influence of risk allocation on the contractor's risk handling strategies. The mechanism of risk allocation by contract clauses is categorised into seven conditions to analyse the allocation in Taiwan's highway projects. Abednego and Ogunlana (2006) did a case study of the Second Stage Cipularang (Cikampek–Purwakarta–Padalarang) tollway project in Indonesia to discover the perception of proper risk allocation of each party involved and utilised the findings as the foundation to develop the concept of good project governance as a mean to achieve proper risk allocation in PPP tollway projects.

Thomas et al. (2003a) identified eight very critical risks in Indian BOT road projects through an all India questionnaire survey among the four major stake holders/participants of Indian BOT road projects—government representatives, promoters/developers, lenders and consultants. Respondents were asked to rate the criticality of 22 probable risks, in a five-point Likert scale. Statistical analysis was carried out on the survey responses to find out the criticality index of each type of risk and to compare the criticality ratings among different category of respondents. The results show a high degree of agreement on the criticality ratings among different category of respondents. Based on the criticality ratings, the following eight risks were identified as "very critical" in Indian BOT road sector (listed in decreasing order of criticality): traffic revenue risk, delay in land acquisition, demand risk, delay in financial closure, completion risk, cost overrun risk, debt-servicing risk and direct political risk.

In a subsequent study by Thomas et al. (2003b), the risk perception of major stakeholders of BOT projects was analysed through a second questionnaire survey and case studies. The respondents of the survey were asked to indicate their preference for sharing the eight critical risks among the stakeholders, and the responses were summarised to show the perception of the stakeholders on the risk management capabilities and risk allocation preference.

On review of the literature and discussion with industry personnel, the following gaps were identified in the existing body of knowledge regarding risk management of PPP projects:

1. The risk identification done by Thomas (2003a) was at a time when BOT concept had just started in India, so the professionals did not have much experience in this mode infrastructure procurement. This might have led to inadequate assumptions regarding risks in the later stages of the PPP projects.
2. The studies carried out in the developed Western countries like the UK and newly industrialized countries of the Far East like Hong Kong, Singapore, Malaysia and Thailand provide a rich source of information, but there is a fundamental dif-

ference in the operating environment of these countries and a country like India, with its uniqueness in terms of economy and culture.
3. A large number of CAs have been used for PPP projects in India. However, no research has been done on the analysis of the contract clauses as in China (Wang 1999) or Australia (Loosemore 2006).
4. There has been change in the contractual allocation of the risks in the different CAs. However, no study has been done on the evolution of the risk allocation in Indian CAs.

## Methodology

A preliminary list of the risks in PPP road projects was first prepared through literature review. They were further classified according to the stage of occurrence. The list of the risks at different stages of an infrastructure project, along with the explanations, is given below.

### *Development Stage Risks*

1. Delay in financial closure (DF)—This risk refers to the delay in timely arrangement of necessary debt and equity finance for the project. Arranging for non-recourse project financing for the high investment requirements meant for the PPP road projects can result in delays and DF beyond the prescribed limit can lead to the termination of concession by the government.
2. Permit/approval (P/A)—In India, prior to the start of construction of a BOT road, multi-level permits (central, state and local) and approvals are required from various authorities. Lack of co-operation from government agencies, frequent transfer of concerned officials, corruption, lack of awareness of concerned laws, lack of co-ordination among government departments, poor documentation, etc. often cause delay in obtaining necessary permits/approvals.
3. Pre-investment (Pi)—This is the risk which a road project promoter is exposed to, on account of the cancellation of the project or inordinate delay in signing of the CA due to various reasons like poor bidder turnout, unfair bid, government decision to drop the project, litigation and court orders on land acquisition, after a considerable investment of money for project feasibility study, bid preparation, etc.

### *Construction Stage Risks*

1. Land acquisition (LA)—This is the delay in getting project land free from encumbrance in specified time. PPP road projects require large stretches of land and

often the concession is signed without acquiring the total land required. Delay in survey, notification and acquisition process, politically motivated public resistance, non-availability of alternate land at reasonable cost, political patronage for encroachers, resettlement and rehabilitation problems, litigation and court proceedings can often lead to long delays in land acquisition.
2. Construction delay (CD)—This is the delay in project completion due to any reason ranging from poor planning and control to poor performance of subcontractors. These risks are common to all types of construction contracts.
3. Technology (T)—Projects face a variety of technical risks that reflect their engineering difficulties and novelties. Some of these risks are inherent in the designs or technologies employed. In some other cases, the technology is known but interactions with natural conditions may be encountered causing risks.
4. Design and latent defects (DL)—This may include faulty/inappropriate design data, design and documentation problems, quality problems, defects in existing road, etc.
5. Cost overrun (CO)—This is the risk of construction cost exceeding original estimate due to reasons like inflation, change in scope, etc.
6. Supply (S)—This is the risk of unavailability, rise in price, supply chain problem, etc. of some essential material/service. There can also be problems in availability of vital resources like manpower (both staff and labour) or equipment.

## *Operation Stage Risks*

1. Revenue (Rv)—This is defined as the non-realization of traffic revenue due to reasons other than demand reduction. Even if there are enough vehicles on the road, the concessionaire may face a number of problems in revenue realization such as non-acceptability of toll, revenue leakage, government-induced toll reduction/tariff variation/concessions, etc.
2. Demand (D)—This is defined as the lack of traffic volume using the road. It may be due to alternate route/technology, toll/recession-induced reduction in demand, failure of feeder roads, capacity constraints, etc.
3. Debt servicing (DS)—This is the risk of non-payment of debt as per the schedule mainly due to cash inadequacy. The major reasons for debt-servicing risk are sudden increase in operation and maintenance costs, inadequate cash flow due to traffic revenue shortfall/faulty debt-servicing structure and increase in taxes or increase in interest rates.
4. Operation and maintenance (OM)—This includes user dissatisfaction, inadequate quality/safety in operation, etc. Lack of experience, traffic-related problems, accidents, overloading, public agitation, failure of associated infrastructure and unexpected maintenance of roads/toll plazas are some of the reasons for this risk.

### *Life-Cycle Risks*

These are the risks that can occur anytime during the project's life cycle, i.e. development phase, construction phase or operation phase.

1. Political (Pl)—Political risks may be direct or indirect. Direct political risks include change in law; expropriation or compulsory acquisition of project assets or rights of concessionaire by any government agency; unlawful revocation of, or unreasonable refusal to grant or renew any consent or approval required by the concessionaire or its agents to perform their respective obligations. Indirect political risks include an act of war (whether declared or undeclared), invasion, armed conflict or act of foreign enemy, blockade, embargo, riot, insurrection, terrorist or military action, civil commotion or politically motivated sabotage; industry-wide or state-wide or India-wide strikes or industrial action or any public agitation.
2. Forex and interest rate fluctuation (FI)—Developing countries are vulnerable to sudden changes in exchange rates and interest rates. Financial issues like appreciation or depreciation of currency, fluctuation in inflation rate, change in cost of indemnities and insurance, frequent changes in taxes and import duties, working capital shortage and changes in interest on debt, add risks to the investment in PPP road projects.
3. Litigation (L)—This includes delay in dispute resolution, low enforceability of law, inadequate legislative framework, etc.
4. Partnering (Pn)—This is the risk of failure of joint venture, technology transfer disputes, disagreement among partners, etc.
5. Environmental (E)—This is the risk of intolerable negative impact on the environment caused by the project, and may lead to problems like litigation, protests and may even result in the termination of the project.
6. Physical (Ph)—This includes damage to road structures, damage to equipment, labour injuries, etc. and is equally critical during construction and operation phases of the road projects.
7. Social acceptability (SA)—Infrastructure projects have a large impact on non-beneficiaries and hence if the project does not have social acceptability, it may end up in problems similar to those resulting from environmental risks, with similar or more serious results.
8. Regulatory (Rg)—This risk arises from the application and enforcement of regulatory rules, both at the economy-wide and industry/project-specific levels. This includes toll notification delay, delay in toll revision, non-assistance from police and government, operational regulations, etc.
9. Non-political force majeure (NP)—Non-political force majeure risks like flood, earthquake, etc. can also occur during the construction and operation phases of the projects. The criticality of these risks is more during the operation phase of the project due to physical damages and possible operation failures.

A focus group consisting of six industry experts and three academicians was formed for the purpose of the research. An in-group questionnaire survey was administered

| | | | | | |
|---|---|---|---|---|---|
| >70% | | | | | |
| 50-70% | | | | | |
| 30-50% | | | | | |
| 15-30% | | | | | |
| <15% | | | | | |
| | negligible | marginal | moderate | acute | catastrophic |

**Fig. 7.1** Risk criticality matrix

**Table 7.1** Risk share ratings

| Rating | Risk share between government and concessionaire |
|---|---|
| −3 | Risk totally on government |
| −2 | Risk significantly more on government |
| −1 | Risk marginally more on government |
| 0 | Risk equally shared by government and concessionaire |
| 1 | Risk marginally more on concessionaire |
| 2 | Risk significantly more on concessionaire |
| 3 | Risk totally on concessionaire |

to rate the frequency and impact of the risks on a five-point Likert scale. The ratings obtained in the survey were summarised and plotted in the two-dimensional frequency vs. impact matrix as shown in Fig. 7.1. The risks falling in the coloured area were considered critical. Further, semi-structured interviews were done with the focus group members, to discuss the shortlisted risks, in order to reconfirm their criticality and learn about instances of occurrences of these risks and their impact in the project.

The following CAs were reviewed to study the contractual provisions addressing the risks, identified as critical risks by the focus group:

1. Ahmedabad–Mehsana Toll Road (1996)
2. Jaipur–Kishangarh Toll Road (1999)
3. Krishnagiri–Thopurghat Toll Road (2005)
4. Planning Commission Model Concession Agreement (MCA) for PPP in NHs (2006)

Each of the above CA represents a different generation and genre of PPP projects for Indian roads and, when studied chronologically, illustrates an evolution in risk allocation strategies in Indian CAs.

The clauses addressing the critical risks were listed for each of the above concessions and the contractual risk shared between the government and concessionaire was rated through discussions with the members of the focus group on a seven-point bipolar scale. Table 7.1 explains the points of the risk-rating scale.

Based on the risk share ratings of the different CAs of different times, the evolution of the risk allocation practice in Indian PPP projects has been analysed.

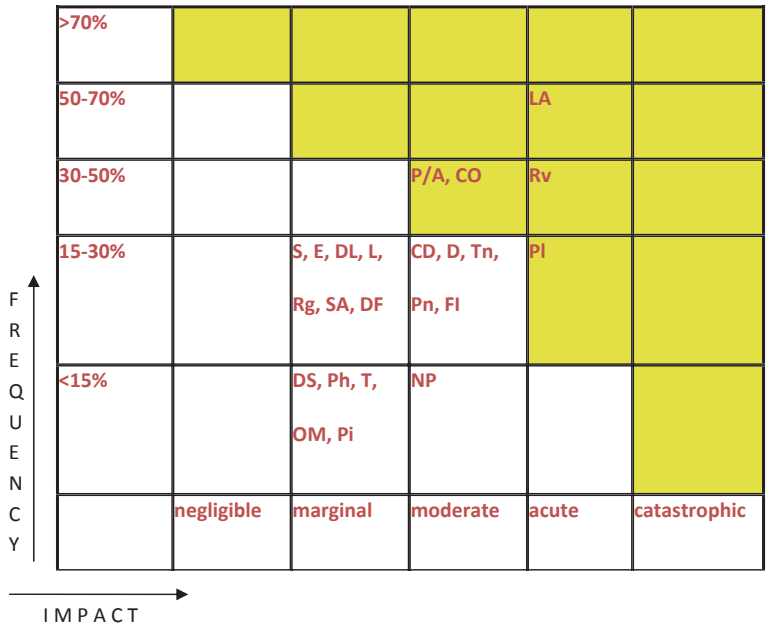


**Fig. 7.2** Position of various risks in risk criticality matrix

## Results and Analysis

### *Identification of Critical Risks*

All the risks rated by the questionnaire survey were plotted on the risk criticality matrix, based on the mean frequency and impact ratings. The result is given in Fig. 7.2.

Based on the position in the risk criticality matrix, the following risks are found to be critical:

1. Land acquisition
2. Revenue
3. Permits/approvals
4. Cost overrun
5. Political

### *Instances of Occurrence of Critical Risks*

*Land acquisition*: Experience shows that land acquisition is the major and critical risk in most infrastructure projects. The procedure for land acquisition for NHs includes the following main steps:

3A(1)—Notification in official gazette

3A(3)—Notification in two local newspapers, one of which will be in vernacular language

3B—Obtaining power to enter land for survey

3C—Hearing of objections

3D—Final and binding declaration of acquisition by notification in official gazette (has to be done within 1 year of 3A(1) excluding the period of court injunctions)

3E—Take possession within 60 days of service of notice

3F—Right to enter land and do any act

3G—Determination of amount payable as compensation after giving notice in two newspapers, inviting claims of persons with interest and resolving disputes, if any, through arbitration

3H—Deposit of money to person entitled

In the very early PPP projects like Coimbatore bypass, 100 % land was available before the construction started. However, in the subsequent projects, as the size of the project became bigger, the acquisition started being done simultaneously with the construction. This resulted in delays due to land acquisition in projects like Jaipur–Kishangarh, Delhi–Gurgaon, Pallanpur–Swaroopgunj and Krishnagiri–Thopurghat. For example, the Krishnagiri–Thopurghat section of NH7 in Tamil Nadu, under north–south (NS) corridor programme of NHDP phase II, involved acquisition of more than 400 hectares of land, and when the concessionaire's team was mobilized, there was precious little acquisition that was done, except for 3A notification. If allowed to go on in the ordinary pace, the total land acquisition procedure would have taken not less than 2 years to complete after that point, and the project would have been in complete jeopardy.

*Revenue*: The toll from vehicles, being the sole revenue stream for NH projects, problem in toll realization may become a critical risk for PPP projects for NH. Some of the reasons hampering toll realization may be as follows:

- Delay in toll notification—A good example is East Coast Road, where the toll rates had not been reviewed as promised, due to political reasons.
- Resistance and refusal to pay by certain groups—In Coimbatore bypass, initially there were politically backed agitations by groups against toll payment. However, these problems could be resolved favourably. At present, generally there is willingness to pay for good roads, among vehicles using the NHs.
- Revenue leakage—There are possibilities of revenue leakage especially in case of manual toll collection. A unique problem of leakage was faced in Mattancherry bridge in Kerala, where vehicles used to stop at one side of the bridge, the commuters used to cross the bridge on foot without paying toll and then board another bus by the same service provider, thus avoiding toll payment. There have also been cases of using service lanes near toll gates to avoid payment in a few projects.

*Permits/approvals*: An interesting case of permit/approval risk was encountered in Bangalore International Airport project, where after the Special Purpose Vehicle was

formed, it was found that under Airports Authority of India guidelines, a private party could not upgrade an airport. Thus, the legislation had to be changed. The same problem was faced in Alandur Sewage Treatment, where again the problem was waived by the government. The permits required for road projects and complexity of procedure to get them vary from state to state. In Gujarat, for example, which is among the most industrialized states in India, with a government religiously undertaking economic reforms, a total of 42 major permits and approvals are required for a PPP road project (Thomas et al. 2003a). Environmental clearance, forest clearance, wildlife clearance and tree cutting permits are generally the most difficult permits to get. The routine permits and approvals related to construction can be managed by experienced Engineering Procurement and Construction (EPC) contractors and concessionaires. However, it is a very time-consuming exercise. For example, for a borrow pit, a passbook with very short validity is given and 14 different authorities are involved en-route before the permit can be obtained. To set up an explosive magazine, the party has to approach the central government, but then the application flows through state government departments before going back to the central government. The most serious problem is faced with respect to tree cutting, where jurisdiction-wise many different agencies are involved. For example, if it is a reserved forest, it comes under Ministry of Environment and Forest, Government of India; if it is normal wayside plantation, it comes under National Highways Authority of India (NHAI); and if it is a social forest, it comes under State Department of Social Forestry. Thus even though this risk can be managed by the experienced contractors and concessionaires, a significant amount of their resources are wasted in follow-ups and often there are delays impacting the time schedule. Problems with permits and approvals were encountered in NH projects in Vadodara–Bharuch and Western Andhra.

*Cost overrun*: Earlier, generally cost overrun was less in PPP projects than in projects done through traditional contracting methodology, as there is an incentive for the concessionaire to complete the project in time within cost and more things are under their control. However, in the last decade, Cost Overrun has become quite frequent because of the steep hike in costs of crucial components. For example, in Vadodara–Bharuch six-laning project, there was a gap of about 2 years between the time of estimation and execution of the project, and the rise in cost of materials in this period made cost overrun a major issue in the project. Another reason of cost overrun can be increase in scope due to technical reasons, local requirements or NHAI requirements. Whenever the road passes through cities or villages, there can be pressure from the locals for structures that are not there in the original specifications. An example of cost overrun due to change in scope is Panipat flyover, where the original Detailed Project Report clearly showed that the six-lane project ends at toll plaza beyond which there is only a four-lane bridge. But as the project was completed, 9 months ahead of schedule, it was claimed that since it is mentioned as a "six-lane" project, the concessionaire was required to construct six lanes from starting chainage to ending chainage, irrespective of what had been shown in the original drawings.

*Political*: Among all the critical risks, this is the least frequent one, even though it has acute impact. The classic and internationally famous Indian case of political risk

in infrastructure project is Dabhol power plant. Enron's Dabhol Power Corporation, proposed as a US$ 2.8 billion plant producing 2,015 MW of power, was among the pioneers of FDI in infrastructure sector in India. The power purchase agreement (PPA) between Dabhol Power Corporation and Maharashtra State Electricity Board (MSEB), guaranteed by the Government of Maharashtra (GoM), then under Congress regime, was signed in December 1993. In 1995, BJP–Shivsena coalition came to power. Later there was a mass protest by villagers resulting in a riot at the site. The project was stopped by the GoM because of serious allegations of human rights violation, lack of transparency, mala fide intentions and environmental hazards. In 1996, GoM and Enron signed a new agreement with price cut by 20% and output increased to 2,184 MW. In 1999, after the first phase went online, MSEB refused to pay for all the power, as promised in PPA, and the project was halted leading to a long legal battle. In road projects, a recent example is the Karur bridge in Tamil Nadu, where the concession was terminated by the municipality because of a damage done by a flood, which probably occurs once in 100 years. However, in NH projects, gross overnight taking over of individual assets is not possible in the current scenario, unless the whole policy of PPP undergoes a sudden transformation. However, there have been indirect political risks like politically backed agitations against toll payment and land acquisition, or political opposition from local authorities affecting preconstruction activities like permits and utility shifting.

## *Contractual Allocation of Land Acquisition Risk*

In the Ahmedabad–Mehsana project, the average expert rating indicated that the land acquisition risk was substantially more on the government. This is because, most of the land for the project was already acquired by the government before the concession was signed and was available to the concessionaire from the beginning. However, the concessionaire did face some risk in terms of additional stretches of land required due to change in scope, whereby the concessionaire had to face delay due to land acquisition, for which there was no contractual relief.

In the Jaipur–Kishangarh project, the average rating from experts implied that the land acquisition risk was equally shared by the government and concessionaire. This is because, while the responsibility to acquire land, free of encumbrance, was on NHAI, delays affected the concessionaire largely. NHAI promised to hand over land within 150 days of agreement, but the compensation paid in case of default was much lesser than the loss suffered due to the delay.

In the Krishnagiri–Thopurghat project, the land acquisition risk, as per the expert ratings, was equally shared by the government and concessionaire. In this case, NHAI was responsible for acquiring the land, but responsibility for removal of encroachment was on concessionaire. Furthermore, only existing right of way was promised upfront, and additional right of way was to be handed over on a piecemeal basis, as per a handover schedule. The compensation to be paid on default of schedule was also much lesser than actual loss of concessionaire. Although it is said that in case of delay in completion due to delay in land acquisition, provisional com-

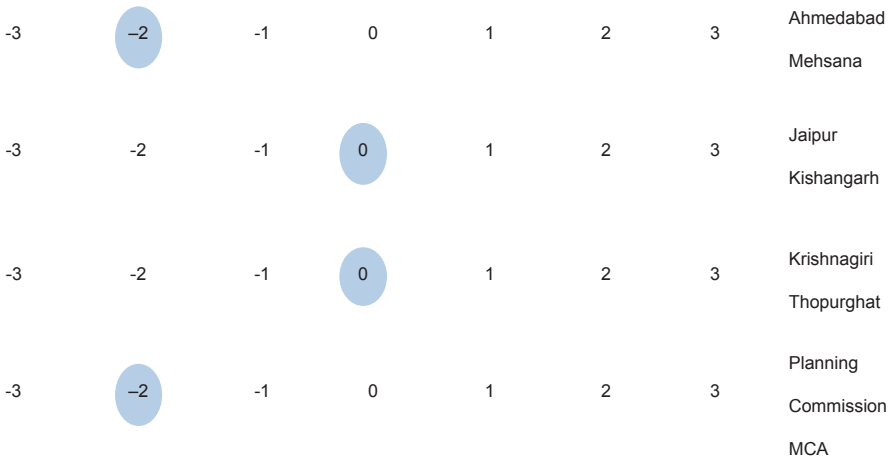


**Fig. 7.3** Risk share ratings for land acquisition

mercial operation date (COD) may be given, being a four-laning project, it might not be practically possible to start tolling on an unfinished road.

In Planning Commission MCA, the ratings suggest that the risk is significantly more on the government. This is because, the MCA being applied for the six-laning projects, the concessionaire can start tolling for the existing four lanes from the very first day. Moreover, if the authority stops paying the compensation for delay, the obligation of the concessionaire to build road in the portions where land is not available ceases to exist. Thus, delay in land acquisition has very minimum effect on the concessionaire. The effect is limited to the cost borne by the concessionaire to mobilize, demobilize and remobilize its resources due to the delays.

Thus, we can infer that allocation of land acquisition risk has been evolving over time. In initial projects, the risk was not so severe because the government had 100% land upfront. However, Jaipur–Kishangarh onwards this became a critical risk, as only a portion of the land was available to the concessionaire on appointed date, and acquisition went on simultaneously with the construction, with land being handed over on a piecemeal basis. In most of the projects in recent past, the concessionaire had to be fully involved in the land acquisition procedure to minimize delay, and the government started transferring more responsibility towards the private party, perhaps because it was believed that private party's efficiency will hasten up the procedure. However, experience has shown that land acquisition is a complex process, which only the government machinery can handle, and private party can never take the responsibility. It can only help the government to speed up the process. The Planning Commission's MCA has provisions which cover the concessionaire's interest. With provision of minimum guaranteed percentage of land upfront, and limited obligation on the concessionaire to finish parts of the project where land is not available, the risk seems to be allocated equitably once again. Figure 7.3 shows the risk ratings of the different CAs in terms of land acquisition.

## *Contractual Allocation of Revenue Risk*

In Ahmedabad–Mehsana CA, the expert ratings suggest that the revenue risk is marginally more on the concessionaire. This is because, there is provision of guaranteed return through extended concession period, and the concessionaire has provisions to collect non-toll revenues such as fees for emergency services from users as well as fees from petroleum dealers, automotive repairs, restaurants, convenience stores, etc. However, the specifications were such that service roads could be used without paying tolls, thus affecting the revenue stream, in the crucial initial period of concession.

In Jaipur–Kishangarh CA, the revenue risk, as per the expert ratings, is significantly more on the concessionaire. The revenue risk has been passed on almost totally to the concessionaire, except for the provision of revenue shortfall loan and police assistance for traffic regulation.

In Krishnagiri–Thopurghat CA, the expert ratings indicate that the revenue risk is marginally more on the concessionaire. This is because there is no alternate facility for the first 8 years of the concession. Beyond this period, if there is a need for capacity augmentation, the concessionaire has the first right of refusal to match the best bid for construction of that additional facility. Moreover, after construction, the additional highway shall be handed over to the concessionaire, who will operate, maintain and collect toll from the entire project highway, including the additional highway, by paying a fee.

In Planning Commission MCA, the expert ratings indicate that the revenue risk is marginally more on the concessionaire. This is because, even though there are clauses in this agreement to balance the risk, like provision of check plazas and fines for non-payment and overloading, to prevent toll leakage, and the mechanism to adjust concession period based on traffic realization, the upside restriction on toll collection reduces the profitability.

Thus, the revenue risk has always been passed on to the concessionaire. It is considered a business risk on which the concessionaire does due diligence before bidding. Only in the Planning Commission MCA, there is a clause whereby the concession period is adjusted depending on the traffic realization. However, this restricts the upside on toll collection, reducing the profitability. Figure 7.4 shows the risk ratings of the different CAs in terms of revenue.

## *Contractual Allocation of Permit/Approval Risk*

In Ahmedabad–Mehsana CA, it was concessionaire's responsibility to obtain all necessary clearances and hence the average rating from experts implies that the permit/approval risk is completely on the concessionaire.

In Jaipur–Kishangarh CA, based on the ratings, the risk is found to be significantly more on concessionaire. This is because almost all permits, including environmental clearances, are to be obtained by concessionaire before financial closure, except for clearances from railways which is obtained by NHAI. In addition, there

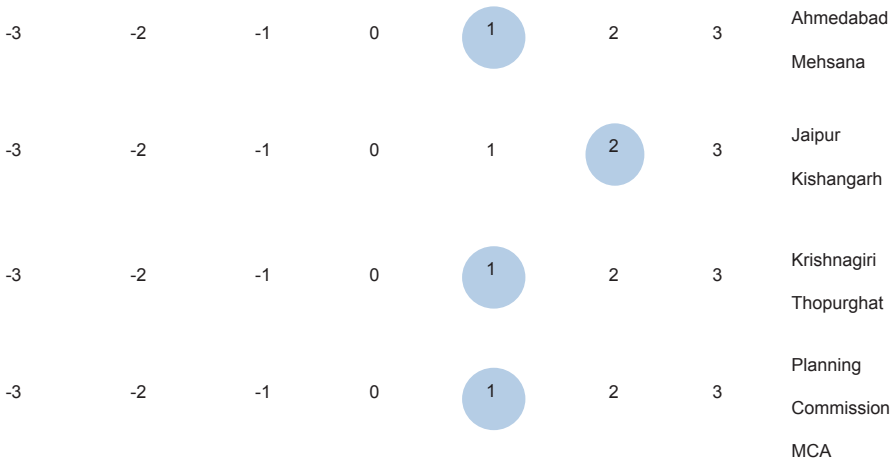


**Fig. 7.4** Risk share ratings for revenue

is a commitment by NHAI to assist the concessionaire in obtaining some of the permits.

The contractual provisions regarding permits/approvals in Krishnagiri–Thopurghat CA is similar to those in Jaipur–Kishangarh. Hence, here also, the expert ratings imply that the risk is significantly more on concessionaire.

In Planning Commission MCA, the average expert ratings suggest that the risk is equally shared by the concessionaire and the government. This is because, while the routine permits for construction are to be taken by the concessionaire, the government is supposed to obtain the environmental and wildlife clearances, apart from taking the clearances from railways and assisting the concessionaire in getting the permits for tree cutting and utility shifting.

There is a definite shift in allocation of this risk from the concessionaire side to the government side. This is because experience has shown that there are some clearances like those from environmental ministry or railways, which the authority is in a better position to obtain than the concessionaire. Thus, while the initial CAs required all permits to be taken by concessionaire, in case of Planning Commission MCA, the risk is equally shared, with the government taking care of railway clearances, environmental clearances, wildlife clearances and assisting the concessionaire in getting others like permits for tree cutting and utility shifting. The risk share ratings are shown in Fig. 7.5.

## *Contractual Allocation of Cost Overrun Risk*

In Ahmedabad–Mehsana CA, the cost overrun risk was found to be significantly more on the concessionaire. This is because of the high limit for variation in scope

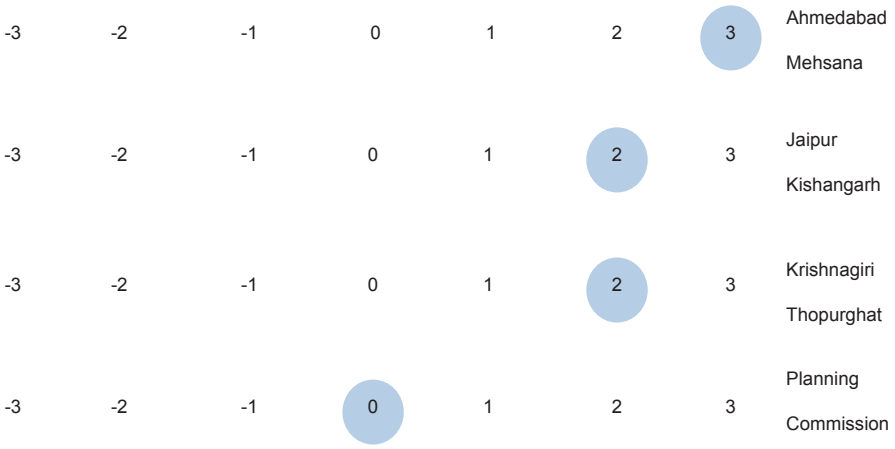


**Fig. 7.5** Risk share ratings for permit/approval

(10%) and the provision that valuation of variation will be done by the steering committee in case of disagreement. In addition, authority does not commit to pay for utility shifting.

In Jaipur–Kishangarh CA, again the ratings implied the cost overrun risk to be significantly more on the concessionaire. This is because, in addition to no commitment for utility shifting payments and the provision for scope variation, which in this case, however, is limited to 5% of total project cost and is to be valued by Dispute Resolution Procedure in case of disagreement, there are a whole lot of penalties for delay. In case of PPP, a delay in completion anyway means revenue loss for the concessionaire. Adding fines makes it double penalization.

In Krishnagiri–Thopurghat CA, again the risk is significantly more on the concessionaire. This is because even though there is the provision of authority paying for the utility shifting, there is the risk of extra cost related to capacity augmentation.

In case of Planning Commission MCA, ratings suggest that the risk is marginally more on the concessionaire. This is because, apart from authority paying for utility shifting, there is no binding obligation on the concessionaire to pay for capacity augmentation. If the cost of augmentation is too high, the concession may be curtailed to 12 years.

Cost overrun risk has always been passed on to the concessionaire, since it is perceived to be dependent on concessionaire's and contractor's efficiency. It was never a problem till last few years, as because of more control, PPP projects were historically less susceptible to cost overrun than traditional construction contracts. Recent abnormal price hike of key components have made cost overrun a key issue but it is yet to be addressed in the CAs. Figure 7.6 shows the risk share ratings of different concessions in terms of cost overrun.

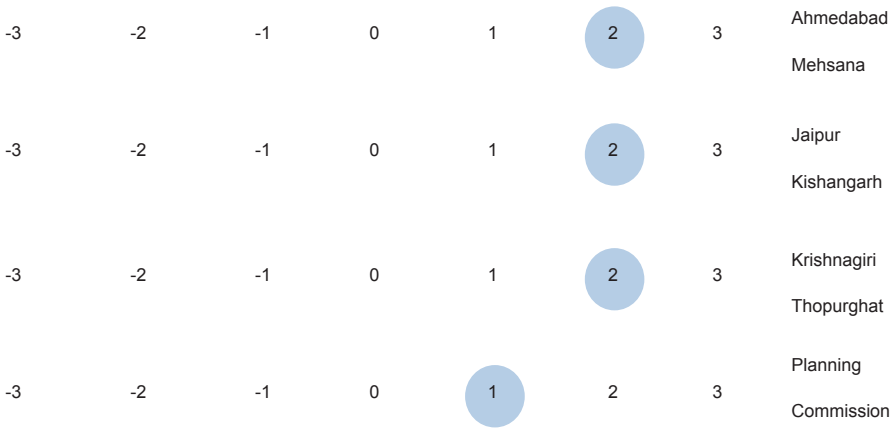


**Fig. 7.6** Risk share ratings for cost overrun

### *Contractual Allocation of Political Risk*

In Ahmedabad–Mehsana CA, the average expert ratings suggest that the political risk is marginally more on the government. This is because the concession guarantees a 20% return on equity in case of termination due to political force majeure.

In case of Jaipur–Kishangarh CA, Krishnagiri–Thopurghat CA and Planning Commission MCA, the risk is equally shared by the government and concessionaire. This is because, even though there is unambiguous provision of termination payment in case of political force majeure, the equity amount to be paid is based on the total project cost which is the minimum of

1. the actual cost incurred;
2. the cost set forth in financial documents and
3. a fixed sum decided by NHAI.

Since usually the sum decided by NHAI is less than the actual cost, the concessionaire shall always lose money in case of termination due to political force majeure.

Except for Ahmedabad–Mehsana, where a 20% return is guaranteed in case of termination, in all other concessions, termination payment is linked to total project cost, which almost always is a cost fixed by NHAI, which is lesser than the actual cost incurred. Thus, other than Ahmedabad–Mehsana, the risk has been always equally shared and there has not been much change between the agreements. The risk share ratings are shown in Fig. 7.7.

## Conclusions

The analysis of the contractual clauses in four different CAs, addressing the five critical risks of Indian PPP road projects, showed an evolution of allocation practice for most of the critical risks, as discussed below.

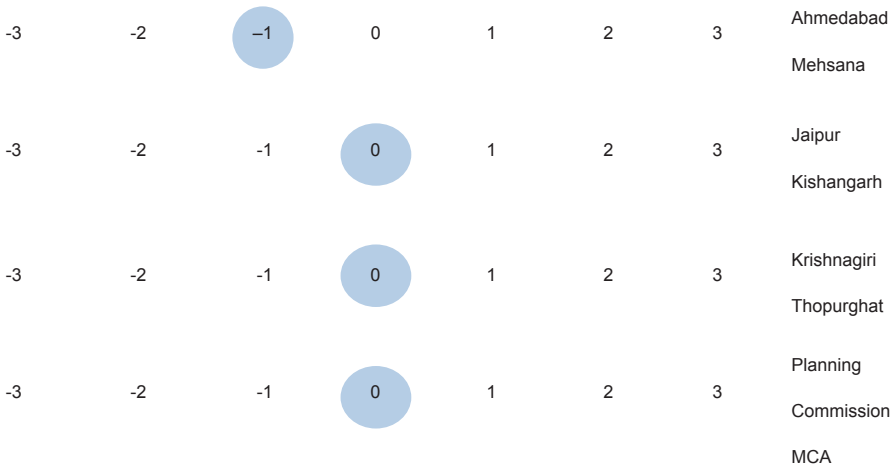


**Fig. 7.7** Risk share ratings for political risk

1. *Land acquisition*: In initial PPP projects like Ahmedabad–Mehsana, there was no risk of land acquisition on the concessionaire as the land was available upfront. In subsequent projects such as Jaipur–Kishangarh and Krishnagiri–Thopurghat, the risk became substantial, as the CA had provision for handing over of land on a piecemeal basis, and the handing over could be delayed indefinitely by paying a small compensation. However, the new Planning Commission MCA has clauses which cover the concessionaire's interests to some extent.
2. *Revenue risk*: The revenue risk has always been passed on to the concessionaire, though there have been some changes in the clauses.
3. *Permits/approvals risk*: In terms of permits and approvals, the responsibility was initially totally on the concessionaire. With subsequent projects, the government started to take some part in the procedure. The new model CA has a more equitable allocation of this risk.
4. *Cost overrun*: Cost overrun is again a risk which has traditionally been passed on to the concessionaire, and the situation is not much different even in the latest MCA.
5. *Political risk*: In Ahmedabad–Mehsana, the political risk was more on the government side, but in all subsequent concessions studied, including the new MCA, the risk is equally shared.

It can be concluded from the above analysis that over the years revenue risk and cost overrun risk have been always passed on to the concessionaire, which reflects the belief of the policymakers that the concessionaire is more capable of mitigating the risk. On the other hand, in case of land acquisition risk and permits/approval risk, the shift of the risk allocation towards the government in the more recent agreements like the Planning Commission MCA signifies the realization that these risks cannot be effectively mitigated by the private party, and allocating these risks to government is in the best interest for the projects.

Risk profile of PPP projects is much more complex than other forms of contract because of the difference between the public sector and private sector in perception and response of risks. This study has concentrated on the perspective of the concessionaire, i.e. the private sector towards management of risks in PPP projects, with the focus group consisting mostly of professionals from one of the large infrastructure promoters in India. Similar analysis from the point of view of other project participants might give interesting results. Further, similar analysis of CAs can be done for other sectors like ports, water, etc.

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# Chapter 8
# Value of Travel Time Saved in Modal Shift from Bus to Metro Case Study: Rohini (West) Delhi Metro Station

**Pawan Kumar**

## Introduction

The public transport plays a vital role in urban passenger movements. The majority of the city residents use public transport in their day-to-day travel. The choice between public transport and personalized mode is an individual decision that is further influenced by the government policies and the decisions of the urban local bodies. Recently, the availability and use of different modes such as metro, monorail, bus, bus rapid transport system, etc. have led to new choices, and the concept of "multimodal public transport system" in metropolitan cities in India has evolved. The multimodal transport system is an integrated approach that incorporates all components of urban transport into a single system for efficient use of available transport resources and infrastructure to ensure better mobility within a wide range of modal options for the commuters**.** In fact, multimodal public transport is a composite system of various modes. It provides access patterns by multiple modes by assuring integration, safety, and ease of use for all commuters, and hence requires adequate transport infrastructure at different levels to provide seamless mobility.

It is a difficult task for the commuters to choose one or more mode(s) among the available multiple modes of public transport. A commuter, while choosing either bus or metro as a mode, prefers to minimum travel time with maximum comfort, and wants proper connectivity to reach the desired destination. The options may be either a direct bus route from origin to destination or an integrated route of both bus and metro. The commuter has to make a choice. The commuter generally prefers the route that connects the destination directly in a complete journey chain. The commuter may prefer metro if the trip requires shorter waiting time, minimum effort for

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The views expressed in the paper are of the author and do not necessarily reflect the views of TCPO/MoUD.

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transfer at interchange, and provides greater comfort, even if its composite fare is higher. On the contrary, commuters may prefer bus, if services are available point to point within catchment areas and cost-affordable fare. In this context, there are multiple factors that affect the decision of modal shift from bus to metro. Therefore, it is imperative to assess the quantification of travel time saved due to modal shift for proper understanding of commuter's preferences and choices.

## Value of Travel Time and Travel Time Saved

Travel time is defined as the cost of time spent on traveling from one point to another, including actual travel and waiting time. It includes cost of personal (unpaid) time spent and cost of business time (paid) spent in travel. Hence, the value of travel time saved due to reduced travel time has a significant share in transport costs. Generally, the cost of travel time and saved travel time depends on trip classification, travel conditions, traveler preferences, etc. The total travel time costs are the product of time spent in traveling multiplied by unit cost (Small et al. 2005).

Various studies have quantified travel time unit costs and the value of travel time savings, based on business costs, traveler surveys, and by measuring behavioral responses of the travelers faced with a trade-off between time and money (Mackie 2003). Generally, the value of travel time tends to increase with income, and is lower for children and the unemployed. However, the employed are often willing to pay more for travel time savings (Hymel et al. 2010). Under favorable conditions, public transit travel time can be productive. The findings of various surveys indicate that the captive users often spend time in working, reading, relaxing, etc. (Lyons et al. 2011). The saving in travel time is inversely proportional to trip length. It is estimated that carpools increase average trip distances by 10%, buses by 15%, and rail by 20%, for automobile access (Delucchi 1998).

Various attributes such as speed, comfort, reliability, etc., affect commuters in choosing a particular mode. Generally, the commuters prefer metro as it has less congestion, fewer accidents, but more speed and more reliability, in comparison to bus (Kumar et al. 2009). The quantification of travel time saved uses wage rate method and revealed reference method. In the wage rate method, the monetary evaluation of travel time of passengers is determined by the average wage rate of the passenger and the same has been treated as the value of time. Generally, monthly wage rate based on 8 hours per working day is considered. The value of time for work journey and nonwork journey is different and hence separate monetary values for both journeys are considered (Srinivasan and Goel 1968).

Commuters are classified into various categories such as metro passengers, bus passengers, car passengers, etc., but time value for cycle traffic, two-wheelers, and pedestrians is also significant. The time involved in walking and waiting is valued at a different rate than the in-vehicle time. If the in-vehicle time is taken as 1, then value of walking time and waiting time is considered as 2 and 3, respectively. However, these values are based on European research (Harison 1974). Generally, data are collected by interviewing sample passengers of various categories and finding

out their average monthly income. The sample interviewed should include nonwage earners such as the unemployed children and homemakers. Suitable accounts are made to arrive at the average wage rate for these categories. In the case of wage rate as a measure of value of time saved, the overheads borne by the employers are added to wages that the wage earners receive. The overheads include the employer's contribution towards provident fund, insurance, pension, and other fringe benefits. The UK uses a figure of 18% as employer's overheads. Possibly a round figure of 20% may be used in Indian conditions (Kadiyali 2007).

In the revealed preference method, the value of time saved is determined by studying the travelers having different time and cost for the journey, according to choice of mode, route, destination, trip frequency, etc. This yields a result reflecting the revealed behavior or preference of the people and therefore is very near to the real value (Stubbs et al. 1980).

There is an estimation of the effect of building height limit on the spatial size of Indian cities and commuting cost. The building height limit is imposed by floor area ratio (FAR). A unit increase in FAR reduces city area (average of linear and semilog effects) by 20% and hence there is significant saving in commuting cost. The findings of the study states that in the city of Bengaluru, the annual commuting cost per kilometer for a household is ₹ 969.00, but there is a reduction in the city's edge household commuting cost by ₹ 523.00 per kilometer per year due to unit increase in FAR. This relation reveals the saving in commuting cost by considering a marginal increase in height limit (Brueckner and Sridhar 2012).

In the Indian context, most of the researchers have derived value of travel time from the wage rate approach. By developing a disaggregated behavioral model based on household data for Ahmedabad city, the value of travel time for car, scooter, and bicycle users is ₹ 2.71/hr, ₹ 3.96/hr, and ₹ 0.36/hr, respectively, for employed persons (Raghavachari and Khanna 1976). The Central Road Research Institute (CRRI) (1982) conducted survey work on selected routes (trunk routes and secondary routes) as part of the Road User Cost Study in 1982. The results of the study stated that the average hourly income of bus passengers was ₹ 7.00 on trunk routes and ₹ 4.50 on secondary routes. However, these values pertain to 1980, but the same was updated in 1992. Based on values pertaining to 1990 prices, the value of travel time for bus passengers on trunk routes was ₹ 27/hr for work trip and ₹ 3/hr for nonwork trip. On secondary routes, the value of the same was ₹ 10/hr and ₹ 2/hr for work trip and nonwork trip, respectively. It was observed that about 40% of trips were work oriented and 60% of the trips were nonwork trips (Kadiyali et al. 1992).

## Measurement of Value of Travel Time Saved

### *Background*

Due to the operation of Delhi Metro Line-I, the commuters started to shift from road-based modes to the metro as road journey was congested, polluted, prone to

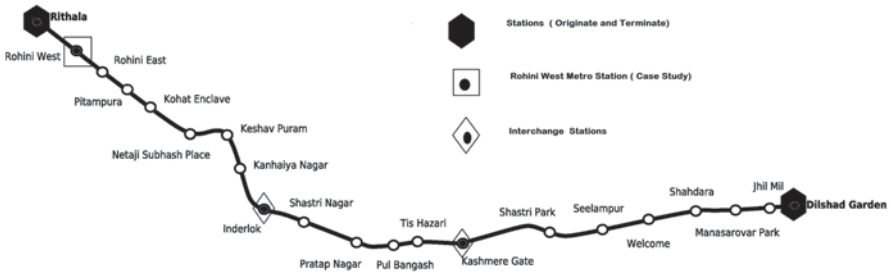


**Fig. 8.1** Location of Rohini (West) Metro Station on Delhi Metro Line-I

accidents, increased travel time, etc. The study has been undertaken for assessing the saving in travel time due to the shift from bus to metro.

## *Survey Design*

A primary survey was conducted to understand travel characteristics and to collect transport-related information among the metro commuters, before and after the use of Metro. Rohini (West) Metro Station on Delhi Metro Line-I was selected. The survey was conducted for a 12-h duration, i.e., from 8.00 a.m. to 8.00 p.m., on a normal working day at the station. A survey pro forma was designed to collect relevant socioeconomic profile and travel characteristics of the commuters. Figure 8.1 shows the location of Rohini (West) Metro Station, station (originate and terminate), and interchange stations on Delhi Metro Line-I also known as Red Line.

## *Aim of the Survey*

The aim of the survey was to assess the time and cost saved due to modal shift from bus to metro at Rohini (West) Metro Station on Delhi Metro Line-I.

## *Methodology*

In the study, "opinion survey approach" has been adopted. The commuters were asked to evaluate the value of travel time themselves. For rating of saving time, commuters depend generally on their wage rate. In other words, the quantification of time saved due to modal shift to metro based on hourly wage income has been adopted. The commuters were classified into various income groups and the average value of time for each group was judged by them. Around 200 random samples were collected at this station.

**Table 8.1** Modal shift from road-based modes to metro

| S. N. | "Modes used" before using metro at present | No. of trips | Percentage of trips (%) | Total values (%) |
|---|---|---|---|---|
| A. | Public transport and intermediate public transport (IPT) modes | | | |
| | Bus/chartered bus/mini bus | 130 | 65.0 | 80.50 |
| | Auto rickshaw | 31 | 15.5 | |
| B. | Private modes | | | |
| | Scooters/motorcycles | 14 | 7.0 | 10.50 |
| | Car | 7 | 3.5 | |
| C. | Nonmotorized transport (NMT) modes | | | |
| | Walk | – | | 9.0 |
| | Bicycles | 5 | 2.5 | |
| | Cycle rickshaws | 13 | 6.5 | |
| | *Total* | *200* | *100* | *100* |

**Table 8.2** Average travel time saved at Rohini (West) Metro Station

| S. N. | No. of passengers | Journey time (before Metro) in minutes | Journey time (after Metro) in minutes | Saving of travel time in minutes | Average travel time saved per passenger in minutes |
|---|---|---|---|---|---|
| 1 | 200 | 25,356 | 19,607 | 5,749 | 28.745 min = 29 min (say) |

## *Modal Shift: Road-based Mode (Bus) to Metro*

The commuters were asked about the "modes used" before using metro at present. The data are classified into three categories of road-based modes as shown in Table 8.1.

Table 8.1 states that 80.50% of the road-based commuters on this route have shifted to metro. Similarly, 10.50% private mode users have shifted to metro, due to park and ride facilities, comfort, safety, etc.

## *Travel Time Saved*

The commuters were asked to inform about their travel time (origin to destination) by using metro. They were also asked to inform travel time if the journey was performed by bus. The difference between both values reveals saving in time as shown in Table 8.2.

## *Value of Travel Time*

As per Opinion Survey, commuters evaluated the value of their reduced travel time of different durations. Table 8.3 shows the calculation of average value of time for the government employees and Table 8.4 for the private sector employees.

**Table 8.3** Calculation of the average value of travel time for government sector employees

| S. N. | Income group in ₹ (Monthly) | Sample size *(work trips)* | Mean monthly income (₹) | Hourly wage rate (₹/h)* | Average value of time (₹/min) |
|---|---|---|---|---|---|
| i. | < 15,000 | 19*(12)* | 11,230 | 64.54 | 1.07 |
| ii. | 15,000–20,000 | 20*(11)* | 16,430 | 94.42 | 1.57 |
| iii. | 20,000–25,000 | 30*(26)* | 22,480 | 129.19 | 2.15 |
| iv. | 25,000–30,000 | 27*(26)* | 27,991 | 160.86 | 2.68 |
| v. | 30,000–35,000 | 31*(28)* | 31,190 | 179.25 | 2.98 |
| vi | 35,000–40,000 | 26*(21)* | 37,679 | 216.54 | 3.60 |
| vii. | 40,000–45,000 | 23*(12)* | 41,871 | 240.63 | 4.01 |
| viii. | 45,000–50,000 | 13*(7)* | 45,934 | 263.98 | 4.39 |
| ix. | > 50,000 | *11(3)* | 52,001 | 298.85 | 4.98 |
| | *Total* | *200 (146)* | | | |

*The mean monthly income under various income groups has been calculated from the primary survey sheets, and the values are shown in Table 8.3. The total working days for the government employees is derived by considering 5 working days in a week. Hence, the total working days in a year is 261 days (i.e., 365 days—52 Saturdays—52 Sundays = 261 days). The hourly wage rate is derived after assuming 8 working hours per day, for 261 working days in a year (i.e., 261 working days × 8 hours per working day = 2088 h). Further, the calculation follows the following steps: mean monthly income is multiplied by 12 months. It gives the annual income, which is further divided by the total number of working hours in a year (i.e., 2,088 h). It yields hourly wage rate, which is further divided by 60 min to get the average value of time per minute. For example,

*For the 1st category of income group, i.e., income group < ₹ 15,000 as shown in Table 8.3*

| | |
|---|---|
| Mean monthly income | = ₹ 11,230.00 |
| Annual income | = ₹ 11,230.00 × 12 months = ₹ 134,760.00 |
| | = ₹ 134,760.00 is income for 261 working days in a year |
| | = ₹ 134,760.00 is income for 2,088 hours (261 days × 8 working hours/days) |
| Hourly wage | = ₹ 134,760.00 is divided by 2,088 hours = ₹ 64.54 per hour |
| Hourly wage rate (₹/hr) | = ₹ 64.54 per hour |
| Hourly wage rate (₹/min) | = ₹ 1.07 per minute, i.e., average value of time for the commuter of income group less than ₹ 15, 000 per month. |
| Average value of time (₹/min) | = ₹ 1.07 |

The same procedure may be applied for calculation of average value of travel time for other income groups as shown in Table 8.3.

## *Value of Travel Time Saved*

The opportunity cost is a component of value of travel time saved. In fact, it is the economic value of the time that a commuter may get if that time is not spent in performing the journey. The CRRI (2007), New Delhi, has defined opportunity cost for different income groups based on number of trips performed by each occupational group. It is noted that the percentage values are obtained from the survey data and not necessarily true in all circumstances. The CRRI study states that opportunity

**Table 8.4** Calculation of average value of travel time for private sector employees**

| S. N. | Income group in ₹ (monthly) | Sample size *(work trips)* | Mean monthly income in ₹ | Hourly wage rate (₹/hr)** | Average value of time (₹/min) |
|---|---|---|---|---|---|
| i. | < 15,000 | 19*(12)* | 11,230 | 53.81 | 0.89 |
| ii. | 15,000–20,000 | 20*(11)* | 16,430 | 78.73 | 1.31 |
| iii. | 20,000–25,000 | 30*(26)* | 22,480 | 107.73 | 1.79 |
| iv. | 25,000–30,000 | 27*(26)* | 27,991 | 134.14 | 2.23 |
| v. | 30,000–35,000 | 31*(28)* | 31,190 | 149.47 | 2.49 |
| vi. | 35,000–40,000 | 26*(21)* | 37,679 | 180.57 | 3.01 |
| vii. | 40,000–45,000 | 23*(12)* | 41,871 | 200.65 | 3.34 |
| viii. | 45,000–50,000 | 13*(7)* | 45,934 | 220.13 | 3.66 |
| ix. | > 50,000 | *11(3)* | 52,001 | 249.20 | 4.15 |
| | *Total* | *200 (146)* | | | |

**The mean monthly income under various income groups has been calculated from the primary survey sheets and values are shown in Table 8.4. The total working days for the private sector employees is derived by considering 6 working days in a week. Hence, the total working days in a year is 313 days (i.e., 365 days—52 Sundays = 313 days). The hourly wage rate is derived after assuming 8 working hours per day for 313 working days in a year (i.e., 313 working days × 8 hours per working day = 2,504 h). Further, the calculation follows the following steps: mean monthly income is multiplied by 12 months. It gives the annual income, which is further divided by the total number of working hours in a year (i.e., 2,504 h). It yields the hourly wage rate, which is further divided by 60 min to get the average value of time per minute. For example

*For 1st category on income group, i.e., income group <₹ 15,000 as shown in Table 8.4*

| | |
|---|---|
| Mean monthly income | =₹ 11,230.00 |
| Annual income | =₹ 11,230.00 × 12 months = ₹ 134,760.00 |
| | =₹ 134,760.00 is income for 313 working days in a year |
| | =₹ 134,760.00 is income for 2,504 h (313 days × 8 working hours/days) |
| Hourly wage | =₹ 134,760.00 is divided by 2,504 hours = ₹ 53.81 per hour |
| Hourly wage rate (₹/hr) | =₹ 53.81 per hour |
| Hourly wage rate (₹/min) | =₹ 0.89 per minute i.e., average value of time for the commuter of income group less than ₹ 15,000 per month. |
| Average value of time (₹/min) | =₹ 0.89 |

The same procedure may be applied for the calculation of average value of travel time for other income groups as shown in Table 8.4.

cost for income group (₹ 10,000–15,000) and income group (>₹ 50, 000) is 85% and 91%, respectively. However, the same relationship—range of opportunity cost from 85% (income group <₹ 15, 000) to 91% (income group >₹ 50,000)—has been used as a base to derive opportunity cost of different income groups for calculation of travel time.

Generally, it is believed that the opportunity costs of travel time saved are higher for higher income groups and hence suitable values have been assigned based on intuitive perception. For income group (<₹ 15,000), the opportunity cost is taken as

**Table 8.5** Opportunity cost for different income groups. (The Central Road Research Institute, New Delhi (2007))

| S. N. | Income groups in ₹ as assigned by CRRI (monthly) | Opportunity cost as assigned by CRRI (%) | Income groups adopted (monthly) | Opportunity cost adopted (%) |
|---|---|---|---|---|
| i. | Not specified | 83 | | |
| ii. | <=3,000 | 93 | | |
| iii. | 3,000>=5,000 | 96 | | |
| iv. | 5,000>=10,000 | 91 | | |
| v. | 10,000>=15,000 | 85 | <15,000 | 85 |
| vi. | 15,000>=20,000 | 80 | 15,000–20,000 | 86 |
| vii. | 20,000>=25,000 | 85 | 20,000–25,000 | 86 |
| viii. | 25,000>=30,000 | 80 | 25,000–30,000 | 87 |
| ix. | 30,000>=40,000 | 79 | 30,000–35,000 | 87 |
| x. | | | 35,000–40,000 | 88 |
| xi. | 40,000>=50,000 | 89 | 40,000–45,000 | 89 |
| xii. | | | 45,000–50,000 | 90 |
| xiii. | >50,000 | 91 | >50,000 | 91 |

**Table 8.6** Average value of travel time saved for government employees

| S. N. | Income groups in ₹ (monthly) | Passenger trips | Rate of time (value in ₹/min) | Opportunity cost (%) | Total saved time (value in ₹/min) |
|---|---|---|---|---|---|
| i. | <15,000 | 19 | 1.07 | 85 | 17.28 |
| ii. | 15,000–20,000 | 20 | 1.57 | 86 | 27.00 |
| iii. | 20,000–25,000 | 30 | 2.15 | 86 | 55.47 |
| iv. | 25,000–30,000 | 27 | 2.68 | 87 | 62.95 |
| v. | 30,000–35,000 | 31 | 2.98 | 87 | 80.37 |
| vi. | 35,000–40,000 | 26 | 3.60 | 88 | 82.36 |
| vii. | 40,000–45,000 | 23 | 4.01 | 89 | 82.08 |
| viii. | 45,000–50,000 | 13 | 4.39 | 90 | 51.36 |
| ix. | >50,000 | *11* | 4.98 | 91 | 49.84 |
| | *Total* | *200* | | | *508.71* |
| | *Average value* | | | | ₹ *2.54/min* |

Calculation of Value of travel time saved per day

- Number of Metro passengers at Rohini West Station =15,000
- Average time saved by per passenger =29 min
- Average value of time =₹ 2.54/min
- Percentage of regular trips =60%
- Value of travel time saved per day =15,000×29 min × ₹ 2.54/min×0.60
  =₹ 662,940.00

**Table 8.7** Average value of travel time saved for private sector employees

| S. N. | Income groups in ₹ (monthly) | Passenger trips | Rate of time (value in ₹/min) | Opportunity cost (%) | Total saved time (value in ₹/min |
|---|---|---|---|---|---|
| i. | < 15,000 | 19 | 0.89 | 85 | 14.37 |
| ii. | 15,000–20,000 | 20 | 1.31 | 86 | 22.53 |
| iii. | 20,000–25,000 | 30 | 1.79 | 86 | 46.18 |
| iv. | 25,000–30,000 | 27 | 2.23 | 87 | 52.38 |
| v. | 30,000–35,000 | 31 | 2.49 | 87 | 67.15 |
| vi. | 35,000–40,000 | 26 | 3.01 | 88 | 68.86 |
| vii. | 40,000–45,000 | 23 | 3.34 | 89 | 68.36 |
| viii. | 45,000–50,000 | 13 | 3.66 | 90 | 42.82 |
| ix. | > 50,000 | *11* | 4.15 | 91 | 41.54 |
| | *Total* | *200* | | | *424.19* |
| | *Average value* | | | | ₹ *2.12/min* |

Calculation of value of travel time saved per day

- Number of Metro passengers at Rohini West Station = 15,000
- Average time saved by per passenger = 29 min
- Average value of time = ₹ 2.12/min
- Percentage of regular trips = 60 %
- Value of travel time saved per day = 15,000 × 29 min × ₹ 2.12/min × 0.60
  = ₹ 553,320.00

85 %, which is the same as assigned by CRRI for income group ₹ 10,000–15,000. Further, income groups ₹ 15,000–20,000 and ₹ 20,000–25,000 have given equal opportunity cost, i.e., 86 %, followed by 87 % for income group ₹ 25,000–30,000 and ₹ 30,000–35,000, due to less variations in sample size and majority of the trips belong to these income groups. Gradually, opportunity costs have been increased up to 91 % for income > ₹ 50,000 which is the same as assigned by CRRI. Table 8.5 shows the opportunity cost of different income groups assigned by CRRI and adopted for the present study.

Based on the values shown in Table 8.5, average value of travel time saved is calculated for both the government employees and the private sector employees as shown in Tables 8.6 and 8.7, respectively.

## *Discussion*

1. The saving in travel time is one of the reasons for modal shift from bus to metro along the Delhi Metro Corridor Line-I. The roads are saturated with all kinds of modes of transport. Both motorized and nonmotorized vehicles use the same right of ways. The congestion, accidents, pollution, and slow speed of the vehicles are common phenomena, which lead to increased travel time. In this context, shift of commuters from bus to metro is a healthy sign.

2. The cost of travel time is a part of transport cost. Hence, the travel time saved has its own value, in terms of both money and time in journey chain. The study shows that the average time saved due to modal shift from bus to metro is 29 min. The saving in travel time highlights the improved transport infrastructure, better services in terms of punctuality, frequency, less congestion, etc. The saving in travel time can be further evaluated for other purposes by the different commuters in different travel conditions.
3. The monetary value of travel time saved may vary among different types of commuters having different socioeconomic backgrounds. The study shows that the value of travel time saved is ₹ 2.54/min and ₹ 2.12/min for government employees and private sector employees, respectively. Various holidays, such as gazetted holidays, restricted holidays, leaves, etc., are not taken into account. The variation in value is only due to the difference in number of working days in both sectors. In this study, the opportunity cost is taken to be the same for both, but depending on the quality of work delivered/output of work, it may vary significantly.
4. The average time saved is 29 min per passenger due to modal shift from bus to metro in a trip. In fact, the journey includes walking to a bus stop/metro station, waiting time, in-vehicle travel time (IVTT), etc., and each one has different unit costs. In this context, the saving in travel time is due to both out-vehicle travel time (OVTT) and IVTT apart from parking charge if park and ride facility is used at metro stations. Hence, value of travel time varies depending on commuter preferences and use of personalized modes at access points to the metro.
5. Time saving is not the only factor responsible for commuters switching to metro. There are many other factors that directly affect choice of metro in comparison to bus. The most important factors that motivate the commuters to use metro are comfort, reliability, safety, and security, followed by time saving and accessibility. Similarly, the facility for a separate ladies compartment (coach) also helps women to take the metro ride safely and comfortably. However, the role of feeder bus services and park and ride facilities at metro stations is crucial to increase metro ridership.

The observations are based on a single case study at Rohini (West) metro station on Delhi Metro Line-I. It is caveated that certain factors such as change in land uses, vehicle ownerships, road design, available right-of-ways, etc., can affect the modal shift on other corridors. Further, micro factors such as waiting environment at transfer points, availability of connecting modes, cleanness of stations/stops, and other amenities/facilities may be considered for assessing travel time saved in modal shift from bus to metro at the stations.

## Conclusion

Delhi Metro Line-I is characterized by various interchanges such as Rail–Metro Interchange at Shahdara; Bus–Metro Interchange at Kashmere Gate, and Metro–Metro Interchange at Inderlok, but Rohini (West) is a station just near the hospitals,

hotels, and malls, and shift is basically from bus to metro. Hence, the improvement in physical design at station areas, use of mechanized devices for connecting at various space levels, etc. may reduce transfer time. Similarly, unified ticketing system of both bus and metro can provide smooth transfer from one mode to another. Hence, transfer time is an important attribute that affects the saving of travel time. Further, the frequency of metro has significant impact on the commuters' mind, to choose metro as the main mode in their journey chain because the frequency of metro is at the interval of 4 min during peak hour and 5–15 min during off-peak hours on Line-I (Red Line). During peak hours, frequency at shorter interval provides less waiting time and hence may attract more modal shift. Generally, Delhi Metro runs on time and there is hardly any delay on the route except some unavoidable situations such as signaling problems, technical snags in heavy rains, software malfunction, unclaimed bags on the platforms, etc. The intelligent transport system applications also avoid line congestion and provide well-defined headways. Hence, less possibility in delays also favors more ridership of the metro.

In metropolitan Indian cities, one group of commuters (preferably government employees) may prefer to stay in the core area by paying higher rents but lower transport cost and hence saving both journey time and transfer cost. On the contrary, some of them may prefer to live away from the city (i.e., in satellite towns) by paying comparatively lower rent but higher transport cost and time. Hence, it is totally based on the choice and the willingness of the commuters to pay a higher price for either transport or house rent. In both cases, the value of travel time depends on affordability and paying capacity of the commuters by striking a balance between saving of travel time and paying of extra housing rent.

The findings of this research work support that there is always demand for connecting multinodes of employment centers, residential pockets, commercial areas, recreational centers, educational hubs, etc. with high capacity rapid transit for better mobility and less travel time, and hence city residents prefer to shift from bus to metro. Further, central business districts, housing areas, shopping centers, etc. may be encouraged to grow on mass rapid transit corridors, which further reduce transport demand. In this context, the concept of transit-oriented development is promoted. Transit-oriented development is a concept that aims at integrating high-trips-generating land uses with mass transit system in a city and its periphery. It reduces personalized modes, congestion on roads, air pollution, etc. by promoting mass transit and its ridership.

The policy recommendation for modal shift from bus to metro is a part of good governance that integrates all components of urban transport for sustainable transport system. The modal shift is not justified only based on travel time saved but due to indirect contribution in reduction of congestion, pollution, fuel consumption, and accidents on the roads. Similarly, bus-metro integration and multi mobility plan in station area is necessary which may further save travel time by reducing waiting and transfer time. Furthermore, planning efforts for all stops/stations with basic information, interchange points with real-time information, updated website, provisions of transfer facilities, etc. are more important to make modal shift more attractive with increased patronage and improved services.

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# Chapter 9
# Hidden Cost in Public Infrastructure Project: A Case Study of Kolkata East–West Metro

**Sutapa Das**

## Introduction

In developing countries, various types of infrastructure projects have gained momentum to address the growing need for public facilities (Mahalingam et al. 2011). Among these, public transportation in urban India deserves a special mention because of its pressing demand to provide a safer, faster, cheaper and less polluting travel option for the ever-increasing urban population (JNNURM 2006). The total number of people living in Indian cities has swelled up in last four decades—rising from 109 million in 1971 to 160 million in 1981, 217 million in 1991, 286 million in 2001 and to 377 million in 2011 (Ministry of Home Affairs 2011; Padam and Singh 2001). As most of the present developments are taking place at the fringe areas, people are forced to stay and work in the suburbs and often need to travel for hours between home and office, while being exposed to alarmingly high air pollution, noise, congestion and traffic fatality levels.

Tiwari and Mohan (1999) identified that the worst sufferer among this group is a huge population that can afford only non-motorised mode of transport including walking. They also argued that catering for these people's requirements by redesigning the existing roads would effectively increase the safety and efficiency for both motorised and non-motorised modes. This fact is more applicable for low- and middle-income countries, where non-motorised traffic is huge, and even for motorised traffic, more than 50 % comprised of public transport and para-transit modes (Mohan 2008).

Given these caveats, in order to purportedly create better living and travel conditions for people, several Indian cities, such as Delhi, Kolkata, Bangalore, Mumbai, Hyderabad etc., are developing metro-rail network. These projects, being loss making (except Delhi Metro), are traditionally built and operated with government funds (Dalvi and Patankar 1999). India's National Urban Transport Policy or NUTP

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(MUD 2006) suggests that Government of India (GOI) or central government will provide maximum 20 % of capital funds with equity share from the concerned local government. The rest of the funding will come from other sources. However, the users, i.e., the direct and indirect beneficiaries within the city, must pay for the operating costs and the rolling stock. Though NUTP is framed 'in favour of sustainable development', it can be questioned whether this costing model itself is sustainable, as metro tickets are usually subsidised at least 10–15 times more heavily than a bus ticket for the same journey (Tiwari 2007). This is possible only through a huge subsidy from government, using tax payers' money. That means a person from a remote village who may never use the metro service is also paying for its construction and operation.

Such burdensome nature of public infrastructure projects is well researched, but their dire necessity forces government and other financing bodies to make massive investments (Dalvi and Patankar 1999; JICA 2010). Hence, viability of such projects is judged by social cost–benefit analysis. However, there exist few cost components similar to those used as social benefits. These cost components go unnoticed as neither the financer nor the user need to bear them. The present study probes into these unnoticed or hidden costs of mega infrastructure projects in order to find their significant impact on national resources, using the case study of Kolkata East–West Metro by Kolkata Metro Rail Corporation (KMRC).

## Kolkata Traffic Scenario

The overcrowded city of Kolkata (24,718 people/km$^2$.), under Kolkata Metropolitan Corporation, has a North–South linear growth with its main traffic spine running parallel as: (1) ferry service on the River Hoogly at West; (2) existing metro-rail at centre and (3) Eastern Metropolitan Bypass at East. However, the city occupies just 14 % of 1,851.41 km$^2$ of Kolkata Metropolitan Area (KMA) with a population of 14.1 million (Ministry of Home Affairs 2011) and traffic scenario of the main city is intertwined with the same of KMA. Length of highways, arterial and other major roads in KMA is about 700 km, while mainly arterial, sub-arterial and local roads run at city level (Chakraborty and Roy 2005).

Even with the most varied types of transport modes than any other Indian city and being the first metro-rail system in Asia, Kolkata's traffic scenario is bleak. In a recent study by MUD & Wilber Smith Associates (2008), various transport-related indexes were reported (Table 9.1). In comparison to the country's average, Kolkata falls far below in positive parameters such as accessibility or safety, and exceeds in negative parameters such as congestion, parking interference etc.

With many extinct bus routes and reduction in number of buses (in average 3.5 % p.a.), people are increasingly opting for private cars, two-wheelers and para-transit modes such as autos (3-wheeler) for comfortable and faster travel. Two-wheelers and autos have the two lowest occupancy rates with highest pollution per person per unit distance, in addition to risks associated with reckless driving and

**Table 9.1** Index for public transportation for Kolkata

| Index for | Definition | Value |
|---|---|---|
| Public transport accessibility | 1/ Avg. distance in km to the nearest bus stop or railway station | 11.12 |
| Service accessibility | % of work trips accessible within 15–30 minutes time | 114.00 |
| Congestion | $1-\frac{\text{Avg. speed on major roads during peak hours}}{\text{Desirable avg. speed on major roads during peak hour}}$ The desirable avg. speed taken as 30 km/h. | 0.40 |
| Walkability | Availability of footpath (i.e., Footpath length/Length of major roads in the city) + Pedestrian facility (i.e. score estimated based on opinion on available pedestrian facility) | 0.81 |
| City bus transport supply | No. of city buses (both public and private operations) for 1,00,000 population | 26.20 |
| Safety | 1/ (No. of road accident deaths per 1,00,000 population) | 0.08 |
| Para-transit | No. of para-transit vehicles for 10,000 population | 28.50 |
| Slow-moving vehicle | Availability of cycle tracks + Share of slow-moving vehicles in trips | 0.03 |
| On-street parking interference | 1/ (% of major road length used for on-street parking + on-street parking demand on major roads) | 3.00 |

violating traffic rules. Moreover, safety is a major issue for autos that are notoriously infamous for over-speeding, over-crowding and driving in the opposite lane. As a high number of autos in Kolkata are not registered and ply with fake number plates or drivers do not have licences, it is difficult to punish such auto-drivers for breaking traffic rules especially when such auto-drivers are protected by unions.

In spite of the fact that Kolkata has the highest road length of 4,613 km among the four metropolitan areas of the country, in terms of both area and total length (Sridhar and Kashyap 2012), city roads suffer from inadequate width, unscientific geometrics, close intersections and same right-of-the-way for all types of vehicles. Narrow roads have an added problem of illegal parking and hawkers; these reduce the vehicular speed and increase emission. The pathetic conditions of present traffic scenario as noted in various studies (Ghose et al. 2005; IDFC & Superior Global Infra. Consult. 2008; KMDA 2008; MUD & Wilber Smith Assoc. 2008) are:

- Only 6% of area for transport is present, which is far below the recommended value of 15–18%.
- 65% of the roads have D or lower level of service.
- 72% of roads have travel speed less than 20 kmph.
- 7% is the annual vehicle growth.
- 70% of buses and 50% of cars are older than 10 years, causing 35% and 16% of the total pollution, respectively.
- Autos using adulterated fuel contribute to 31% pollution.
- Noise during peak hours is around 81.60 dB. It is much higher than the acceptable limit of 60–65 dB and little below 85 dB, causing hearing damage over long-term exposure.

- Suspended particulate matter is 150–250 μg/m$^3$ against World Health Organization (WHO) limit of 90 μg/m$^3$. It is the highest pollution level in country. The average respirable suspended particulate matter (RSPM) values for Kolkata district averaged over the 3 years, 2009–2011, is 109.35 (Sridhar and Kashyap 2012), which is higher than the National Ambient Air Quality (NAAQ) standard of 60 for residential and industrial areas set by the Ministry of Environment and Forest (2009).
- There was an incidence of around 25 road accidents per 1,00,000 population with a fatality rate of 13 % in 2005.

## Overview of Kolkata East–West Metrorail Project

The main objective of the Kolkata East–West Metrorail project is to meet the ever-rising traffic demand in KMA, by developing a mass rapid transit system. Indirectly, it will contribute to the economic development and improvement of the urban environment in the region, by reducing traffic congestion and vehicular pollution (JICA 2010). With a high primacy factor, KMA serves a vast hinterland, extending over 11 Indian states of east and northeast (Roy 2009). Connectivity of KMA with its neighbouring region is served by road network and rail route emerging from Howrah and Sealdah. As the Kolkata East–West Metro connects the city's eastern growth boundary with Howrah at west via Sealdah at central location, it is expected to positively influence the eastern India as a whole.

KMRC, as a joint-venture company of GOI and state government of West Bengal, is carrying out the project with partial financial assistance of ₹ 2,983.9 crore (1 crore = 10 million) as loan from Japan International Cooperation Agency (JICA). The original plan was to build a 13.74 km long line between Howrah Railway station and Sector–V of Salt Lake, using a budget of ₹ 4,676 crores. In 2009, the project was extended up to Howrah Maidan with an increased budget of ₹ 4,874.58 crore (Table 9.2). The revised route of 14.58 km consists of 8.84 km of underground corridor and 5.74 km of elevated corridor. The grade change takes place between the stations of Salt Lake Stadium and Phoolbagan. Between the two stations of Mahakaran and Howrah, 470 m of tunnel will pass 12 m below the river bed (Fig. 9.1). Such underwater tunnelling is first of its kind in India (KMRC 2011).

### *Project Schedule*

After approval in 2008 by GOI, the project schedule has changed several times. Originally, the duration of execution was 3.5 years (01.07.2006–31.12.2010) and the next 3 months were set aside for testing and commissioning (DMRC 2006). However, the project actually started on 7 February 2009, targeting October 2014 as the date of completion and next 5 months for testing and commissioning (KMRC

**Table 9.2** Cost breakdown of Kolkata East–West Metro Project (KMRC 2011)

| Construction cost in ₹ crores | | Other cost heads in ₹ crores | |
|---|---|---|---|
| Description | Cost | Description | Cost |
| Traction and power supply | 157.92 | Land cost | 126.06 |
| Underground tunnelling | 1,856.93 | Escalation at 5% p.a. | 364.00 |
| Viaduct of elevated portion | 154.50 | Interest on borrowed money | 234.00 |
| Construction of stations | 75.00 | Tax and duty | 300.00 |
| Depot for rolling stock maintenance | 280.00 | Cost to be paid to E. Rly. | 30.00 |
| Detailing of elevated stations | 3.15 | Contingency | 180.00 |
| Lifts and escalators | 59.00 | Interim consultancy charges | 5.00 |
| Platform screen door | 82.30 | | |
| Roof work of elevated stations | 47.99 | | |
| Track work of entire stretch | 82.94 | | |
| Auto fare collection system | 43.02 | | |
| Rolling stock | 467.20 | | |
| Signal, telecom, train control | 134.72 | | |
| Station security | 10.00 | | |
| General consultants | 180.85 | | |
| Subtotal | 3,635.52 | Subtotal | 1,278.30 |
| Grand total | | 4,874.58 | |

This excludes design charge of ₹ 39.24 crore (KMRC 2011) and environment management of ₹ 56.86 crore (DMRC 2006)

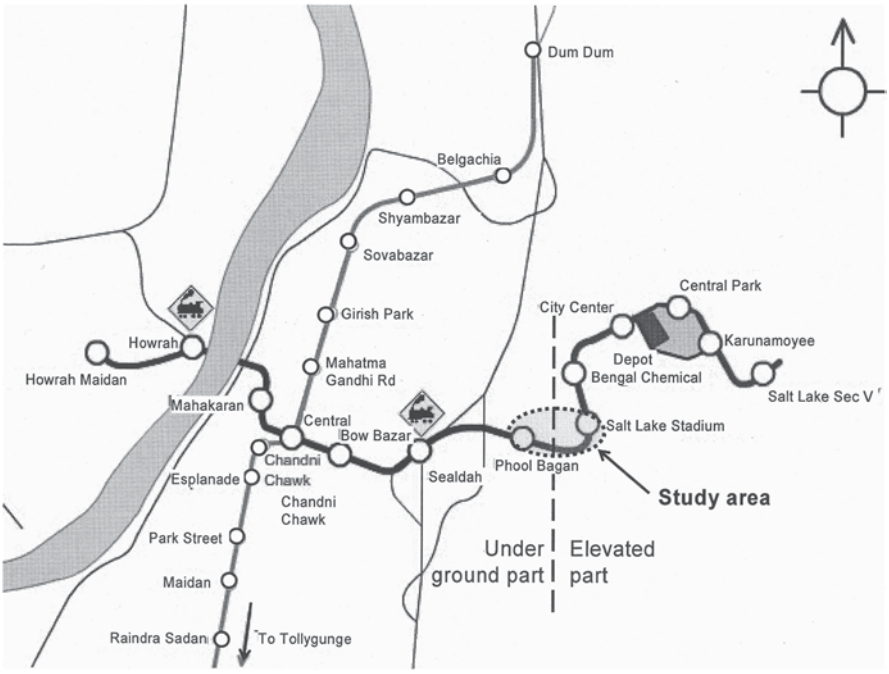


**Fig. 9.1** Kolkata East–West Metro corridor (DMRC 2006)

2011). It was also planned to start partial operation between Sealdah Station and Salt Lake Sector–V by November 2013. However, very recently, the managing director of KMRC forecasted a delay of 2 years to July 2016, i.e., total duration of 7.5 years that will incur significantly high cost of Rs 5,000 crore (Pramanik 2012).

### *Project Cost Breakdown*

Various direct and indirect costs involved in the project can be grouped under broad categories as: construction, pre-operative (tax, duty, escalation etc.) and interest during construction. Apart from these, there is cost involved in environmental mitigation and management plan (Table 9.2).

### *Traffic Diversion*

KMRC planned for temporary traffic diversion for different roads along the proposed corridor only where alignment is in transition phase. Diversion will be for a short period to facilitate construction such as decking etc. The alternate routes were proved suitable to cater for diverted traffic. For example, 1.5 km stretch of Narkeldanga Main Road, between Swabhumi cultural complex near Salt Lake Stadium and Phoolbagan, is presently closed. The planned alternative routes parallel to it are: (1) Satin Sen Sarani near Bengal Chemical; (2) Suresh Ch. Banerjee Road near Beliaghata and (3) Canal Circular Road near Chingrihata (DMRC 2006). However, in reality, the roads along the bank of Subhas Sarobar lake is used (Banerjee 2010). From now, this road will be mentioned as Lakeside Road for easy understanding.

## Methodology

As the project is under construction, a complete study of the entire alignment is not feasible. Instead, one of the critical parts—the above-mentioned stretch of 1.5 km—has been chosen for this research where tracks go underground from elevated level. Hence, instead of pre-cast piling or tunnel boring, cut-and-cover method is used, which leads to the closure of the busy Narkeldanga Main Road and traffic diversion becomes unavoidable. A three-pronged data collection approach was adopted to capture the economic impact of this diversion:

- Road network inventory survey
- Classified volume count survey
- Opinion survey of people

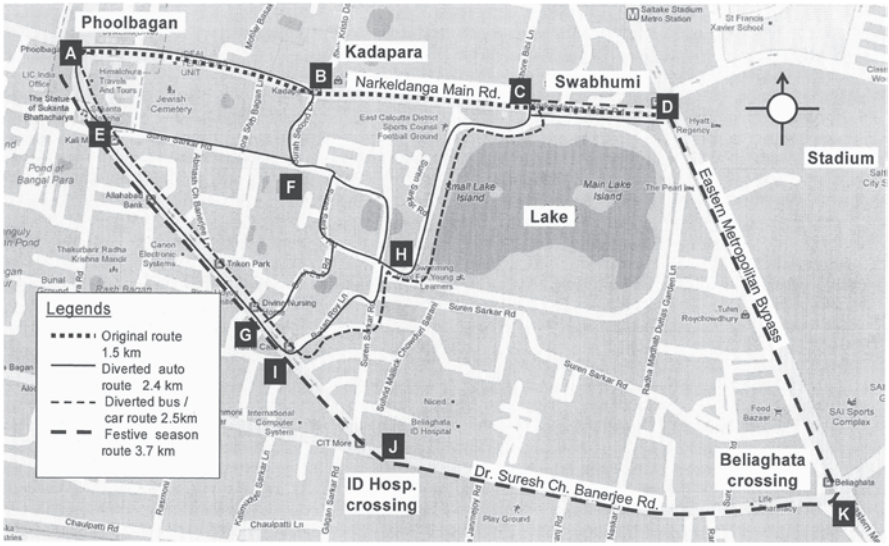


**Fig. 9.2** Normal routes and various diverted routes

## *Road Network Inventory Survey*

Inventory survey was conducted on Suren Sarkar Road, Badan Roy Lane, Surah Second Lane and Lakeside Road through which majority of the diverted vehicles pass (Fig. 9.2). Information was noted such as: lanes, median availability, intersection facilities, pedestrian facility details, driving condition, on-street parking and traffic control measures.

## *Classified Volume Counts Survey*

The survey was conducted on a Wednesday—a normal working day—from 6 am till 10 pm for both directions. Classified traffic volumes in 15-min intervals were recorded for buses, minibuses, cars, taxis, autos and two-wheelers. Slow-moving vehicles and trucks were neglected. The survey location was near Swabhumi (Point C in Fig. 9.2) where traffic flow of Narkeldanga Main Road shunts to Lakeside Road.

## *Opinion Survey of People*

This area is mainly residential with a few large gated communities such as Rukmani–Parashmani and Lake District. Apart from that there are:

- Offices for state government and IT industry;
- Educational institutes: Sir Gurudas Banerjee College and four big high schools;
- Health-care facilities: Apollo Gleneagles Hospital, Suraksha Lab, B.C. Roy Children's Hospital etc;
- Commercial complex: Pantaloons, Mani Square, Khudiram Hawkers Market etc;
- Sports facility: Salt Lake Stadium, SAI (Sports Authority of India) complex and
- Others: Swabhumi cultural complex, Hyatt Regency hotel.

People predominantly using this closed road stretch are local residents or people enjoying above mentioned facilities or who need to access far-away places via EM Bypass, Sealdah station or Sir Gurudas Banerjee halt station. Respondents were randomly selected for survey from this sampling frame along with auto and bus drivers who travel regularly in this route (one private bus, one minibus and two auto routes). They were mainly asked about safety, convenience and driving condition of roads and pedestrian facilities.

### *Calculation of Hidden Cost*

From the results of the road network inventory and the classified volume count survey, the detour for different types of vehicles and passengers carried by them were found respectively. Using unit values for fuel consumption, pollution and emission for different types of vehicles, the total values for each of these entities per day were found. Similarly, loss for man-hour per day was also calculated. The fuel for detour is also associated with subsidy for diesel and health impact, which in turn can be quantified as cost/litre of diesel (Sengupta and Mandal 2002). All these values were summed for 1 year as annual hidden cost, assuming full traffic operation on 260 working days and 50 % traffic operation on weekends. As the unit rate for different cost heads has a different reference year, the cost heads were adjusted for escalation and reported as present cost. The mathematical calculations for computing are simple and self-explanatory as shown in the section for hidden cost analysis.

## Results and Discussion

### *From Road Network Inventory Survey*

Refer Fig. 9.2 for interpretation of the results. Until February 2011, 1.5 km stretch of Narkeldanga Main Road (A–B–C–D route) was open. In June 2011, the stretch between Point A and Point C was blocked. Only a narrow strip between Phoolbagan and Kadapara Crossing (Point A to Point B) was open and autos entered through Surah Second Lane to reach Lakeside Road, i.e., A–B–F–H–C–D route. Autos also used Suren Sarkar Road (A–E–F–H–C–D route) and Surah East Road (A–G–H–


**Fig. 9.3** **a** Dangerous road curve near Swabhumi. **b** Footpath occupied by KMRC

C–D route). Buses, cars and taxis used Badan Roy Lane to access Lakeside Road, which is a 2.5-km-long A–I–H–C–D route resulting in a detour of 1.0 km. As the name itself suggests, Badan Roy Lane and Surah Second Lane are lanes through residential areas and are not meant for catering to public transport especially the long Jawaharlal Nehru National Urban Renewal Mission (JNNURM) buses. Suren Sarkar Road is meandering in nature with many intersections with narrow lanes. Though it has two lanes, residents often park their vehicles on the road, effectively leaving one lane for the moving traffic. Also, instead of following Suren Sarkar Road or Surah Second Lane, autos take all possible shortcuts (shown in solid line) suitable for pedestrians only. It is apparent that these roads cannot have crossing bays, medians, signals or manual traffic control. As a result, there is no convenience or safety for the pedestrians.

Lakeside Road is wider (two lanes), but it is also not designed or constructed for such heavy traffic including construction vehicles. As a result, all the roads show signs of deterioration. Debate between Kolkata Municipal Corporation and KMRC on the responsibility to maintain the roads keeps these roads in a bad shape. Often construction vehicles or KMRC staff buses are parked on Lakeside Road. Presently, the yard has swallowed almost one lane at the curve near Swabhumi (Point C in Fig. 9.2). One cannot see the opposite side traffic at this bend which is very dangerous (Fig. 9.3a), and there is no traffic surgeon or traffic signal available to help. Footpaths are also occupied by KMRC (Fig. 9.3b).

During festive season of Durgapuja and Diwali, in 2011 and 2012, buses could not enter Lakeside Road as religious and cultural activities blocked the Badan Roy Lane and parallel lanes for almost 1 month. As a result, those buses had to ply via Dr. Suresh Ch. Banerjee Road and EM Bypass (3.7 km long A–E–G–J–K–D route in Fig. 9.2) to reach Swabhumi. These activities are local traditions, but neither traffic police nor KMRC envisioned the problem. Hence, for buses, cars and taxis, there is a detour of 1.0 km for 240 days (5 week days × 48 weeks) and a detour of 2.2 km for 20 days (5 weekdays × 4 weeks) of festive season, leading to an average of 1.09 km/day of detour. Detour details are summarised in Table 9.3.

**Table 9.3** Summary of various detours

| Route type | Path followed | Route length (km) | Detour (km) |
|---|---|---|---|
| Normal route | A–B–C–D | 1.5 | 0.0 |
| Diverted auto route | A–B–F–H–C–D, A–E–F–H–C–D, A–G–H–C–D etc. shown in solid line | 2.4 km in avg. | 0.9 |
| Diverted bus/car route in non-festive season | A–I–H–C–D | 2.5 | 1.0 |
| Diverted bus/car route in festive season | A–E–G–J–K–D | 3.7 | 2.2 |
| Avg. Diverted bus/car route year-round | – | 2.59 | 1.09 |

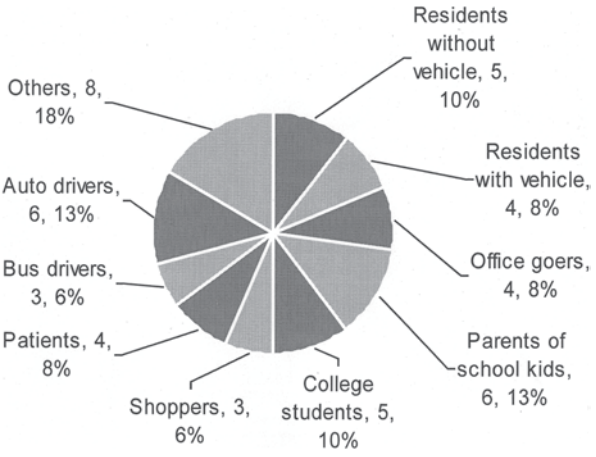


**Fig. 9.4** Demography of the respondents

## *Results from Opinion Survey*

Demography of the respondents is shown in Fig. 9.4. Member from each group being small and sampling method being rather informal, it is justified to draw a very broad conclusion. In general, people appreciated the benefits of the project and the need for traffic diversion. However, they blamed unplanned and unorganised diversion routes without any traffic control for unsafe and uncomfortable ride, congestion, loss of time and money. They also noted the delay in project schedule as a critical issue.

Auto-drivers charged ₹ 1.00 extra or 20% over the regular fare of ₹ 5.00 when preliminary detour via Surah Second Lane started. Presently, a longer detour is compensated by taking up to six passengers (while maximum four is allowed) or breaking the licensed route into smaller segments. Buses and cars are not only suffering from lengthy route, but congestion and bumpy drives are causing wastage of time and fuel. Drivers are uncomfortable with poor visibility at the narrow turn near Swabhumi as mentioned in the previous section and also of the fact that children

**Table 9.4** Average number of passengers (Excludes driver)

| Vehicle type | No. of motorised vehicles on a typical weekday | | | | | | Avg. occupancy[a] | Total passengers |
|---|---|---|---|---|---|---|---|---|
| | Early morning | Morning | Afternoon | Evening | Late evening | Total | | |
| | 6–8 hr | 8–12 hr | 12–16 hr | 16–20 hr | 8–10 hr | | | |
| Bus | 9 | 24 | 18 | 21 | 8 | 80 | 53.8 | 4304 |
| Minibus | 4 | 11 | 7 | 9 | 4 | 35 | 29.1 | 1018.5 |
| Taxi | 9 | 34 | 20 | 31 | 12 | 106 | 3.3 | 349.8 |
| Car | 17 | 155 | 113 | 104 | 86 | 475 | 4.1 | 1947.5 |
| Auto | 14 | 85 | 57 | 78 | 36 | 270 | 4.6 | 1242 |
| 2-wheeler | 20 | 63 | 40 | 47 | 19 | 189 | 1.8 | 340.2 |

[a] Source: Datta et al. 2008

of the neighbourhood frequently cross or play on the inner roads or Lakeside Road. Plying on bad roads was reported to damage vehicle parts and increase maintenance costs roughly by 30%.

Local residents complained about the ordeal to access their homes, increased pollution and were of the view that continuous flow of public vehicles in inner roads is affecting safety, especially of children. Shoppers and patients reported to have restricted choices and usually they preferred to avoid the rough ride through Lakeside Road.

## *Results of Classified Volume Counts Survey*

Average speed noted in normal condition is 18 km/h. (KMDA 2008). The average speed noted here is 14 km/hr as per the local traffic police.

## *Economic Analysis: What is Lacking?*

Usually, for public infrastructure projects, economic analysis is carried out within a broad framework of social cost–benefit analysis. Here apart from first cost and operating cost, tangible and intangible benefits are considered. The Kolkata East–West Metro is also evaluated over a period of 5 years of construction and 32 years of operation by DMRC (2006) who mentioned, in the detailed project report, the benefits of the current project, which are:

- Cost savings for operation of all vehicles due to decongestion.
- Time saving of metro-commuters and also of those using the existing modes but on less congested roads.
- Reduced pollution and fuel consumption by fewer vehicles and their improved speed.
- Reduced number of road accidents.

- Savings in road infrastructure and development costs that would be needed to handle increasing traffic if metro-rail is not introduced.
- Intangible benefits: reduced road stress; better accessibility and mobility; economic stimulation in the micro region and increased business opportunities; improved image etc.

Recollecting the results from road network survey or people's opinion, it was found that exactly these points were mentioned to be lacking in the present scenario due to traffic diversion. In fact, previous studies have shown that people opt for diversion to avoid unexpected delays or to decrease overall travel time or both. When a forced diversion affects these factors, people usually feel very frustrated especially on their return trip (Heathington et al. 1971). Moreover, the diesel used by buses and many cars are highly subsidised, whose cost is borne by the entire nation. As the construction time is also a significant part (here 19%) of project life cycle, socio-economic loss due to traffic diversion must be calculated for all such public infrastructure projects.

## Proposed Hidden Cost Analysis Due to Diversion

This cost analysis is based on the following assumptions. For precise values, more accurate data collection should be carried out. Refer Fig. 9.2 for point locations. The calculations are shown in Tables 9.5 and 9.6.

- Vehicles only near Swabhumi and Lakeside Road crossing (Point C) are considered as diverted vehicles.
- Number of days of operation is 260 days per year (5 working days /week for 52 weeks).

**Table 9.5** Calculation of lost man-hours due to traffic diversion

| Vehicle type | Route details[a] | Trip time (min) | Time loss (min) | No. of passenger per day[b] | Lost man-hrs per day by all passengers (h) | Value loss /man-hrs (₹)[c] | Value loss /day (₹) |
|---|---|---|---|---|---|---|---|
| Bus | 2.59 km at | 11.1 | 6.1 | 4,304.0 | 437.57 | 10.23 | 4,476.38 |
| Minibus | 14 km/h | | 6.1 | 1,018.5 | 103.55 | 10.23 | 1,059.29 |
| Taxi | | | 6.1 | 349.8 | 35.56 | 17.50 | 622.35 |
| Car | | | 6.1 | 1,947.5 | 198.00 | 35.81 | 7,090.23 |
| Auto | 2.4 km at | 10.3 | 5.3 | 1,242.0 | 109.71 | 10.23 | 1,122.33 |
| 2-wheeler | 14 km/h | | 5.3 | 340.2 | 30.05 | 21.67 | 651.21 |
| | | | | | | Total | 15,022 |

Annual loss of man-hour (for 260 weekdays) = ₹ 3905665
Extra fair of ₹ 1.00 paid by auto passengers = ₹ 1242/day or ₹ 322,920/year
[a] From Table 9.3; [b] from Table 9.4; [c] from DMRC (2006)

**Table 9.6** Calculation of loss of fuel and increased emission. (Source: [a] Nesamani 2010; [b] Datta et al. 2008)

| Vehicle type | No. of vehicles/day | Detour (km) | Fuel consumption (L/km)[a, b] | Extra fuel for detour/vehicle (L) | Total extra fuel for detour/day (L) | Daily Pollution emission (gm/km)[b] | Daily total emission for detour (gm) |
|---|---|---|---|---|---|---|---|
| Bus | 80 | 1.09 | 0.279 | 0.304 | 24.33 | 5.2426 | 457.15 |
| Minibus | 35 | 1.09 | 0.182 | 0.198 | 6.94 | 3.2376 | 123.51 |
| Taxi | 106 | 1.09 | 0.077 | 0.084 | 8.90 | 2.8333 | 327.36 |
| Car | 475 | 1.09 | 0.077 | 0.084 | 39.87 | 1.1906 | 616.43 |
| Auto | 270 | 0.09 | 0.046 | 0.004 | 1.12 | 8.0163 | 194.80 |
| 2-wheeler | 189 | 0.09 | 0.029 | 0.003 | 0.49 | 9.7350 | 165.59 |
| | | | | | | Total | 1884.85 |

- For buses, taxis and cars, the operation is 240 days by diverted route and 20 days (4 weeks) by festive route leading to average 1.09 km/day of detour, i.e., diverted route length of (1.5 + 1.09) km. = 2.59 km (refer Table 9.3).
- Normal trip duration is 5 min (for 1.5 km at18 km/h).

As bus, minibus, taxi and about 30% of cars use diesel, total extra diesel for detour can be calculated from the sixth column of Table 9.6 as (24.33 + 6.94 + 8.90 + 30% of 39.87) = 52.129 L/day or 13,553.5 L/year (for 260 working days).

- Approximate annual expenditure for this extra diesel = ₹ 609,906.00.
- Annual subsidy at ₹ 13.55/L = ₹ 183,649.00.
- Similarly, cost for petrol for bikes and 70% of cars is at ₹ 70/L = ₹ 507943.80
- Cost of LPG for autos at ₹ 48.67/L = ₹ 14172.70.
- Annual damage cost of pollution from detour at ₹ 38.40/kg. (DMRC 2006) = ₹ 18,818.34.
- Annual health cost at ₹ 5.77/L of diesel (Sengupta and Mandal 2002) for 13,553.5 L of diesel = ₹ 78,203.70.

## *Summary of All Hidden Costs in ₹ per Year Due to Traffic Diversion*

After adjustment for escalation at 5% p.a. (DMRC 2006) for items with unit rate from past, all hidden costs excluding consideration for accidents and vehicle maintenance cost are totalled as ₹ 7,000,460 for 260 weekdays of a year (Table 9.7). If it is assumed that on weekends the traffic flow and number of travellers constitute 50% of that of a weekday, the cost for the remaining 105 days of year will accrue ₹ 1,413,554 resulting in ₹ 8,414,014 p.a for road closure of 1.5 km and detour of 0.9–1.09 km. From the list, it is apparent that loss of man-hour, subsidy, pollution and health effect has a socio-economic impact at the national level.

**Table 9.7** Summary of hidden costs excluding accidents and vehicle maintenance

| Cost head | Reference year for unit cost | Cost in ₹ | Present cost in ₹ after adjustment for escalation |
|---|---|---|---|
| Man-hour | 2006 | 3,905,665.00 | 5,233,964.64 |
| Extra fare | 2012 | 322,920.00 | 322,920.00 |
| Diesel cost | 2012 | 609,906.00 | 609,906.00 |
| Diesel subsidy | 2012 | 183,649.00 | 183,649.00 |
| Petrol | 2012 | 507,943.80 | 507,943.80 |
| Auto LPG | 2006 | 18,818.34 | 18,818.34 |
| Health damage from diesel | 2002 | 78,203.70 | 127,385.59 |
| | | Total | 7,004,587.37 ≈ 7,000,460.00 |

## Conclusion

This present study to identify and to quantify the hidden cost of a mega infrastructure project using case study of Kolkata East–West Metro is the first of its kind. Other studies done on similar projects mainly cover social benefit vs. economic cost (Dalvi 1999; JICA 2010; Mury et al. 2007). However, these two entities—the former being subjective and the latter being objective in nature—do not fit into the same scale. Hence, judging a project without the substantial social cost is not scientific.

In this research, it was found that factors considered as social benefits of a project are contributing to the hidden cost burden on the society itself during construction. A traffic diversion of 1.5 km causing a mere detour of 0.9–1.09 km was found responsible for a loss of ₹ 8,414,014.00 p.a. for extra fuel, subsidy, loss of man-hour, pollution etc., and excludes higher vehicle maintenance cost and accident-related cost. As these, costs are not directly borne by the financer or the metro-user; they remain unnoticed or hidden. However, definitely, it has a significant socio-economic impact. As such, road closure and diversions are unavoidable in cases like this one; their impacts must be considered in initial planning of mega public infrastructure projects and also during construction if the project is heavily delayed. Else, strictly speaking the technical analyses and cost projections are manipulated.

However, the aim should be to minimise its duration or impact by proper project planning and its strict implementation. For example, in this case, prohibition of unauthorised parking, temporary signalling and traffic control could have been implemented. Similarly, festive activities on these roads could have been restricted by seeking co-operation of local residents. By adopting good construction practices, KMRC could have avoided project delay, parking of construction vehicles on Lakeside Road, spill over of construction yard on road and dumping of debris on footpath.

Considering the magnitude of public infrastructure project in terms of both cost and its expected return, time management in work completion has immense implications. Longer gestation period will, in fact, not only eat away maximum of estimated budget with shorter output but also add up public cost in the form

of extra-pay for diverted route along with additional time spent on travelling. Although the present study focuses on a single area, it throws light on policymaking for mega infrastructure projects in the transport sector of the developing world with similar situations. Apart from the predominant factor of traffic diversion, other common issues related to public infrastructure projects such as congestion, slow speed of vehicles, air pollution, etc. are the major concerns. A comparative study of their contribution towards the hidden cost with or without diversion can be a promising direction of future research in this domain. As high-capacity bus system costs only 5–10% of metrorail (Tiwari and Mohan 1999), such alternatives should also be considered while deciding upon the best option of mass rapid transport system.

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# Chapter 10
# Impact of Urban Policy Reform: A Case Study of the Informal Sector in Solid Waste Management in Delhi

**Pooja Ravi**

## Introduction

The initiation of reforms by governments, in order to improve their functioning and overall development or progress, has been the hallmark of both developed and developing countries across the globe. During the 1980s, as a result of internal and external pressure, governments around the world brought about functional reforms[1] in order to make public-service delivery more efficient and more responsive to the needs of the citizens and to have greater accountability.[2] However, such developments left certain sections of the population out of the ambit of positive effects envisaged at the time of formulation of the reforms. It is difficult to determine the exact reason as to why certain state interventions or measures to improve the way of life for people have gone so tragically awry, as James Scott puts it.[3]

In order to determine the reasons for the inability of the state to disperse the benefits of reforms the present chapter takes up the case of reforms which were introduced in solid waste management (SWM) in the city of Delhi and the impact it had on ragpickers who form the informal sector in the management of such wastes.

Waste management has been given scant attention in the developing countries, being sidelined in comparison with other issues such as the provision of housing,

[1] Reforms have been defined as "deliberate efforts on the part of the government to redress perceived errors in prior and existing policy and institutional arrangements" by Grindle and Thomas 1991, p. 4.

[2] Donald 2000, p. 1.

[3] Scott 1998, p. 4.

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electricity, water etc. In India it was with the Surat plague that the dismal state of SWM activities in urban centres was highlighted and its importance in urban governance. The Chap. 11 by Sacratees in this volume estimates welfare loss due to improper municipal solid waste management in Tirunelveli, which highlights its importance for urban governance acknowledged. Despite coming up with various measures and committees to improve the management of wastes, it was only in 1996 that by way of a PIL filed in the Supreme Court of India (Special Civil Application No.888 of 1996, Almitra H. Patel and Another vs. the Union of India and Others) that the Ministry of Environment and Forests notified Municipal Solid Waste (Management & Handling) Rules 2000 (MSW Rules) making it mandatory for all municipal bodies to follow the rules. However, the attempt to reform SWM by the MSW Rules proved to be far from satisfactory. This led municipal authorities to seek the help of the private sector to provide better services. Such an action led to the "municipal authority moving from being a service provider to being a regulator and service facilitator."[4] Such a step was adopted by many cities in India with Delhi being one of them. However, the amount of attention that has been paid in policy documents to the informal sector which is involved in the management of wastes has been very sparse. The informal sector which is involved in SWM comprises various levels. The sector is labour intensive and comprises a chain constituted by recyclists (ragpickers), recyclable dealers (small, medium and large) and finally the recycler units at the top. It has a hierarchical structure, with increasing specialisation and decreasing numbers as we move upwards. Ragpickers are the actors at the bottommost level in the informal sector engaged in SWM. They earn a livelihood out of collecting recyclable material from garbage which is generated from households, commercial establishments etc. and selling off the recyclable material to the junk dealer. Ragpickers form the focus of this study.

The incorporation of the ragpickers in the formal mechanism of waste management can fill four gaps in the waste management system. First, they can help in the door-to-door collection of waste. Second, they can contribute to the segregation of waste which is by and large ignored by the municipal authorities. Third, incorporating this section into the formal mechanism of waste management would lead to better collection of waste in congested cities than using sophisticated machinery and would allow for more areas to be covered as well. Fourth, the formal incorporation of ragpickers in SWM activities would also ensure that they get a proper livelihood and the conditions of their work can be improved as opposed to the risky environment that they presently work in, with no proper equipment which can jeopardise their health. Despite the contribution of ragpickers to SWM, Urvashi Dhamija notes that "public policy by and large has considered it impractical to incorporate this section in the official waste management system."[5]

It is this non-inclusionary nature of reforms in SWM which had a negative impact on the informal waste industry, more specifically on ragpickers leading to a dent in their source of livelihood that the present study tries to explore. With

[4] Zhu et al. 2008, p. 73.

[5] Dhamija 2006, p. 72.

approximately 1,50,000–2,00,000 waste workers in Delhi, most of whom belong to vulnerable communities and are unable to find alternative livelihoods apart from the fact that they work in extremely hazardous conditions, it becomes imperative to explore such questions.[6]

The chapter at hand is divided into three sections. The *first* section illustrates the review of literature undertaken, wherein the concept of reforms and the various processes and the role of policymakers by which they come about, are explored. The section also deploys the concept of social exclusion to see how certain groups in the population are excluded by the reform process and how well inclusion can fare when it is used as an antidote for social exclusion as well as the various obstacles which prevent a democratic reform process. The *second* section dwells on the methodology used to empirically test the theoretical framework built by the review of literature. For this purpose, the case of SWM reforms introduced in Delhi has been taken up along with an assessment of the resultant impact of these reforms on ragpickers who constitute the informal sector involved in the management of wastes. The *third* section of this chapter presents the results of the study carried out by the researcher. The final section summarises all elements explored in the chapter, bringing forward the main obstacles which prevent policy reform from being inclusive and democratic in nature.

## I

## *Review of Literature: Reforms, Reformers and the Logic of Development*

The forces which drive reforms can be broadly classified into two: external and internal factors. The chief external factor which drives reforms would be "market-driven globalization, generally in the guise of international financial institutions that impose their perspectives on governments and act as purveyors of ideas about appropriate policies for development"[7] making inroads into the domestic policy-making arena by forging close ties with not only the reformers or policymakers but also the economic elite. The influence of globalization also has another dimension. The reformers are mostly urban-educated individuals and, due to the kind of training that they receive, are pushed to believe that the reforms are needed to keep up with the changes that governments across the globe are bringing about and that their own country must not be left out. As a consequence, they sometimes bring in reforms which are ill-suited to the needs of their own state reflecting their "strong

[6] Schindler and SB 2012, p. 8.

[7] Grindle 2000, p. 5

belief in the superiority of the market"[8] which to a great extent is due to their "academic training"[9] and "professional experience".[10]

The internal or domestic factors which bring about reforms are varied. However, the main actors and institutions which play an important role would be pressure from certain groups or individuals in society, NGOs, mass media, small bodies within the executive and political pressure. Thus, by looking at the various factors which lead to the generation of reforms it can be concluded that reforms are "elite projects generated by small groups that shared similar concerns about problems of governance in their countries".[11] In this context Richard Bately argues that reforms are highly bureaucratic in nature, with negligent levels of public engagement, especially when it comes to the poor or "silent stakeholders".[12] These factors suggest that the reform processes do not, as is generally believed, emerge from the need to meet the demands of particular challenges, but are carefully calculated actions that may benefit a particular group or give political mileage.

When it comes to the formulation of reforms and their failure or success, policymakers occupy a significant position. One of the chief reasons cited for the inability of the policymakers to come up with policy change which incorporates the needs of all is their lack of "reflexive-self understanding of the community" that they are working for due to the "high-modernist"[13] manner in which they are trained, where only rationality becomes the basis for reforms, turning a blind eye to the social conditions present. Despite the negative role that has been associated with policymakers in the reform process there is also a literature which shows that policymakers are not always to be blamed when reforms go awry. Policymakers do not function in isolation as they have to work under pressures coming from the political realm as well as the social realm. Thus policymakers have to juggle between various interests to arrive at a reform which meets the demands of all. However, policymakers function within a "policy space"[14] which allows them the freedom to bring about significant changes through reforms, belying the general belief that policymakers work solely to fulfil the demands of the political elite. Again, the utilisation of this space depends "on the ability of the decision makers to utilize information that they have at hand".[15]

Another factor which makes the reform process a top down approach is the role of development which is seen to be the driving force behind reforms for policymakers. When the way in which development is perceived is skewed, it can have adverse consequences. For instance, when development is equated solely with numbers rather than assessing whether or not it is leading to the development of all in

[8] Ibid., p. 4.

[9] Ibid.

[10] Ibid.

[11] Ibid., p. 7.

[12] Batley and Larbi 2004, p. 44.

[13] Goodin et al. 2005, p. 3.

[14] Grindle and Thomas 1991, p. 8.

[15] Ibid., p. 8.

society. One way of avoiding such pitfalls would be how Amartya Sen describes it, that is to link development with freedom. If a particular policy for development leads to enhancement of an individual's freedom then that policy can be seen as being of some use as "development can scarcely be seen merely in terms of enhancement of inanimate objects of convenience, such as rise in the gross national product (GNP) or in personal incomes, or in industrialization or technological advance or social modernization. These are of course valuable—often crucially important—accomplishments, but their value must depend on the effect on the lives and freedoms of the people involved".[16] Therefore, the state needs to have a more nuanced understanding of the concept of development in the name of which it tries to bring in reforms. The propensity of the state to continually ignore the kind of problems certain people face when it comes to development can be better understood when there is a careful examination of the perspective of the state and the kind of relationship that the state has with such sections of the population. In other words, the concept of social exclusion needs to be examined to understand how and why some people are excluded from the purview of the state and what the obstacles to inclusive policy reforms are.

Arjan de Haan states that social exclusion is a *process* and that "social exclusion goes beyond the mere description of deprivation and focuses attention on social relations, the processes and institutions that underlie which are part and parcel of deprivation".[17]

As a consequence of social exclusion at the political, economic and group level, individuals and communities can also be excluded when it comes to policy-making or the concurrent reforms in the existing policies. Exclusion could be stark, that is when a group is completely excluded from a reform, or it can be more subtle, wherein groups or individuals may be adversely affected due to their non-consideration when it comes to policymaking. The reasons which can be accorded for exclusion of a group from policymaking are firstly, lack of thought about a group in society due to their social standing which determines the intensity of efforts which would be made for their upliftment. So a group which is looked upon with disdain due to its economic status, ethnicity, caste or nature of work, and is seen as a blot which society can do without, receives less attention not only from formal governmental agencies but also from society at large. As Evelin Hust puts it "whether the voice of the poor is actually heard or not depends also very much on how they are perceived".[18] Secondly, due to the nature of identity and the kind of work performed by a section can also lead to their exclusion from policymaking. For example the nature of the work done by ragpickers which is generally viewed as being dirty, filthy and illegal and ragpickers themselves being seen as dirty, due to their low caste, can affect the amount of space that policymakers give to them. As Barbarra Harris White points out, the work done by ragpickers due to the informality involved in the profession

[16] Sen 2000, p. 506.

[17] Haan 1999, p. 1.

[18] Hust and Mann 2005, p. 10.

makes it "either below all tax thresholds or concerns untaxed products";[19] hence the activity is not recognised by the state. Thirdly, various factors prevent their speaking out making it difficult for the marginalised to make themselves heard and thus leads to a non-consideration of their interests when it comes to policymaking and the concurrent reform process.

To remedy this situation, the state does come up with policy solutions which are more inclusive in nature. However, inclusive action fails when policy disregards the social and cultural factors of the social group that they are working for. This is signalled by James Scott when he talks of "*metis*", that is the local knowledge which is imperative to take into consideration as it helps to better understand the issue at hand and also helps to ensure that the reform is long lasting. So there is a need for policy to be guided by the cultural factors "that may seem commonsensical to the intended beneficiaries but are often exotic, irrelevant or irrational from the perspective of the policy maker."[20] Doing so would ensure that policy reform which comes about is better suited to the needs of the various groups in society rather than being based on what the policymaker envisions as being the appropriate solution.

The rise of a vibrant and assertive middle class as a part of economic liberalization in the 1990s also impacted the inclusive policy process wherein there was a significant tilt towards this section of the society and a "growing amnesia"[21] towards the poor and vulnerable sections in society. In an attempt to naturalise these processes of exclusion a middle class-based definition of citizenship[22] emerged, which led to the "politics of spatial purification",[23] aimed at cleansing public places from sections which seem to come in the way of or do not fit in with the plans of modernization. Also the ability of the middle classes to establish themselves as legitimate citizens or as Partha Chatterjee calls them "proper citizens"[24] further pushed the urban poor to the margins "precisely because their habitation and livelihood were so often premised on a violation of the law",[25] hence driving policymakers to bring in more reforms to cater to the needs of the middle classes, thereby seriously impinging on inclusive policymaking.

[19] Harris 2003, p. 4.

[20] Schindlmayr et al. 2005, p. 8.

[21] Fernandez 2004, p. 2416

[22] Ibid.

[23] Ibid.

[24] Chatterjee 2004, p. 131.

[25] Ibid.

## II

## *Methodology: Solid Waste Management (SWM) in Delhi*

This part of the chapter links the arguments made in the previous sections exploring the level of development of the informal section associated with SWM, more specifically ragpickers. In order to empirically test and determine further challenges for sustainable urban development for the exclusionary nature of policy reform which leaves the most marginalised sections of the population in a lurch due to the drive of the state to bring in measures for development for efficiency, the researcher examined the reforms brought about in the management of waste by the city of Delhi in the wake of Municipal Solid Waste (Management & Handling) Rules 2000 (MSW Rules) which made it mandatory for all municipal bodies to bring about better management of waste. However, the rules provide no space to involve the informal sector which is involved in waste management, more specifically the ragpickers, which jeopardizes their livelihood. Thus, the main objective of this study is to analyse how the measures to reform SWM in Delhi have impacted the lives of ragpickers who are a part of the informal chain involved in SWM, and in particular to determine whether they have been negatively or positively impacted and the causes for this outcome.

Delhi, like many other cities in India, in the wake of Municipal Solid Waste (Management & Handling) Rules 2000 (MSW Rules) which made it mandatory for all municipal bodies to bring about better management of waste, brought about a slew of measures to meet the targets, the latest being collaborations with private companies via public private partnerships to bring in better waste management. However, the rules provided no space to involve the informal sector which is involved in waste management or more specifically the ragpickers, thereby jeopardizing their livelihood. Thus, the main objective of this study is to analyse how the measures to reform SWM in Delhi impacted the lives of ragpickers who are the part of the informal chain involved in SWM, and in particular to determine whether they have been negatively or positively impacted and the causes for this outcome.

Delhi's governance is carried out by three local bodies: the Municipal Corporation of Delhi (MCD), the New Delhi Municipal Committee (NDMC) and the Delhi Cantonment Board. Of the three, the MCD is one of the largest municipal bodies in the world, which provides civic services to more than the estimated population of 11,007,835 million citizens in the capital city. Recently, the MCD was trifurcated into three civic bodies which are: North Delhi Municipal Corporation, South Delhi Municipal Corporation and East Delhi Municipal Corporation.[26]

The researcher carried out the study in the erstwhile MCD zones which had used public private partnerships as a means to improve waste management. The study was divided into two phases wherein in the first phase the researcher examined secondary data in the form of official documents on the urban situation in India,

[26] http://www.newstrackindia.com/topics/relevant/MCD.html.

with regard to SWM and ragpickers and specifically Delhi, drawing upon newspaper reports and articles in magazines to get a better understanding of how inclusive the SWM paradigm has been in the past and present vis-a-vis ragpickers. Doing a secondary data study helped the researcher to better understand the various laws and measures taken with regard to SWM in India and the amount of attention that had been given to ragpickers before and after the reforms were introduced in SWM. This also helped in triangulation and verification of the primary data which were collected in the second phase via personal interviews conducted with different actors associated in the process of waste management, to assess the impact of reforms in SWM on ragpickers.

The study used qualitative methods, mainly personal interviews, to gather information from the various actors, using semi-structured questionnaires with both open and close ended questions. The study began by conducting key informant interviews with five NGOs (Vatavaran, Toxics Link, Chintan, ACORD and Waste 2 Wealth), a union of waste recyclers (All India Kabadi Mazdoor Mahasangh, formerly known as Harit Recyclers Association), officials in the Central Public Health and Environmental Engineering Organisation (CPHEEO) under the Ministry of Urban Development, officials from the Municipal Corporation of Delhi, two private players involved in waste management and finally 40 ragpickers.

The objective of the interviews was to determine the basic demographic profile of ragpickers, the nature of the work that they perform, the income that they earn from the profession, their relationship with the urban authorities and urban residents, the provisions that the government has made for them, the demands that they have and the response/non-response to these demands as well as the reasons for the same. The interviews helped the researcher to determine the attention that has been paid (or not) by the government agencies to this section of the population in Delhi, and hence determine if the aim of sustainable development has been achieved, or in other words how inclusive reforms in SWM in Delhi have been. Non-availability of a proper governmental data on ragpickers proved to be a limitation to the study and the researcher had to depend on approximate numbers provided during the interviews. Another limitation was locating ragpickers as they are not confined to any one place in particular, making it difficult for the researcher to find ragpickers in the initial days of the survey.

## III

## *Results: Problems and Prospects for Effective SWM*

### Refusal to Grant Formal Recognition

During the field visits, the researcher, by way of personal observation and formal and informal discussions with the various actors, found that the segregation of

wastes, a crucial step in SWM, was performed by ragpickers and not by the Municipal Corporation of Delhi (MCD). For this they had to pay to get access; hence, revealing that despite not recognising the work done by ragpickers, the labour of ragpickers is being utilised by the MCD. Such a practice was also confirmed by NGOs who worked with ragpickers. On being asked if ragpickers were employed by the MCD waste workers to segregate waste, the response of all NGOs was in the positive. On being further questioned on the reasons as to why the contribution of ragpickers to the segregation of wastes was not acknowledged by the municipal authorities they stated that this is due to fear of disruption of status quo amongst the employees of the state who do not wish to part with the multiple benefits that they are now enjoying (i.e. they are being paid by the state, paid by the ragpickers to have access to waste, and have enough time to do moonlighting and be paid for that as well). The private companies do not highlight the fact that they utilise ragpickers because they do not want to show that it is a lucrative job.

**Lack of Coordination**

During the study another pattern which could be observed was the lack of coordination between the various agencies which were involved in SWM which could be one of the reasons why ragpickers have not been involved in the formal process of SWM. The interview with the MoUD revealed that even though ragpickers have not been mentioned in the MSW Rules, their role has been recognised in the Manual on MSWM which was to act as a guidebook for the municipal authorities. The MSW rules are to be enforced according to the needs of a particular municipality. However, this has not been the case in Delhi where there has only been an attempt to adhere to the Rules and no reference has been made to the Manual which gives enough "space" to the municipalities to involve ragpickers in the formal system of SWM. Moreover, due to the pressure put by NGOs working for ragpickers, an effort has been made by the MoUD to send directions to all state authorities asking them to make sure that their municipalities take measures to incorporate rag in the process of SWM. However, when the MCD in Delhi was questioned as to whether they had received any such circular, there was denial and it was also stated that the MCD has no policy for ragpickers so it cannot take any initiatives for this section without any orders from the centre. Two possible implications of this are: first, there is a communication gap between the central authorities and the urban local bodies; second, there is a certain laxity among the MCD officials to take relevant action for ragpickers. The relevant plans are being formulated for ragpickers at the centre but there is a total lack of implementation of these plans.

**The Shortcoming of a One-Size-Fits-All Policy**

It was also observed that at times, as is well known, reforms are informed purely by their success in another country, without always understanding their ramifications

or applicability in another area. This is evidenced in the case study carried out by the researcher in Delhi, in which measures to reform SWM in Delhi were overly guided by the desire to find technical solutions. For example, the move to bring in more waste to energy plants as a way to dispose of garbage may work in developed countries where waste has a high calorific value, but this is not the case in India. The move was made without any consultations with the various stakeholders who would be affected by such a move. Since participation by the ragpickers is not possible, the various NGOs which had been working in this field were also not consulted, showing that the government was looking for a quick solution to the problem of waste in the city, especially in the backdrop of the Commonwealth Games that the city was to host very shortly.

The study also shows that the expectation that ragpickers would be eventually incorporated into the practices of private waste management companies has also been belied, as the two waste companies who were interviewed were not keen to recognize the contribution of the ragpickers. Lack of commitment on the part of municipal agencies to pressure private companies to include ragpickers into their fold, and just resorting to advising the private companies to do so, lessens the chance of ragpickers to be involved in the work of private companies handling waste in Delhi.

## Mismanagement of Solid Wastes

There is a reason to believe that wastes are still being mismanaged. This can be ascertained from an incident of radiation suffered by scrap dealers in Mayapuri in Delhi due to contact with a radioactive material called cobalt-60 while dealing with waste.[27] The incident once again puts a question mark on the state of SWM in the city. It can however be concluded that the issue of better management of waste has been now given considerable attention but the issue of ragpickers is still largely neglected. When asked if SWM activities in the city had improved at the cost of ragpickers the response was in the positive from the interviews conducted with the NGOs, ragpickers and the MCD officials. Ragpickers in the city have continued to work in a hazardous environment with all those interviewed stating that they handled garbage with bare hands, with no effort from the MCD to improve their condition. Of the 40 ragpickers interviewed, 24 said that they had a hostile relationship with the MCD and described how they have to bribe the MCD officials to carry on their work and also to ensure that they are not evicted from their make-shift homes. The precarious relationship between the MCD and the ragpickers in the city could also be seen in the response of the MCD official that the department had never tried to contact the ragpickers. Although the effect of privatisation of SWM on ragpickers does not seem negative when ragpickers were interviewed, as they still have access to waste, the response of the private companies to the issue of ragpickers does not seem promising. While one company does involve ragpickers in its activities to

[27] For further information refer to the work of Payal Saxena, "Radiating Error," *The Week,* June 12, 2010.

segregate waste, it is on a purely temporary basis with no measure to make them permanent employees. The other company does not involve ragpickers at all in its activities and even stated that it has plans to innovate technology by which waste could be segregated without using any manual labour. The response of the private companies shows that if the possibility of employing ragpickers in their activities is very minimal at present, it would be even bleaker in future. Thus the reforms brought about in SWM have only translated into sparse improvement in the management of waste and have not been able to bring about a change in the lives of the ragpickers as they are not included.

**Sociocultural Dimensions of SWM**

Another finding which came out was that urban residents have a complex relationship with ragpickers. One of the explanations for such a situation is due to the attitude of people towards waste; it is mostly guided by notions of culture. Waste is seen as something to be discarded and not an issue which requires much attention. This leads to apathy when it comes to waste and the people who are dealing with it. This point is discussed by Emma Maldawsky who writes about "the debate between the domestic space and 'the outside'".[28] It is this apathy which is also reflected in the intense efforts by urban residents to demand better waste management without any attention being paid to people such as the ragpickers who form an important part of the waste hierarchy. This also points towards a growing tendency of "bourgeois environmentalism"[29] which encourages the urban residents to take up issues but only those issues which are seen as being "appropriate". Ragpickers do not fall in the category of people who could be described as "proper" citizens, which makes taking up their cause not so attractive. It is this "bourgeois environmentalism where middle and upper classes push their concern with visual beauty, entertainment, cleanliness and safety in an organised way to shape a metropolitan space of their own vision, while the urban poor are unable to articulate their own agenda for the city."[30] Thus, reforms in SWM in Delhi are "myopic in nature"[31] as the "policies fail to recognise SWM as a livelihood issue".[32] Since the work done by ragpickers leads to "no visible benefit in economic, environmental and sociological terms and the value generation is low as opposed to private companies, where the results are measurable, ragpickers do not seem to be a viable option to invest in; hence no move to have policies for them or a move to incorporate them into the formal process of SWM."[33]

[28] Mawdsley 2004, p. 89.

[29] Gill 2010, p. 191.

[30] Ibid.

[31] Interview with Ms. Malati Gadgil of Chintan on 5th April, 2010.

[32] Ibid.

[33] Ibid.

The study revealed that there have been no concrete efforts on the part of the local authorities to integrate ragpickers in the formal sector of SWM with zero contact with ragpickers. The same goes for private companies who are not so accessible to ragpickers in terms of employment. Despite the fact that ragpickers have space in the Manual on Municipal Solid Waste Management wherein it has been advised that they be incorporated into the formal waste management sector, no concrete steps have been taken by the municipalities on this accord.

## IV

## *Conclusion: Towards a Non-Exclusionary Approach to Reforms*

It can be concluded from the study that there is a need to take more concrete steps "to capitalize on the effectiveness of the informal sector and institutionalizing its participation in waste management"[34] instead of gearing towards measures which have not been able to bring about any positive change in the management of wastes. Including ragpickers in the formal sector in the management of wastes can have twin advantages of firstly, "improving the working conditions of waste workers by providing them access to protective equipment, healthcare and a pension scheme; and secondly, by ensuring that Delhi's high recycling rates are maintained".[35] Therefore, it can be concluded that when reforms are solely informed by the "high modernist" agenda wherein reform is only equated with "visible" outcomes, it can have negative effects. It can also be concluded that reforms in policymaking are successful when they are informed by the context and have proper accountability measures as well as a social system which takes into consideration the needs of even the most marginalised in society. It is only then that true democracy can be achieved.

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[34] Schindler and SB 2012, p. 19.

[35] Ibid.

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# Chapter 11
# Estimating Economic Costs of Municipal Solid Waste Management: Using Contingent Valuation Method

**J. Sacratees and G. Hari Govindaraj**

## Introduction

Municipal solid waste management (MSWM) is one of the major environmental problems of Indian cities. Improper management of municipal solid waste (MSW) causes economic loss and health hazards to inhabitants. MSW is basically useless and unwarranted materials discharged as a result of human activity. Most commonly, they are composed of solids, semisolids or liquids found in containers disposed from houses and commercial or industrial premises (Nyangababo and Hamya, 1980).

The quality and quantity of MSW generated by a particular community will vary according to its socioeconomic status, cultural habits, urban structure, population and commercial activities. Asian countries are facing MSWM problems due to the rapid growth in MSW generation rate. The total quantity of waste generated by 23 metro cities in India was 30,000 t/day (tpd) in 1999, and has increased considerably to about 52,000 tpd in 2004 (Inanace et al. 2004). Government bodies at all levels (central, state and municipal) are taking proactive steps to improve the MSW scene in India. The Government of India issued new rules that regulate the MSWM at the local level (MoEF 2000).

Waste management is a problem in urban as well as rural areas. Many areas, particularly in developing countries such as India, still have inadequate waste management; poorly controlled open dumps and illegal roadside dumping remain a serious problem. Such dumping spoils scenic resources, pollutes soil and water resources and is a potential health hazard to plants, animals and people. According to the United Nations Centre for Human Settlements, only between 25 and 55 % of all waste generated in large cities is collected by municipal authorities. At least 60 % of

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the countries that submitted national reports to the United Nations before the 1992 Earth Summit said that solid waste disposal was among their biggest environmental concerns. The importance of proper solid waste management (SWM) is one of the primary functions of the civic body, as improper management of solid wastes is a cause of much discomfort. Since waste management is a fundamental requirement for public health, Article 48-A of the Indian Constitution affixes it to be the responsibility of the state to manage these wastes properly.

Realizing the need for proper and scientific management of solid waste, the MSW (Management and Handling) Rules, 2000, were notified by the Ministry of Environment and Forests, Government of India. The severity of solid waste management is crucial and inevitable in the modern world. Tirunelveli, the sixth largest municipal corporation in Tamil Nadu, has been generating more solid waste in recent days because of increasing urbanization and consequent urban growth coupled with the emergence of more and more new colonies and extension areas and the changing lifestyles of the people. The corporation found it difficult to clean all areas regularly. On the basis of the discussion in various forums, the corporation started the concept of promoting residential associations to take up sanitation in their colonies by engaging private sanitary workers. The increasing public awareness and concern over the solid waste management problem are the main factors that motivate this study that aims to provide research-based solution for promoting an effective and efficient way of maintaining solid waste management by the municipal corporation. This study aims to estimate the willingness to pay (WTP) for efficient solid waste management services by implementing a contingent valuation (CV) survey. The survey results would also significantly facilitate in fixing a tariff ceiling to every household based on the service provided towards solid waste management by the corporation.

## Municipal Solid Waste in Tirunelveli City

As per the 2011 census, Tirunelveli district had a population of 30,72,880 with 15,18,595 (49.42%) males and 15,54,285 (50.58%) females. The decadal growth rate of population has increased from 8.9 to 13.7%. The city has an average literacy rate of 78%, which is higher than the national average of 59.5%; male literacy is 83% and female literacy is 73%. In Tirunelveli, 10% of the population is less than 6 years of age. Among the municipal corporations, Tirunelveli has been identified with a gender ratio for urban agglomeration of 20.22%. The city is spread over an area of 108.65 $km^2$. The population density of the city has increased from 3,781 persons/$km^2$ in 2001 to 4,370 persons/$km^2$ in 2011.

The main aim of the research is to assess the economic impact of solid waste management in Tirunelveli Corporation in general and its impact on human health in particular. The economic impact is evaluated in terms of work-days lost and health impact due to solid waste disposal by the corporation. The concept of environment in a developing nation brings about the vision of a society where settlements in urban area would be healthy and drinking water would be easily accessible and free from disease. Sanitary conditions would be at an acceptable level and the

urban society will be able to provide opportunities to its members to live healthy. All these complexities pose a greater challenge to the policymakers on how they would solve the crucial problem of solid waste management without affecting the environment. There is no proper solid waste management measure available. Existing legal measures are not effective in ensuring efficient solid waste management.

Table 11.1 shows the unit-wise solid waste collection by Tirunelveli Corporation during 2003–2010. MSW falls into many categories, such as food waste, rubbish, commercial waste, institutional waste, street-sweeping waste, industrial waste, construction and demolition waste and sanitation waste. MSW contains recyclables (paper, plastic, glass, metals, etc.), toxic substances (paints, pesticides, used batteries and medicines), compostable organic matter (fruit and vegetable peels and food waste) and solid waste (blood-stained cotton, sanitary napkins and disposable syringes) (Jha et al. 2003; Reddy and Galab 1998; Khan 1994).

The quantity of MSW generated depends on a number of factors, such as food habits, standard of living, degree of commercial activities and seasons. Data on quantity variation and generation are useful in planning collection and disposal systems. With increasing urbanization and changing lifestyles, Indian cities now generate eight times more MSW than they did in 1947. Presently, about 161.44 t of solid waste is generated annually by the people of Tirunelveli Corporation. The amount of MSW generated per capita is estimated to increase from 340 g in 2011 to 355 g in 2015 owing to the changing lifestyle of the people in Tirunelveli city.

According to the United Nations Centre for Human Settlements, only between 25 and 55% of all waste generated in large cities is collected by municipal authorities. For instance, waste generation every day in Tirunelveli Corporation was estimated to be 170.94 t, out of which 61.5 t was left uncollected. Out of the total amount of waste generated, 35.98% remained uncollected while the rest 64.02% was collected. The remaining uncollected solid waste creates huge environmental problems for city dwellers, and this becomes a daunting task for the corporation. This study would propose a feasible solution to manage solid waste in an efficient way without affecting the environment.

## Objectives of the Study

The overall objective of the study is to empirically study the solid waste management problem in Tirunelveli city using primary and secondary data and a methodology based on a contingent valuation (CV) technique. The specific objectives are as follows:

1. To study the existing practices of solid waste management and their environmental and health impacts in Tirunelveli city.
2. To estimate the cost incurred owing to solid waste management by Tirunelveli Corporation.
3. To estimate respondents WTP to improve solid waste management in Tirunelveli Corporation by using the contingent valuation method (CVM).

**Table 11.1** Unit-wise solid waste collection by Tirunelveli Corporation during 2003–2010 (in tonnes). (Source: Compiled data from Municipal Corporation, Tirunelveli-1)

| Year | Units | | | | | | | | | | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | XIII | XIV | XV | XVI | XVII | |
| 2003 | 3,538 | 2,236 | 2,155 | 1,759 | 1,662 | 2,362 | 1,649 | 1,830 | 2,025 | 1,920 | 1,581 | 1,721 | 2,299 | 1,689 | 2,556 | 1,825 | 1,663 | 34,470 |
| | (10.27) | (6.49) | (6.25) | (5.10) | (4.82) | (6.85) | (4.78) | (5.31) | (5.87) | (5.57) | (4.59) | (5.00) | (6.67) | (4.90) | (7.41) | (5.29) | (4.83) | (100) |
| 2004 | 3,161 | 1,574 | 1,158 | 1,158 | 1,395 | 3,439 | 959 | 1,548 | 1,291 | 1,865 | 1,178 | 1,849 | 2,895 | 1,649 | 2,109 | 1,657 | 1,420 | 30,305 |
| | (10.43) | (5.19) | (3.82) | (3.82) | (4.60) | (11.35) | (3.16) | (5.12) | (4.26) | (6.15) | (3.89) | (6.10) | (9.55) | (5.44) | (6.96) | (5.47) | (4.69) | (100) |
| 2005 | 4,022 | 1,589 | 863 | 916 | 1,307 | 3,781 | 702 | 1,562 | 1,149 | 2,010 | 1,147 | 2,127 | 3,839 | 1,025 | 2,261 | 1,530 | 1,469 | 31,299 |
| | (12.85) | (5.08) | (2.76) | (2.93) | (4.18) | (12.08) | (2.24) | (4.99) | (3.67) | (6.42) | (3.66) | (6.80) | (12.27) | (3.27) | (7.22) | (4.89) | (4.69) | (100) |
| 2006 | 3,943 | 1,835 | 1,216 | 1,300 | 1,380 | 4,084 | 827 | 1,668 | 889 | 1,957 | 1,191 | 2,261 | 3,892 | 841 | 2,286 | 1,335 | 1,220 | 32,125 |
| | (12.27) | (5.71) | (3.78) | (4.05) | (4.30) | (12.71) | (2.57) | (5.19) | (2.77) | (6.09) | (3.71) | (7.04) | (12.12) | (2.62) | (7.12) | (4.16) | (3.80) | (100) |
| 2007 | 4,518 | 1,429 | 999 | 1,371 | 1,410 | 4,509 | 746 | 1,855 | 975 | 1,921 | 1,060 | 2,463 | 4,265 | 1,672 | 1,840 | 2,086 | 1,481 | 34,600 |
| | (13.06) | (4.13) | (2.89) | (3.96) | (4.08) | (13.03) | (2.16) | (5.36) | (2.82) | (5.55) | (3.06) | (7.12) | (12.32) | (4.83) | (5.32) | (6.03) | (4.28) | (100) |
| 2008 | 3,778 | 1,463 | 1,045 | 991 | 1,180 | 3,642 | 603 | 1,136 | 711 | 1,502 | 297 | 2,422 | 3,559 | 1,879 | 2,077 | 1,744 | 1,202 | 29,031 |
| | (13.01) | (5.04) | (3.60) | (3.41) | (4.07) | (12.58) | (2.08) | (3.91) | (2.45) | (5.17) | (1.02) | (8.34) | (11.57) | (6.47) | (7.16) | (6.01) | (4.14) | (100) |
| 2009 | 3,935 | 1,378 | 1,388 | 740 | 1,185 | 3,838 | 609 | 1,186 | 773 | 1,442 | 689 | 2,290 | 3,579 | 1,645 | 2,136 | 1,947 | 1,295 | 30,055 |
| | (13.09) | (4.58) | (4.62) | (2.46) | (3.94) | (12.77) | (2.03) | (3.95) | (2.57) | (4.80) | (2.29) | (7.62) | (11.91) | (5.47) | (7.11) | (6.48) | (4.31) | (100) |
| 2010 | 3618 | 2339 | 1884 | 1926 | 1709 | 4110 | 1078 | 2109 | 977 | 2164 | 1681 | 3001 | 3736 | 2648 | 2585 | 2124 | 1712 | 39401 |
| | (9.18) | (5.94) | (4.78) | (4.89) | (4.34) | (10.43) | (2.74) | (5.35) | (2.48) | (5.49) | (4.26) | (7.62) | (9.48) | (6.72) | (6.56) | (5.39) | (4.35) | (100) |

## Methodology

Tirunelveli Corporation has been divided into four zones: Tirunelveli, Thatchanallur, Palayamkottai and Melapalayam. Further, these zones were divided into 55 wards. Each ward is divided according to the size of population not exceeding a maximum of 7,500 per ward. In order to give equal representation to every zone and to every ward of Tirunelveli Corporation, it was decided to cover 510 sample households (30 households for each unit) in Tirunelveli Corporation. A field survey was conducted in all the units by the researcher from October 2010 to March 2011. This study is based on both primary and secondary sources of data. Primary data were collected by administering appropriate questionnaires. The sample selection was executed on the basis of stratified random sampling of 510 household respondents. The researcher has used two types of questionnaires. The first type of questionnaire focused on the respondents' demography, environmental quality, the household's WTP, door-to-door collection, available infrastructure, frequency of garbage collection, level of satisfaction of consumers, improved solid waste management and health and environmental damage. The second questionnaire collected institutional responses from the corporation covering information, such as annual budget for solid waste maintenance, solid waste collection, transport and disposal during 2003–2010. In addition, data were collected about the staff employed for each unit, solid waste management regulations, bylaws, waste processing procedures, availability of incineration facility, waste collection, transfer, disposal and general policy issues regarding MSWM. Additionally, the health data were collected from Primary Health Centres (PHCs), the Deputy Director of Health Services, Palayamkottai, and the Joint Directorate of Health Services, Tenkasi, and the Directorate of Health Services, Chennai.

The literature review was performed by going through relevant books, national and international journals, reprints, monographs, working papers and various reports of national and international organizations. Additionally, some relevant sources have been collected from the Madras School of Economics (MSE), Chennai; Indira Gandhi Institute for Development Research (IGIDR), Mumbai; Institute of Economic Growth (IEG), New Delhi; and Tata Energy Research Institute (TERI), New Delhi.

CVM is a widely used nonmarket valuation method, especially in the areas of environmental cost-benefit analysis and environmental impact assessment.[1] Its application in environmental economics includes estimation of nonuse values (e.g. Walsh et al. 1984; Brookshire et al. 1983), nonmarket use values (e.g. Choe et al. 1996; Loomis and duVair 1993) or both (e.g. Niklitschek and Leon 1996; Desvousges et al. 1993) of environmental resources. In recent years, this method is commonly used in developing countries to elicit individual preferences for basic infrastructural projects, such as water supply and sanitation (see Whittington 1998;

[1] For detailed discussion in this context see Mitchell and Carson (1989) and Cummings et al. (1986).

Merrett 2002). Although a popular nonmarket valuation method, a group of academicians has criticized this method for not being proper for estimating nonmarket values (see Hausman 1993). Hence, the main objective of the concept is to portray the WTP to improve the river water quality in the study area based on empirical aspects of the CV method.

The survey was conducted using the CVM to ascertain the household's actual WTP to improve solid waste management by Tirunelveli Corporation because environmental services do not have explicit markets like other commodities and services that can be expressly traded in the market. In order to understand the WTP ranges, the researcher has used welfare loss based on the CVM models through various econometric regression models like the Logit and Tobit estimations to arrive at a result. The main reason for using the WTP approach is to see whether there is a strong enough demand among the people within the city for improved solid waste management services. When there is a strong implicit demand for such services, it is then possible to generate considerable additional revenues to support the improved solid waste management services. This additional revenue can also supplement the amount currently spent by the municipal authorities for solid waste management. But, it is important to note that both the probability and the level of WTP, as well as the extent of the additional revenue, depend on the people's perception of the delivery of assured and qualitatively improved solid waste management services.

Despite its wide use in practical policy purposes, CVM's ability to reliably estimate WTP is not universally accepted. While some economists have expressed scepticism over the use of direct questioning to estimate the WTP, one of the early verdicts on the soundness of CVM came from a group of world-renowned economists: Kenneth Arrow, Robert Solow, Roy Radner, Edward Leamer and Howard Schumann (Arrow et al. 1993).

CVM has improved significantly during the past 50 years. One of the pioneers in the field of CV surveys, V. Kerry Smith (2006), argues that CV research has witnessed robust progress, enabling better understanding of consumer preferences. More specifically, the progress of econometric analysis, survey research methods, sampling and experimental design and policy applications in the past 50 years has been remarkable. In Smith's assessment, concerns relating to measurement bias in estimating nonuse values can be excessive. However, in our case, a similar measurement bias is a lesser concern because of the estimation of direct use values. As Smith further elaborates, hypothetical bias can also be large because of the nature of CV surveys. Careful development of survey instruments (through initial preparatory work, focus groups, cognitive interviews and pretests); conscientious implementation of fieldwork and rigorous econometric analysis that link the data to underlying theoretical models (e.g. utility functions) can help reduce hypothetical bias in a CV study. In this context, the pragmatic approach is to use CVM meticulously, applying the improved methodology to generate a reliable estimate of the WTP to improve solid waste management within the Tirunelveli Corporation limit.

## Contingent Valuation Method

In this study, we will use regression models in which the dependent or response variable itself can be dichotomous in nature. Basically, it is a 'Yes'- or 'No'-type answer received from the respondents with regard to improvement of solid waste management in Tirunelveli Corporation. We use the values of 1 or 0 to measure this. With respect to this question, some of the respondents are willing to pay and the others are not. To estimate and infer the WTPs, we will use the Logit model. We have to classify all categories according to their actual contribution in terms of rupees to improve solid waste management. To measure the actual contribution to the respondent's solid waste disposal improvement, we will use the Tobit model.

The specification of the Logit equation is as follows:

$$WTP = \alpha + \beta_{1\text{AGE}} + \beta_{2\text{SEX}} + \beta_{3\text{MS}} + \beta_{4\text{INCOME}} + \beta_{5\text{DIS}} + \beta_{6\text{RUPWTP}} + \beta_{7\text{HCOST}} + \beta_{8\text{WLOSS}} + \beta_{9\text{PRIEDU}} + \beta_{10\text{HEDU}} + \beta_{11\text{DEDU}} + \beta_{12\text{PRI}} + \beta_{13\text{GOVT}} + \beta_{14\text{BUSI}} + \beta_{15\text{PQUAL}}, + \beta_{16\text{MQUAL}} + \beta_{17\text{FAIRLY}} + \beta_{18\text{HIGHLY}} + \text{Ui}$$

where

dependent variable $WTP = 1$ if the respondent is willing to pay for solid waste management improvement = yes and = 0 otherwise.

Dummy independent variables (description) are as follows:

$\beta_1$ = Age of the respondent (years)
$\beta_2$ = 1 if sex = male, 0 = otherwise
$\beta_3$ = 1 if married, 0 = otherwise
$\beta_4$ = 1 if income earner, 0 = otherwise
$\beta_5$ = 1 if distance is closer to dustbin, 0 = otherwise
$\beta_6$ = 1 if willing to pay in rupees, 0 = otherwise
$\beta_7$ = 1 if health cost is high, 0 = otherwise
$\beta_8$ = 1 if wage loss, 0 = otherwise
$\beta_9$ = 1 if primary educated, 0 = otherwise
$\beta_{10}$ = 1 if high school educated, 0 = otherwise
$\beta_{11}$ = 1 if the respondent is a graduate, 0 = otherwise

*Base category—illiterates (for education)

$\beta_{12}$ = 1 if private employee, 0 = otherwise
$\beta_{13}$ = 1 if government employee, 0 = otherwise
$\beta_{14}$ = 1 if business, 0 = otherwise

**Base category—unemployed

$\beta_{15}$ = 1 if SWM is poor quality, 0 = otherwise
$\beta_{16}$ = 1 if SWM is middle quality, 0 = otherwise

***Base category—very poor quality

$\beta_{17}$ = 1 if the person is fairly agreed to improve solid waste management, 0 = otherwise

**Table 11.2** Logit estimates of WTP for improvement of solid waste management. Dependent variable: WTP (willingness to pay to improve solid waste management). Source: Computed from primary data

| Independent variable | Coefficient | Marginal effects |
|---|---|---|
| Constant | 0.39776 (2.51) | 0.0119 |
| Age | −0.00109 (−0.83)*** | 0.4067 |
| Sex | 0.03530 (0.89)** | 0.3734 |
| Marital status (MS) | −0.00453 (−0.08)*** | 0.9361 |
| Income | −9.71238 (−3.59)* | 0.0003 |
| Distance | 7.20779 (0.73)** | 0.4642 |
| Rupee Willingness to Pay (RUPWTP) | 0.00557 (19.51)* | 2.8865 |
| Health cost (Hcost) | 1.42612 (0.12)*** | 0.9033 |
| Wage loss | 1.02141 (1.36)** | 0.1721 |
| Primary | 0.12401 (1.93)** | 0.0524 |
| High | 0.09747 (1.55)** | 0.1193 |
| Degree | 0.18956 (3.08)* | 0.0020 |
| Private | −0.20014 (−1.75)*** | 0.0784 |
| Government | −0.15817 (−1.44)*** | 0.1471 |
| Business | −0.16333 (−1.43)*** | 0.1511 |
| Poor | −0.00644 (−0.15)*** | 0.8793 |
| Middle | 0.04714 (1.04)** | 0.2980 |
| Fairly | 0.05496 (1.04)** | 0.2945 |
| Greatly | 0.11306 (2.32)* | 0.0199 |
| Log likelihood | 113.0455 | |
| Restricted log likelihood | 129.8231 | |
| Chi-square | 46.10672 | |
| Pseudo $R^2$ | 0.37 | |

Figures in parentheses show the *t* values
*Statistically significant at the 1% level; **statistically significant at the 5% level; ***statistically significant at the 10% level

$\beta_{18}$ = 1 if the person is highly agreeable to improved solid waste management, 0 = otherwise

****Base category—not at all interested to pay WTP for SWM

The actual estimation in the Logit model will capture a simple Yes/No answer on whether a respondent would pay to improve MSWM in Tirunelveli city. The data from all the sample households were used at this stage in order to understand a broad perspective of the factors underlying a respondent's decision. The results are reported in Table 11.2. This survey report of the WTP for the improvement of solid waste management has been included; the data from various stretches were pooled to get a WTP group. Out of 510 respondents who were questioned on their WTP to improve solid waste management, 322 (that is, 63.14%) gave positive answers and the rest gave negative answers. These results have several noteworthy features. Mainly, the model has a good fit. The chi-square value is 46.10, which is highly significant at 1%. Pseudo $R^2$ value is 0.37, which means that about 37% of the variations in the WTP are explained by the included independent variables. Almost all the independent variables have a positive influence on the WTP except the variables of occupational classifications. The age variable is positively related to the WTP. As the age goes up, the probability of getting a positive response also increases.

The variables—sex, income, education and distance—have a higher probability of influencing WTP for improving MSWM in Tirunelveli city. In the case of sex variable, there was a higher probability of positive response from female respondents towards improving solid waste management as compared with male respondents. Awareness and income level was also higher among the female respondents compared with the males. When the respondent's income rises by 1%, the probability WTP for better MSW quality also rises by 0.0219%. Distance has a positive significance. Respondents residing closer to street dustbins showed higher probability for WTP for improving solid waste management. WTP dropped when the street dustbins are a little away from the dwellings. Those dwellings near the landfills or disposal areas are important factors to decide positive influence on the WTP because the coefficients of the variable are positive; they imply that a respondent, who has a higher education, knows about the importance of improving solid waste management in an urban city and who has a higher probability of paying for it. Age and income have a positive significance at 1 and 5% and sex has a 5% level of significance.

The variable health cost also plays a major role in determining WTP. If the health costs were high, the probability of WTP for improving the solid waste management increased at 10% level of significance. Wage loss was a lesser deciding criterion for WTP among the respondents. It directly influenced WTP and indicated a positive sign and significance at 5%. The deterioration in health was due to an improper management of solid waste disposal and something must be done to conserve and improve the environment.

Education at the primary and high school level had a negative sign and significance at 5%. But education at the degree level had a positive sign at 1% level of significance. Thus, education may also be interpreted as a proxy for the knowledge about the poor quality of solid waste management practices taking place in Tirunelveli city and it clearly highlighted the importance of education at the graduation level. As the level of education goes up, the probability of WTP for improving solid waste management also goes up. This was evident with respondents who had degree-level education, whereas those who had primary and high school-level education do not have much awareness about MSWM. It had a positive sign and significance at 5%, confirming the earlier results.

Occupation with private, government and business groups had a negative impact on WTP. The respondents working in the private sector get lower wages, thereby causing a poor response towards the WTP for improving MSWM.

Under this Tobit model, the actual magnitude of the monetary value of the WTP is directly linked with the respondent's WTP for improving MSWM. If the coefficient sign was positive, one unit increase in age when other things remain constant would increase the WTP amount by about 0.14%. Sigma value (0.478) is highly significant. Because of this, the ordinary least square (OLS) is an unbiased estimate, which is highly significant, and it shows that leaving the sample would lead to selection bias. It is the same case as with that of the variable sex. It would increase the probability of WTP by about 0.3332% for 5% level of significance. If the distance decreases, the probability of WTP increases by 0.4957%. Health cost and wage loss have a negative influence on WTP and, to some extent, variable health has got a

**Table 11.3** Tobit estimates of WTP for solid waste management improvement. Dependent variable: WTP. (Source: Computed primary data)

| Independent variables | Coefficient | Marginal effects |
|---|---|---|
| Constant | 0.18581 (0.79) | 0.4266 |
| Age | −0.00168 (−0.86)*** | 0.3865 |
| Sex | 0.05621 (0.96)** | 0.3332 |
| Marital status (MS) | −0.00250 (−0.02)*** | 0.9763 |
| Income | −1.4628 (−3.65)* | 0.0002 |
| Distance | 9.93958 (0.68)** | 0.4957 |
| Rupee Willingness to Pay (RUPWTP) | 0.00764 (17.09)* | 2.8865 |
| Health cost (Hcost) | 1.07757 (0.06)*** | 0.9515 |
| Wage loss | 1.41199 (1.29)** | 0.1947 |
| Primary | 0.19387 (1.97)** | 0.0483 |
| High school | 0.14875 (1.54)** | 0.1227 |
| Degree | 0.2856 (3.05)* | 0.0022 |
| Private | −0.29345 (−1.75)*** | 0.0786 |
| Government | −0.22826 (−1.42)** | 0.1528 |
| Business | −0.23514 (−1.40)*** | 0.1592 |
| Poor | −0.00925 (−0.14)*** | 0.8834 |
| Middle | 0.07359 (1.09)** | 0.2720 |
| Fairly | 0.08049 (1.02)** | 0.3056 |
| Greatly | 0.16324 (2.23)* | 0.0251 |
| Thatchanallur | 0.00904 (0.13)*** | 0.8932 |
| Palayamkottai | −0.06933 (−0.92)*** | 0.3570 |
| Melapalayam | −0.02614 (−0.35)*** | 0.7257 |
| Sigma | 0.478 | |
| Likelihood function | 2,029.1032 | |
| N | 338 | |

Figures in parentheses show the t values
*Statistically significant at the 1% level; **statistically significant at the 5% level; ***statistically significant at the 10% level

positive influence at the 5% level of significance. It would increase the probability of health cost and wage loss by 0.9515 and 0.1947% respectively. Education has a much stronger influence. As expected, it improved the WTP amount at each level of education, namely, primary, high school and degree level, by about 0.0483%, 0.1227% and 0.0022%, respectively. Occupation does not have any influence on the WTP amount for improving solid waste management. Therefore, as predicted in theory, there are many factors that influence the WTP amount, leading it to deviate. It has a negative sign and is also insignificant. However, the variables government employees and business group have a positive effect on WTP. In contrast, one unit increase in the business group variable will influence WTP by 0.1592% as against the government employee, which is just 0.1528%. The respondents have responded well to the personal health loss because solid waste as a subjective variable influences an increase in the WTP amount by 0.3056 and 0.0251% for fairly affected and highly affected variables, respectively. Thus, the estimated Tobit model is realistic in explaining the role of different socioeconomic factors in the levels of WTP by the respondents (Table 11.3).

**Table 11.4** Morbidity statistics of Tirunelveli Corporation from 2004 to 2010. (Source: Municipal Corporation, Tirunelveli-1)

| Sr. No | Type of disease | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|
| 1 | Vector-borne | *241* | *62* | *592* | *246* | *35* | *222* | *524* |
| | | *(6.01)* | *(1.53)* | *(26.40)* | *(6.27)* | *(0.72)* | *(4.56)* | *(10.15)* |
| 2 | Air-borne | 169 | 278 | 87 | 124 | 183 | 619 | 637 |
| | | (4.22) | (6.87) | (3.88) | (3.16) | (3.75) | (12.73) | (12.34) |
| 3 | Water-borne | 26 | 51 | 10 | 149 | 45 | 191 | 70 |
| | | (0.65) | (1.26) | (0.45) | (3.80) | (0.92) | (3.93) | (1.36) |
| 4 | Others | 3,572 | 3,654 | 1,553 | 3,404 | 4,618 | 3,832 | 3930 |
| | | (89.12) | (90.34) | (69.27) | (86.77) | (94.61) | (78.78) | (76.15) |
| Total | | *4,008* | *4,045* | *2,242* | *3,923* | *4,881* | *4,864* | *5161* |
| | | *(100.0)* | *(100.0)* | *(100.0)* | *(100.0)* | *(100.0)* | *(100)* | *(100)* |

Location, as captured by the variable representing different zones, also influences WTP for improving MSWM. The variations in the level of WTP for the three zones Thatchanallur, Palayamkottai and Melapalayam are 0.8932, 0.3570 and 0.7257% respectively. The Melapalayam zone has a higher level of WTP because this zone generated more solid waste as the New Bus Stand is located here and it also has a huge Muslim population who have more mutton and chicken stalls, which generate high volumes of solid waste in this region. Another significant factor that needs to be noted is that the lifestyle of the people in this zone is also one of the influencing factors which generate more solid waste. The percentage of respondents who said 'yes' for the WTP question here is less as compared with other zones, whereas the actual mean value of WTP is relatively higher for Palayamkottai and Thachanallur zones showing their high-income status. However, the magnitude of the amount of WTP for improving solid waste management is not as much as we expected in all the zones. It has a negative sign with a statistically insignificant value.

It is important to note that it might be possible and correct to directly formulate a linear regression model based on the OLS method using maximum WTP figures as the dependent variable. Similar to the WTP, the data employed also exclude the protest bids. In addition, outliers are also identified and excluded from the estimation process. The outcome of the OLS model is given in Table 11.4 and the outcomes of both linear models are mostly on expected lines, not only in terms of variables that affect the fees but also their signs and levels of significance. For WTP, coefficients associated with the variables—referendum fee, level of education, income, need for the study, the severity of existing solid waste management practices and whether a respondent is living near street dustbins—are all observed to be significant. Their positive relationships are also consistent with what we have predicted. It should be noted that sex seems to play a significant role in determining WTP in this equation. However, a relatively low $R^2$ is a bit of a concern. The explanation might lie in the fact that the actual fee (value of WTP) that respondents are willing to sacrifice has a very wide dispersion and their increments are very small, making it difficult for a model to precisely determine each individual figure. However, the results indicate a significant positive relationship between the referendum fee and the stated fee.

Regression results indicate that 46.10% of the variation in WTP was explained by the hypothesized household characteristics. Only age and marital status were not significant in explaining household WTP. This may perhaps be due to multicollinearity. All coefficients for the income and education variables were highly significant and negative as expected, suggesting that respondents who were degree holders (17.25%) with a household income in the range of ₹ 15,001–20,000 or more were willing to pay significantly more than those in other income and education categories. Hypothesis testing indicates that respondents who were degree holders with household incomes between ₹ 15,001 and ₹ 20,000 were also willing to pay significantly more than most respondents with less education and equal or less income. This finding, in conjunction with the lack of significance of most other differences in the above table, suggests that income and education may not significantly influence WTP unless the respondent is a degree holder. The significance of the coefficients for income and education suggests that degree holders who were in the highest income class were willing to pay about ₹ 300 more than degree holders with household incomes between ₹ 20,001 and ₹ 25,000. Hence, for degree holders, the level of income appears to be important.

The coefficients for sex (0.96) had their hypothesized signs and were highly significant. Female respondents (sex) were willing to pay about ₹ 175 more than male respondents, whereas respondents who depended on piped water or bottled water for drinking were willing to pay about ₹ 60 less than those who relied on bore well or river water. Those who said they were very concerned about health risks from the proposed landfill were willing to pay ₹ 300 more than those who said they were unconcerned. Another major finding of the results shows that household size significantly reduced WTP only for households with more than four members. It seems possible that the lack of difference in WTP between the one-to-three person households with the previous group may be due to the likely presence of children in the latter, offsetting the effect of the lower per capita income on the ability to pay. The year of residence in Tirunelveli is also significant in determining WTP. However, certain anomalies existed in its parameter estimates. Because of residence loyalty, one might expect that the respondents who had lived in Tirunelveli city longer would be willing to pay more than those who had moved in more recently. Another interesting point to be noted in the field survey is that the household characteristic that exhibited an unusual pattern in its coefficients was the distance of the household from the dustbins. Respondents who lived closer to the dustbin were expected to be willing to pay more than those who lived farther away. This pattern holds for a distance of up to 500 m, whereas those households who lived within 100–200 m were willing to pay between ₹ 150 and 200, more than those who lived within 300–500 m. However, those who lived more than 300 m from the dustbin were not willing to pay significantly less than those who were living within 200 m. They were, in fact, willing to pay significantly more than those households located within 300–500 m.

These findings reported above are valuable to policymakers for several reasons. First, since Tirunelveli Corporation is about to develop comprehensive waste management plans, it could use the approach adopted here for evaluating the external

costs or benefits of all waste disposal alternatives, including the use of street dustbins, landfill disposal, incineration and recycling. If such expenditures are to be made in a cost-effective manner, a more complete analysis is needed to compare the total costs of all solid waste disposal alternatives. Second, if minimizing the overall costs was the only objective and if similar results were found to hold for other areas, one might conclude that landfills could be situated in areas with fewer degree holders in higher income classes. However, equity considerations would likely limit an explicit statement of such a strategy publically.

The increasing threat posed to human health as a consequence of the improper way of solid waste dumping in Tirunelveli Corporation has become a burning issue in recent years. This study has attempted to introduce environmental tax by the way of WTP in order to improve the solid waste collection. The results of the WTP indicate that unhygienic conditions and the mosquito menace are due to an unplanned dumping of MSW. The survey results show that the respondents in the area are well aware of the present situation of the MSW collection and management by the corporation and the necessity of their participation to maintain the city clean and tidy. The study results also give a positive scope for introducing environmental tax (user fee). Most of the WTP studies carried out in developing countries in the past have been mainly limited to the estimation of the user's mean WTP. This research has attempted to extend the use of WTP survey results indicating that charging for improving the solid waste management in Tirunelveli Corporation may not have a negative impact among city dwellers. In this case of the observed behaviour method, the assumptions made about the use of WTP for improving the MSW services may be far from true in developing countries. Also, there could be difficulties in charging excessive amounts as WTP because of low levels of education and faulty perception about environmental values due to lack of awareness. The paucity of adequate data on the extent of solid wastes and their effects on people's health cannot be stated as the reason for inaction. Generally, the community and nature in general can only be speculated and the fast deteriorating trend of the urban civic environment can never be denied. The spread of vector-borne diseases has been increasing at an alarming rate in recent days because of unhygienic maintenance of urban civic environment. If the present quantum of MSW generation continues in future and preventive steps are not taken by Tirunelveli Corporation, the society's foregone health expenditure would accrue, causing a huge burden for the people.

The Tirunelveli city's annual solid waste collection is 3,94,01,000 kg (as per 2010). Solid waste collection coverage is very low, which means that solid waste is thrown everywhere in the city, such as open spaces, green areas, rivers, canals, ditches, etc. Because of this, the waste gets spread to all houses in the form of dust, which is distributed by the high wind in the city and causes disease. River stretches and other water bodies are found to be replete with waste, thus causing flooding on the streets. In addition, none of the modern solid waste management practices are implemented and still there are no recycling activities by the municipality in an organized manner. Solid waste is not separated or sorted out at the source and after collection—it is simply dumped all together. But, more importantly, cost recovery is a serious problem of solid waste management in the city. The revenue generated

covers only 9.5% and the rest 90.5% has to be recovered from other sources. Since the waste management does not have enough source of revenue, it cannot be sustained even in the present condition. This study aims to analyze households' WTP to improve the solid waste management service in Tirunelveli city by using the data obtained from a sample of 510 household heads.

The CVM was employed with the single-bounded elicitation format followed by open-ended follow-up questions in a face-to-face interview. The study used both descriptive and econometric techniques of analysis and developed a model, where 18 explanatory variables were used within a regression framework. The Probit and Tobit models were used to identify the determinants of the households' WTP for an improved solid waste management system and to analyze the mean WTP of households.

In the estimated results of the Probit model, the variables that are significantly related to providing positive WTP values are only household education and the income of the respondents. Age has a negative but significant relation with the likelihood that the respondent will provide a positive WTP value. All the signs for the coefficients of these three variables make intuitive sense. The rest of the variables have no significant impact on the likelihood that the respondent will provide a positive WTP value.

In the Tobit model regression results, on the other hand, 4 variables out of 18 explanatory variables have a statistically significant impact on the amount of WTP for improved solid waste management system. The amount of solid waste generated by the household, educational level of respondents, income and age of respondents and house ownership of the household heads have a positive relationship with the amount of WTP and are significant even at 1% level. The type of solid waste service demanded by the households and the income of respondents (income) have a positive relationship and are significant at 5% level and the sex of respondents has positive and significant relationship at 5% significance level, whereas the perception of respondents for the current solid waste management has a negative relation and is significant at 5% level with the amount of WTP for improved solid waste management system.

When the single-bounded method is used, the mean WTP for improved solid waste management per month per household is found to be ₹ 100. But, when the open-ended approach is used, the maximum WTP is found be in the range of ₹ 150–200 per month per household. The total monthly WTP for the city as a whole using the aggregation method is estimated to be ₹ 1,28,94,700. When the dichotomous single-bounded method is used, the monthly WTP is estimated to be ₹ 50–100. This means that the actual WTP of the households in the Tirunelveli city may fall between these two figures. Comparing with the revenue collected based on the service fee regulation and current expenditure on the existing solid waste management, this WTP is much larger and SWM of the city can be improved with the payment and participation of the residents.

The use of OLS models also concludes that the amount of fee the respondents are willing to pay depends a great deal on the referendum fee, income, education and the frequency of solid waste collection in the city. Finally, the significance of

the referendum fee in determining the stated fee in the OLS application also leads to the discovery of a starting point bias as the referendum and the means of the corresponding stated fees tend to go in the same direction. A majority of those unwilling to pay for the service have been found to be either protesting the bid or too poor to pay. The implication of this finding is that if they are more aware of the status of MSW and understand its importance, they might be more willing to support and even to pay the necessary fee to maintain solid waste. Institutional arrangements are essential for improving the condition of solid waste and the most controversial issue which needs to be addressed is which organization should be responsible for collecting an environmental tax for maintaining solid waste management. Based on the results of the household survey, it is likely that while initial charges will be constrained somewhat low by WTP, they could be set at levels which would support the system that could encourage building a feasible way to finalize the surcharges effectively. To improve MSWM in the city, the residents should be aware of the prevalence of vector-borne diseases and based on which the government should appropriately respond to this issue and keep the city clean, which is mandatory in this era of urbanization without any further delay.

## Valuation of Municipal Solid Waste Management Activities

In this study, each activity of the MSW management has been formulated into a multivariate functional model based on theoretical considerations with due consideration given to all the implicit costs and benefits. The researcher has valued each component and the MSW management as a whole, and this is done by collecting data for various parameters from Tirunelveli Municipal Corporation. The following section presents multivariate functional models for each activity of the MSW management, followed by a valuation of those components of the MSWM in Tirunelveli. The unit cost of waste disposal is used to measure the efficiency of the system. The unit cost of waste disposal is defined as follows:

Unit cost of waste disposal (₹/t), $C_{\mathrm{OD}} = \frac{\sum_{i=1}^{3} e_i - b_i}{W_{\mathrm{a}}}$

where

| | |
|---|---|
| MSW generation per year (million tonnes) | $W_{\mathrm{a}}$ |
| Cost of collection (₹) | $e_1$ |
| Cost of transportation (₹) | $e_2$ |
| Cost of disposal (₹) | $e_3$ |
| Benefits | $b_i$ |
| Cost of collection ($e_1$) | |
| Waste generated per day (metric tonnes) (161.44 t) | $W_{\mathrm{d}}$ |
| Waste that can be collected by each worker per day (tonnes) | $W_{\mathrm{w}}$ |
| Number of workers per tonne of waste per day | $1/W_{\mathrm{w}}$ |

| | |
|---|---|
| Salary of each worker per day (₹) | $W$ |
| Collection cost per day (₹) | $(1/W_w w)W_d$ |
| Waste generated per year | $W_d 365 = W_a$ |
| Number of bins used for collection | $N_b$ |
| Cost of each bin | $C_{bin}$ |
| Total cost of bins | $N_b C_{bin}$ |
| Annual cost of collection ($e_1$) (₹) | $\left(\frac{1}{W_w} w\right) W_a + N_b C_{bin} + misc$ |
| (Miscellaneous includes cost of minor equipment, trolleys, etc.) | |
| Cost of transportation ($e_2$) | |
| Length of travel per truck per year | $L\,an-km$ |
| Cost of travel per truck per tonne in a year | $Ctr/t/yr$ |
| Number of trucks required | $T_n$ |
| Travel cost per tonne ($Ctr$) | $Ctr/t/yr T_n$ |
| Total cost of transport ($e_2$) (₹) | $C_b W_a C_{coll}$ |
| Collection efficiency | $C_{coll}$ |
| Cost of disposal ($e_3$) | |
| Cost of maintenance of disposal sites (₹ Nil) | $m$ (not spent for 2009–2010) |
| Tirunelveli Corporation ignores the cost of land, hence the total cost of disposal (₹ Nil) ($e_3$) | $m$ |
| Valuation of Tirunelveli MSW management | |
| $W_d$ (tonnes) | 5,89,25,600 kg (converted into kilograms) |
| $W_w$ (kg) | 294.72 |
| $1/W_w$ (kg) | 0.294 |
| $w$ (₹) | 298.46 |
| Waste generated per year (tonnes) | 58,925.6 |
| Number of containers | 442 |
| Price per container (₹) | 9,206.74 |
| Total cost of containers (in ₹) | 40,69,379.08 |
| Miscellaneous expenses (stores, uniforms) (in ₹) | 15,46,000 |
| Total cost of collection (in ₹) | 10,03,19,000 |
| Owing to lack of data, the cost of transportation is taken from Tirunelveli Corporation estimates. The total cost of solid waste management, without considering implicit costs, is as follows: | |
| $e_1$ (₹) | 5,61,15,387.31 |
| $e_2$ (₹) | 42,06,000 |
| $e_3$ (₹) | 40,97,000 |
| Total cost of MSW (₹) | 6,44,18,387.31 |
| Unit cost of disposal | 1,032.46 |
| Total solid waste generation per day (tonnes) | 161.44 |
| Total solid waste collection per day (tonnes) | 108 |
| Uncollected waste (shortfall) (tonnes) | 53.44 |

The unit cost of disposal calculated by Tirunelveli Corporation is not available. However, if there is any difference in the estimates of the unit cost of disposal as assessed by the researcher and by the corporation, it could be due to errors in the estimation. Keeping in view the importance of solid waste management, the money which has been spent for collection and disposal is not sufficient for an existing expansion of urbanization in Tirunelveli Corporation as the population size has been increasing manifolds in recent years. Out of 161.44 t of solid waste generated, only 108 t of solid waste was collected and the remaining 53.44 t of solid waste has been neglected or uncollected due to nonavailability of sufficient funds and other infra-

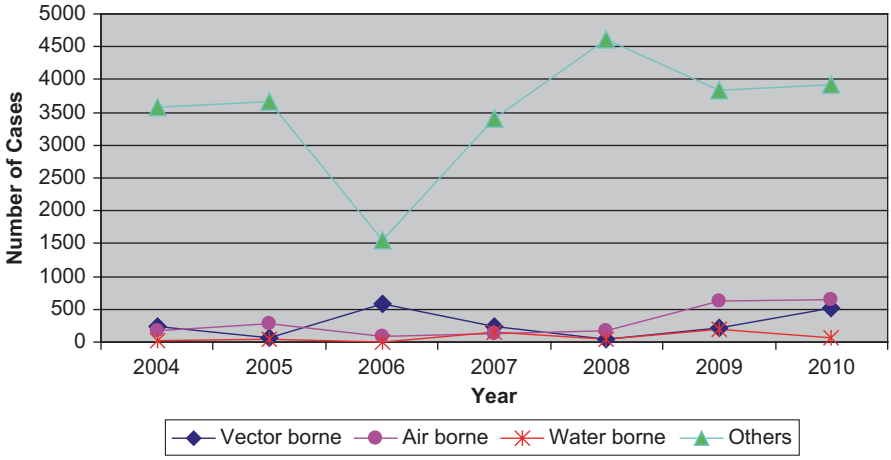


**Fig. 11.1** Morbidity trends in Tirunelveli Corporation

**Table 11.5** Linear regression model of health impact of solid waste. Dependent variable—distance. (Source: computed data)

| *R* | Standard error of the estimate | Degrees of freedom | Significance | $R^2$ | Adjusted $R^2$ |
|---|---|---|---|---|---|
| 0.074 | 159.6575 | 2 | 0.253 | 0.005 | 0.001 |

Independent variable—health greatly affected

structural limitations. Even the money spent for solid waste collection per tonne is not enough for efficient collection when we compare the same with other metropolitan cities in India. Therefore, this study would recommend to the municipal authorities to enhance the fund allocation for solid waste management, at least to the tune of the people's WTP so that the solid waste in the city can be efficiently managed (Fig. 11.1).

Table 11.5 shows a positive value for the variable *R*, which indicates that there is a positive relationship between the distances where dustbins are kept (i.e. whether it is placed near a residence) and the impact on health. The model result shows that the data are good fit revealing an $R^2$ value of 0.005, which indicates that there is a positive significance between health impact and the distance between the garbage dustbins and the residence. It is a well-established fact that dumping of waste into areas close to residences or on roadside will cause mosquito menace that often goes uncontrolled in Tirunelveli in almost all the wards. Therefore, many complaints have been filed by the residents of Tirunelveli city to the corporation officials but nothing has been done to reduce the increasing vector-borne diseases. However, in recent years, with some strict instructions from officials and councillors, the mosquito control operation is being carried out, but this is only in selected areas and other areas still remain neglected.

## Conclusions

Most of the MSW in Indian cities is dumped in open space or near roadside in an uncontrolled manner. Such inadequate disposal practices lead to problems that will impair human and animal health and result in economic, environmental and biological losses. An open dump or an uncontrolled waste disposal area should be rehabilitated. It is advisable to move from open dumping to sanitary land filling in a phased manner. The current regulations (MSWM rules, 2000) are very stringent. Norms have been developed to ensure a proper MSWM system. Unfortunately, clearly there is a huge gap between policymaking and its implementation. The producer responsibility is to avoid having products on the market that cannot be handled effectively and cannot be safely disposed of environmentally when they become waste products. The study concluded that the lack of resources, such as financing, infrastructure, suitable planning and data and leadership, are the main barriers in MSWM. Therefore, this study would recommend to Tirunelveli Corporation to adopt minimum user fee—based on the results obtained—from city dwellers by the way of WTP analysis towards MSW. Finally, this methodology and results reported here are not without limitations. The model is not complete as many relevant variables could not be included. For instance, the variable capturing the perception of the public as to the assurance of quality service has not been included. As a result, the WTP estimates may be biased downwards. Similarly, since the MSW is heterogeneous in nature, a large number of samples have to be collected and analyzed to obtain statistically reliable results. Some of these issues will be explicitly addressed in future empirical research on the subject.

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# Chapter 12
# A Study of Small And Micro Enterprise Regulatory Impediments in Fiji

**Salvin Saneel Nand**

## Introduction

Small and micro enterprises (SMEs) are a vital segment of an economy. If not most vital, due to SMEs' ability to address significant economic and social issues, SMEs are here with us and have considerable potential for socioeconomic development. Especially characteristics such as growth with clear benefits for poverty reduction put a premium on SMEs in the process of economic growth. SMEs have long been significant in terms of generating income for many Fiji Islanders, with up to 60 % earning an income from these categories of enterprises.[1] A rapid increase of urban population with a desire for urban income has placed a high demand on the informal SME sector. The 2007 census revealed 17.3 % increase in urban population since the first census in 1966. The informal sector[2] alone generated 37 % of economic activity in 1996.[3] The significance of the SME sector as an "engine for economic development" means economic policies must consider the needs of the SME sector.[4]

Despite various attempts to promote the SME sector by creating a more conducive environment to enhance SMEs' growth, this sector continues to face numerous difficulties, such as poor policies, regulatory red tape and financial securities. The policy concentration on the SME sector was mainly due to two reasons. Firstly, the government recognized the ability of the SME sector to provide an excellent oppor-

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[1] Fiji Bureau of Statistics 2002.

[2] The Informal Sector in this chapter is defined as business that is not properly registered under the company's office as business or establishment under the town and city councils in Fiji.

[3] Chand 2002.

[4] Beck and Demirguc-Kunt (2005).

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tunity for formal and informal employment opportunities.[5] Secondly, the SME sector can be a good measure to solve rural–urban drift by promoting subsistence rural products and producers. These policies are introduced without any due diligence or cost analyses conducted to see the effect of the policies on SMEs. The fact that SME policies are implemented in response to the increasing poverty and high level of unemployment suggests that these policies are based on the incrementalism model.

Numerous studies have discussed that SMEs face high regulatory constraints than larger firms. Little systematically documented literature appears available on the subject in the case of Fiji, a socioeconomically disadvantaged country, inherently vulnerable, small and in dire need of economic activity and growth. The purpose of this chapter is to highlight regulatory compliance difficulties faced by the SME sector in Fiji and to investigate solutions for efficient enhancement of this sector, and summarize implications for urban governments. Both quantitative and qualitative data were utilized to establish the regulatory compliance difficulties faced by the SME sector. For qualitative data, structured interviews with questionnaires were submitted to 80 sample respondents in Fiji. This chapter also relied on the survey conducted by the Fiji Bureau of Statistics on 7,061 enterprises in 2004 and a survey by the National Centre for Small and Micro Enterprise Development (NCSMED) on 164 sample SMEs in 2010.[6]

A review of the current regulatory system suggests that sluggish policy formulation and implementation are the main reasons behind the unsustainable development of this sector. It further suggests that while regulations are a necessary part of modern business, compliance, administrative and regulatory costs are a significant concern for SMEs' ability to remain competitive. Robust regulatory burdens have forced SMEs to remain in the informal sector of the economy. Therefore, if SMEs continue to operate in an informal economy, it will adversely affect their potential growth and will hinder the overall urban development. This has manifested itself with regular calls for the reduction of state "red tapes" and the development of better regulation in Fiji. To enhance SMEs' development, the current regulatory system should be streamlined, and a level playing field be provided for this sector.

## The Emerging SME Sector

Fiji is a country in which small and medium-sized enterprises (SMEs) dominate the business population. The government in 2002 established the NCSMED to lead the development in this sector. The establishment of the NCSMED was in response to the inability of the various governments to create adequate formal employment opportunities to the rising labour force especially in the urban areas, and the con-

[5] National Center for Small and Micro Enterprises Development *Report of the 2nd Annual National SME Forum: Putting Co-ordination and Partnership into Action for SME Growth*, Suva Fiji, and NCSMED.

[6] Fiji Bureau of Statistics 2004.

**Table 12.1** Percentage of SME operators by gender, ethnicity and with formal education. (2010 NCSMED report based on NCSMED Expo 29–30 April 2012)

| | Micro ($n=147$) | Small ($n=11$) | Informal/grey ($n=33$) |
|---|---|---|---|
| Male | 67 | 62 | 61 |
| Female | 33 | 38 | 39 |
| Fijian | 42 | 31 | 79 |
| Indo-Fijian | 56 | 38 | 21 |
| Others | 2 | 31 | 0 |
| Primary education | 32 | 15 | 52 |
| Secondary education | 49 | 31 | 36 |
| Tertiary education | 19 | 64 | 12 |

sequent realization that the largest labour absorption capacity is in the SME sector. The NCSMED Act 2002 does not provide rules and regulations concerning SMEs.[7] The establishment of NCSMED is aimed to provide income generation support to disadvantaged groups including women and youth.

The NCSMED Act 2002 defines "micro enterprise" as an enterprise which has a turnover or total assets up to US$ 30,000 and does not employ more than five employees. A "small enterprise" has a turnover or total assets between US$ 30,000 and 100,000 and employs between 6 and 20 employees.[8] The Act does not define "medium enterprise" that would include businesses with US$ 100,000–500,000 turnovers and employs 20–50 persons.

A recent survey by NCSMED 2010 shows that from 164 surveyed businesses based on annual income turnover, a majority (147) of the businesses fall under micro enterprises, 11 under small enterprises and 6 under medium enterprises.[9] An additional 33 enterprises were found to be operating in informal/grey markets.[10] Table 12.1 shows that the SME sector is dominated by 63% male business owners with only 36% females. It also shows that most SME owners only have either primary or secondary education with few tertiary qualifications.

Since its inception, SMEs have long been significant in terms of generating income for the largest number of Fiji Islanders. Some 60% of the total 8,37,271 population earns an income from these categories of enterprises.[11] However, according to the Reserve Bank of Fiji (RBF), the SME sector only accounts for 12% of the economic activity in Fiji.[12] The SME sector has presence in manufacturing, wholesale and retails and transport sectors. However, SMEs are starting to invest in cash crop farming, bee farming, floriculture and handicraft products. Tax incentives are

[7] National Center for Small and Micro Enterprises Development Act 2002.

[8] The National Center for Small and Micro Enterprises Development Act 2002 (FJ).

[9] Fiji Institute of Applied Studies for the National Center for Small and Micro Enterprises Development 2010.

[10] Grey Market is defined to include unregistered enterprises with companies or local town/city councils.

[11] Fiji Bureau of Statistics 2002.

[12] Whiteside 2012.

**Table 12.2** SME by economic sector. (2004 Bureau of Statistic Economic Survey based on 7061 business surveyed)

| Sector(s) | Micro (%) | Small (%) | Medium (%) |
|---|---|---|---|
| Hotels | 46.1 | 35.9 | 9.3 |
| Construction | 47.4 | 37.2 | 10.2 |
| Electricity | 16.7 | 33.3 | 8.3 |
| Manufacturing | 34.5 | 33.9 | 16.4 |
| Mining | 47.1 | 23.5 | 11.8 |
| Transport | 79.9 | 12.8 | 4.1 |
| Wholesale/retail | 57.0 | 32.2 | 8.0 |
| Finance | 23.8 | 44.4 | 29.6 |
| Education | 50.4 | 40.2 | 6.3 |
| Real estate | 84.0 | 11.7 | 2.5 |

the basic reason most SMEs choose to be in these sectors.[13] The 2004 economic survey by the bureau of statistics suggested that the majority of businesses registered were in the wholesale and retail sector (23.5%), 21.5% in transport, 16.7% in real estate and 10.3 in education.[14] Table 12.2 shows the percentages of SME businesses registered under various economic sectors.

The NCSMED introduced a business incubation centre in various parts of Fiji to promote the SME sector. Incubation centres aim to produce successful businesses that are able to operate independently and be financially viable. However, a full detail of goods and services produced by the SME sector is not possible within this chapter due to the limited literature and data available on goods and services produced by the SMEs.

Because of the economic downturn in large businesses, declining employment and the number of hours worked, many workers have turned to opportunities in informal and informal SME sectors to either earn income or supplement their reduced earnings. In recognizing the importance of the SME sector, the government has introduced various policies. The National Employment Centre Decree 2009 is introduced to recognize the potential importance of mentoring support for SMEs. The centre tries to promote opportunities for decent self-employment and provides counselling services, life/employment and entrepreneurship skills training. Both NCSMED and the National Employment Centre are positive signs from the government to boost the economic and social development of the SME sector.

The government through people's charter recognizes the importance of the SME sector and has called for a national strategy "for the development of micro, and small enterprises; and to improve access to microfinance at an affordable rate."[15] In its effort to promote and develop the SMEs' ability to access finance, the government through the RBF has introduced an SME credit guarantee scheme.[16] Under this scheme, the government has allocated US$ 3.0 million for RBF to assist com-

[13] Income Tax Act 2006.

[14] Fiji Bureau of Statistics 2004.

[15] Peoples Charter for Change, Pace & Progress 2008.

[16] The Reserve Bank of Fiji 2012.

mercial banks, licensed credit institutions and the Fiji Development Bank to provide finance with 50% guarantee on principal outstanding SME loans up to US$ 50,000 per business. However, to access such finance, a business has to be registered, leaving no option for the grey/informal market to find necessary start-up capital for registration or to qualify for loans from financial institutions. Some 60% SMEs highlighted lack of finance, lack of know-how and skills and discriminatory government regulations as reasons why many SMEs remain in the informal sector.[17]

Realizing urbanization as the most perplexing problems faced in Fiji, various policies are implemented to foster urban development. There has been a steady increase in urban population since 1966. Around 51% people live in urban areas and this figure is expected to increase to 60% by the end of 2030.[18] Increase in urban population without the simultaneous growth of the urban sector has led to a number of urban problems. Amongst other issues like housing, water and sanitation, high unemployment rate is becoming one of the biggest challenges faced by urban governments. The growth rate of urban development struggles at 1.8% while urban unemployment is at an all-time high of 33.4%.[19]

To strengthen local government to deal with the increasing challenges of urban service delivery and management, the ministry of local government, urban development, housing and environment implemented two polices. The urban policy action plan 2007 aims to foster urban environment, management, economic development, poverty reduction, increase access to finance, provide better access to legal infrastructure and strengthen the institutional framework.[20] To provide better land security, basic infrastructure and service to informal settlement, the government further introduced a national housing policy in 2011. A strategic planning policy 2011–2014 is introduced to implement the hosing policy. Regional efforts have also been made to "improve the quality of life for communities in the Pacific region through strengthened local democracy and good governance."[21] The Commonwealth local government forum, Pacific Project, aims to strengthen regional networks and cooperation between local government practitioners; enhance training and capacity building opportunities and provides the basis for regional exchange on policy, good practice and technical cooperation.

The urban policies are another evidence of the government's attempt to formalize the SME sector. Urban policies, however, should harmonize the attempts made under the Small and Micro Enterprise Development Act 2002, to provide employment opportunities through assisting the informal and formal SME sector development. Despite the implementation of various policies, the SME sector is certainly not free of obstacles. The major problem in the establishment of a business in Fiji

[17] Reddy et al. 2003.

[18] Department of Town and Country Planning, Ministry of Local Government, Urban Development, Housing and Environment presentation 2012.

[19] Ibid; and Fiji Islands Bureau of Statistics 2010.

[20] Ministry of local government, urban development, housing and environment Urban Policy Action Plan 2007.

[21] Parker and Praeger 2008.

is discriminatory regulatory rules. The current laws applicable to SMEs are those applicable to any business and not specifically targeting the SMEs. The SME sector has many impediments related to microfinancing, security, market, location and weather. However, due to the chapter's scope on legislative policy, it will be difficult to provide detailed analysis on all challenges faced by SMEs.

## Legislative Policy Process

Normally, policy change responses to problems in a sector and policymakers must start policy formulation with an appreciation of the SME sector.[22] In Fiji, SME policies were introduced not because the SME sector had problems, but were introduced in response to the governments failing employment and private sector policies.[23] To resolve the continuing woes of unemployment, increasing urban unemployment, rising poverty and declining private sector, SME policies are considered as potential strategies.

At policy formulation stage, the policymakers normally attempt to assess as many areas of potential policy impact as possible.[24] The question here is who develops policy options and how policies are developed. Policy options can be generated using either incrementalism model or rational model. Incrementalism is a policy-making process which produces decisions only marginally different with past practices.[25] In his 1959 article titled "Science of Muddling Through", Lindblom notes, "that in making decision, means and ends are not always distinct, and that there is rarely the time, resource or inclination to conduct a comprehensive search."[26] He further observed that the test of a good policy is not whether it is rational but whether it is acceptable to participations.[27] Many analysts describe incrementalism as muddling through policy planning. According to Dror, the incrementalism model is an "ideological reinforcement of the pro-inertia and anti-innovation forces prevalent in all human organizations, administrative and policy making."[28] He also argued that incrementalism can only work in a stable, pluralist society with relative consensus about goals and acceptable means.[29]

The rational model identifies policy making as a problem-solving process, which is rational, balanced and analytical.[30] The goal of this model is to identify the com-

[22] Davis et al. 1993; Sulton 1999, p. 9.

[23] Qarase 2004.

[24] Davis, above n 22, 160.

[25] Lindblom (1979). Also see Quinn 1980.

[26] Lindblom (1959).

[27] Ibid, also see Lindblom (1977).

[28] Dror (1964).

[29] Ibid.

[30] Lindblom, above n 26.

mon good and organize the society to pursue it.[31] This "process will ensure a rational outcome by selecting the most effective means of achieving an end. It breaks down decision making into phases, ensures comparisons of options and provides a single answer which is logical, supported by evidence, and can be defended as the best choice."[32] According to Scott, top-down policy making routinely fails to deliver on the objectives and is typically accompanied with a range of unanticipated social and environmental impacts.[33] "Consultation and coordination with citizens, social movements and voluntary associations came to be seen as providing an effective means of harnessing local knowledge and energy in both planning and implementation."[34]

The implementation of policies should follow policy formulation. This is because policy implementation is the crucial process of a policy cycle. Even the best-designed policies introduced with the best of intentions still require good implementation and delivery. As Pressman and Wildavsky suggested, history is full of well-intentioned policies, which floundered through inadequate or flawed implementation strategies.[35] It is essential to understand policy implementation because implementation studies have emphasized advice to policymakers of how to structure programmes. The two main approaches to policy implementation are the "top-down" and "bottom-up" approaches.

In a top-down model, normally policymakers of the governments design features of the policy. As Neal Ryan stated, "top-down implementation strategies greatly depend on the capacity of policy objectives to be clearly and consistently defined."[36] This means that if the policymakers fail to formulate proper policy objective, then policy implementation through top-down approach will be difficult. Sabatier and Mazmanian identified a variety of legal political and tractability variables affecting the different stages of the implementation process.[37] The most problematic feature of top-down models is the emphasis on clear objectives or goals. As Majone and Wildavsky argued, few programmes have a clear and consistent policy objective.[38] Another problem with the top-down model is the assumption that there is a single national government that structures policy implementation and provides for direct delivery of services.[39]

The top-down model allows the government to neglect strategic initiatives coming from the private sector, from street-level bureaucrats or local implementing officials, and from other policy subsystems. Weatherly, Lipsky and Elmore clearly summarized the difficulty associated with the top-down approach. As they believe,

[31] Hewlett (1991). Also see Carley 1980.

[32] Davis and above 22, 161.

[33] Scott 1998; Leach et al. 1999. Also see Lane 2001.

[34] Lane 2006.

[35] Pressman and Wildavsdky (1984).

[36] Ryan 1995.

[37] Sabatier and Mazmanian (1979). Also see Sabatier (1986).

[38] Majone and Wildavsky (1978). Also see Majone 1989.

[39] Sabatier (1986).

this model will be difficult to use in situations where there is no dominant policy (statute) or agency but rather a multitude of governmental directives.[40] For example, when implementing the SME policies, the policymakers in Fiji have failed to take into account the views of the different levels of the SME sector (i.e. the small, micro and grey market SMEs).

In bottom-up model, policy implementation begins by understanding the goals, motivations and capabilities of the lowest-level implementers and then follows the policy design upward to the highest-level initiators of policy. According to Benny Hjern (one of the famous philosophers of this model) bottom-up policy implementation:[41]

> Starts by identifying the networks of actors involved in service delivery, in one or more local areas, and asks them about their goals, strategies, activities, and contact. It then uses the contacts as a vehicle for developing a technique to identify the local, regional, and national actors involved in the planning, financing, and execution of the relevant governmental and no-governmental programs. This provides a mechanism for moving from street level bureaucrats (the 'bottom') up to the 'top' policymakers in both the public and private sectors.

This approach has several notable strengths. First, this model has developed an explicit and replicable methodology for identifying a policy network. For example, in the SME sector, the policymakers can start with a random sample of SME business and then interview the owners in each business to ascertain their critical problems. The government then can use these contacts via a networking technique to identify the implementation structure. Second, since this model did not "begin with a governmental program but rather with the actor perceived problems and the strategies developed for dealing with them, they are able to assess the relative importance of a variety of governmental programs vis-a vis private organizations and market forces in solving those problems."[42] Finally, this approach has the potential to deal with a policy/problem area involving a multitude of public and private programmes.

Notably, there are serious shortcomings in the bottom-up model. According to Paul Sabatier, "bottom-uppers are likely to overemphasize the ability of the Periphery to frustrate the Centre."[43] In other words, this model overemphasizes the ability of the street-level bureaucrats to frustrate the goals of top policymakers. In addition, bottom-uppers presume that target groups are active participants in the implementation process. This may be a misguided assumption since there is always a power difference among target groups. As Anne Schneider and Helen Ingram explain, "some target populations are more positively constructed than others, with the result that those with greater power can have a greater influence on the impact of policies that affect them than can other groups."[44]

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[40] Ibid.

[41] Hjern (1982). Also see Hjern and Porter (1981).

[42] Sabatier, above n 39, 26.

[43] ibid, 28.

[44] Schneider and Ingram. (1992).

To implement the legislative compliance policies, most legislation, subordinate legislation, by-laws and rules set by local authorities in Fiji were either adopted or directly copied from the England, Australia and New Zealand laws. The fact that these policies are based on developed economic and social markets different to Fiji (developing country) suggests that the problem is rooted in the legislative compliance application to the SME sectors' sustainability and development. For example, the Companies Act 1983 applicable to all businesses is a replica of the English 1948 Companies Act. The Registrations of Business Name Act, Income Tax Act, Business Licensing Act and the Town Planning Act are still present from the colonial era. This policy implementation allows the government to impose policies from top to the sectors concerned without little consultations with key stakeholders and interested parties. This is exactly what happens in Fiji, as large businesses are able to portray their concerns through financial backing with governments when the SMEs, characterized by their smaller nature, are unable to voice out their concerns and thus become the victim of policies implemented favouring large businesses. In comparison, it is vital to consider what these two approaches in policy implementation designs do best. The top-down model is useful when there is a single dominant programme.[45] However, the bottom-up model is useful when there is no one dominant programme as in the case of the SME sector.

## The Impact of Inflexible Laws on the SME Sector

To investigate the effect of the top-down and incremental methods of policy imposed on SMEs in Fiji, several SMEs were interviewed. To gather information in both qualitative and quantitative data, a survey was conducted with a selected sample of SMEs. A semi-structured questionnaire was administered to a sample of 80 selected businesses within the main island (Viti Levu). The survey was limited to these groups to investigate the impact of legislative compliance cost as factors, such as access to institutions (government agencies, finance and dispute resolution), are constant compared to outer islands. The questions were solely on legislative and compliance difficulties faced by SMEs.

The biggest difficulty SMEs faced in complying with regulatory rules was the lack of awareness of relevant laws applicable to their business. Some 70 SMEs out of 80 surveyed suggested that they were not aware of all business rules and regulations when registering or renewing their business. All 80 participants reported that they took formal advice in registering and filling relevant forms to renew their business licence. Table 12.3 shows considerable regulatory compliance impediments faced by SMEs.

Most respondents claimed that there are too many laws and regulations not suitable for SMEs. Respondents highlighted the need for one-stop checklist or standalone legislation for SMEs. Many also claimed that regulatory institutions are

[45] Rachlinskit 2006, pp. 933–964.

**Table 12.3** Regulatory compliance burden on SMEs. (based on feedbacks provided by SMEs)

| Compliance issue | Selected SMEs by a sample of 80 | % |
|---|---|---|
| Knowledge of "all" existing SME-related laws and regulations | 10 | 12.5 |
| Knowledge of changing laws and regulations concerning SME | 8 | 10 |
| Ability to understand and access laws and regulations | 2 | 2.5 |
| Accessing registration forms | 80 | 100 |
| Knowledge of business registration procedures | 20 | 25 |
| High cost associated in registering starting-up business | 70 | 87.5 |
| Non-compliance penalties in respective laws are harsh on SME | 80 | 100 |
| Knowledge and ability to access dispute resolution | 10 | 12.5 |
| Ability to meet regulatory requirements to access finance | 8 | 10 |

**Table 12.4** Recommendations. (based on feedbacks provided by SMEs)

| Suggestions | SME |
|---|---|
| Implement a standalone legislation on SME | 80 |
| One-stop checklist detailing procedures for registration, access to loan, dispute resolutions etc. | 80 |
| Implementing a toolkit for SME | 80 |
| Translating laws and regulations, in major languages in Fiji: Fijian and Hindi | 80 |
| Straining current laws suitable for SME | 80 |
| Legal training | 80 |

centralized in the capital city (Suva). Some 70% SMEs suggested that NCSMED should be decentralized by appointing suitable staffs in every town and city as part of local government agencies. This officer can assist the SME owners with rules and procedures associated in establishing a business. Nearly all agreed that there was a lack of legal literacy available at the basic level. Table 12.4 shows recommendations by SMEs to improve the current regulatory system.

Inflexibility or unpredictability in laws applicable to the SME sector is a principal legislative compliance reason most SMEs are struggling to survive. To promote the SME sector, the government has to align current laws to accommodate the SME sector's need. There are two basic attitudes towards governmental intervention to assist SMEs in an open competitive economy. On the one hand, Reddy argues that state intervention is necessary to provide financial, infrastructure and technical support to promote poverty alleviation.[46] On the other hand, he strongly emphasizes reducing regulatory intervention—cutting the "red tape" to allow a more effective competition.[47] Therefore, one must ask, is deregulation better for a closed economy like Fiji? Perhaps yes; the current policies need to be streamlined to foster the SME sector development. At the local government level, the capital city is taking the lead role in formalizing and fostering the SME sector.

The Suva city council has implemented urban management policies at various sectors. One noticeable policy is the assistance provided to informal street traders

[46] Reddy 2007, p. 461.

[47] Ibid.

by recognizing them through city council licence under the Business License Act (CAP 204). The Suva city council provides street trader/hawker requirement checklists for SMEs to fulfil the requirement of registration. Checklists can assist SMEs to understand the regulatory compliance and can provide opportunities for SMEs to legitimize their business.

The major concerns for SMEs in Fiji are high regulatory burdens and high compliance costs of doing business. Over-regulation is a concern to businesses whether they are small or large; therefore, the current regulatory burdens and cost of doing business should be reduced in Fiji. For example, being on the right side of the law and complying with all the regulatory rules is costing small firms a fortune. The regulatory red tapes in business registrations are one of the many challenges SMEs face because of the top-down policy processes in Fiji. Lack of information on the know-how in complying with statutory requirements is another concern in Fiji. Businesses are forced to remain in the informal sector due to the inflexibility of business registration procedures and lack of financial support to register their businesses.

## Conclusion

This chapter suggests that one of the biggest problems SMEs face is the regulatory compliance burden. Due to the robust regulatory requirements coupled with the financial constraints, SMEs in Fiji are either forced or choose to remain in the informal sector. If SMEs continue to operate in an informal economy, it will negatively affect Fiji's socioeconomic development. It will also affect the potential development of informal businesses. There is an urgent need for reforms to foster the private sector development. These reforms should address and eliminate obstacles for small business formalization. However, these reforms will not be successful if the current policy process is not strengthened. A good public policy will be both socially and economically viable and will not require additional resources and capital to revisit or review the policies.

In general, there should be a "one-stop" checklist (according to the business type) detailing all the regulatory compliances which need to be fulfilled in opening and maintaining a business. In addition, checklists should be readily available in different languages and should come with considerable advice. Streamlining of legislation is a policy issue and not an administrative issue. Drafting streamlined legislations can only proceed once the details of the policy framework are clear. This can only begin by examining each existing law applicable to SMEs, as well as those in the informal/grey market, to see if it is still consistent with implementing present policies on SMEs. Standalone legislations on SMEs may be considered desirable for SMEs, rather than a plethora of provisions in different legislation.

Despite the recent policies in urban governance and development of the SME sector, a considerable gap between formal and informal businesses in Fiji still remains. A single reason is that policies are developed in isolation to each other. For

instance, the urban development policies targeting SME development in urban areas failed to harmonize the existing policy initiative by the NCSMED. One suggestion would be to allow local government agencies to handle administrative issues connected to SMEs' development. The town and city council should design a proactive approach to supplement efforts of national agencies by establishing and implementing various measures. For example, city councils can appoint a skilled in-house officer to handle SME-related issues. Town and city councils should collect data on formal and informal SME sectors and design programmes and awareness for SMEs within their respective boundaries.

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# Part III
# Urbanization and Environment

# Chapter 13
# Trends of Land-Use Change in India

**Geetika Rathee**

Land is a crucial natural resource and an important determinant of a country's socioeconomic and ecological health. Given the finite supply of land resource, sustainable use and management of land resources is a necessity for the well-being of people of a country. Land-use change has broad lines of impact, with a potential for influencing economic growth, quality of life, management of environmental resources, and national food supply. A country's socioeconomic priorities at any given time shape the drivers of the land-use change. India, as a developing country, is pushing its industrial and service sector to create favorable conditions for production and consumption of goods and services. Urban regions, as widely recognized, are favorite spots for the consumption and production of a large number of these goods and services. Although the causal relationship of economic growth with that of urbanization is not well established, it is the backdrop for any nation's economic growth (Tolley 1987). It is the very reason for which urbanization has become a major policy guide map for India and many other developing countries[1]. With rising rate of urbanization, more changes in land-use are taking place to supplement evolving demands and expectations. This chapter looks at some of the changes in land-use by looking at land-use statistics at the national level and in major metropolitan regions to assess the direction and scale of these changes that have come about as a result of refreshed urbanization focus in country's development strategy.

In the first section of the chapter, land-use changes that occurred in the period from 1950 to 2010 are mapped with the five-year plan budget priorities for differ-

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[1] Studies show that China too witnessed a sea change in land-use patterns, majorly led by government-promoted urbanization (Xu et al. 1999; Wu et al. 2001; Su et al. 2011; Siciliano 2012).

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ent sectors. A regression is run to establish an empirical relationship among different land-use categories. The analysis helped in deducing the direction of these changes. This is followed by an analysis of land-use changes for six metropolitan regions of the country for the last decade, which shed light on the extent of land-use changes due to urbanization. Section 3 highlights the issues and concerns that have emerged as a result of the current land-use trends. The chapter concludes with some tentative policy options that could facilitate in addressing the issues and concerns that have cropped up.

## Land-Use Trend at National Level

In order to study the trends for land-use, classification of land area under different categories is necessary. Directorate of Economics and Statistics, Ministry of Agriculture, Government of India classifies land-use under nine categories[2]. They are as follows:

- Forest area (this includes all land classified either as forest under any legal enactment or administered as forest, whether state-owned or private, whether wooded or maintained as potential forestland. The area crops raised in the forest and grazing lands or areas open for grazing within the forests remain included under the "forest area");
- Area under nonagricultural uses (this includes all land occupied by buildings, road, and railways or under water, e.g., rivers and canals, and other land put to uses other than agriculture);
- Barren and nonarable land (this includes all land covered by mountains, deserts, etc. and land that cannot be brought under cultivation except at an exorbitant cost whether such land is in isolated blocks or within cultivated holdings);
- Permanent pasture and other grazing land (this includes all grazing land whether it is permanent pasture/meadows or not. The commons of the village is included under this category);
- Land under miscellaneous tree crops, etc. (this includes all cultivable land that is not included in 'net area sown' but is put to some agricultural use. Land under Casuring trees, thatching grasses, bamboo bushes, and other groves for fuel, etc., which are not included under "orchards" are classified under this category);
- Arable waste land (this includes land available for cultivation, whether taken up or not taken up for cultivation once, but not cultivated during last 5 years or more in succession including the current year for some reasons);
- Fallow land other than current fallow (this includes all land which was taken up for cultivation but is temporarily out of cultivation for a period of not less than 1 year and not more than 5 years);

[2] The Directorate of Economics and Statistics (DES), an attached office of the Department of Agriculture and Cooperation, collects, disseminates, and publishes statistics on diverse facets of agriculture and related sectors required for policy formulation by the government.

- Current fallow (this represents cropped area, which is kept during the current year); and
- Net sown area (this represents the total area sown with crops and orchards. Area sown more than once in the same year is counted only once.)

I have however focused on land-use changes under four different categories namely forest area, land under nonagricultural uses, barren and nonarable land, and arable land area[3]. These mutually exclusive and exhaustive categories of land-use endorse economic activities (*area under nonagricultural uses*), ecological system (*forest area*), and national food supply (*arable area*). The barren and nonarable land category reflects the constraints on land resource development which could be topographic, economic, or biophysical in nature. The source of land-use-related data for the study is time series land-use statistic tables from the Directorate of Economics and Statistics (DES), Ministry of Agriculture, Government of India.

Land-use trends are continually shaped by the changing nature of economic activity and the public policy of a country. Over time, each land-use category except forests experienced its share of growth or declining rates (summarized under Table 13.1) that mirrored the socioeconomic priorities of the country during the period. Land area under forests increased throughout the period of study. The increase was substantial for the first decade as it marks the very first development of land management after independence, Forest Act 1952 under which a sizable share of arable land was classified as forestland which is reflected in the high percentage rise in forestland area complemented by huge decline in arable land area. In subsequent decades, Forest Act 1976 and 1988 had further promoted afforestation in barren and fallow land area through programs like Joint Forest Management and Social Forestry. The total forest area of the country sustained growth (although marginal in last decade) owing to the pressure for environment sustainability from all over the world[4].

## *History of Socioeconomic Policy Guiding Land-Use Change*

As for other categories, the changes in land-use trends happened in tandem with investment trends and development strategies laid under five-year plans for the related sector[5]. Five-year plan is a useful tool for mapping the socioeconomic priori-

[3] Arable land area was calculated from the sum total of land under miscellaneous tree crops, arable wasteland, total fallow land (summation of fallow land other than current fallow and current fallow) and net sown area. Note: Permanent pasture and other grazing land which are also known as commons are not studied in this chapter. Therefore, the total sum of the percentages of land area under four studied categories will be less than or equal to 100.

[4] Despite economic benefits of the forests, it is usually acknowledged for its socioecological importance.

[5] The country marked the inception of 12th five-year plan in 2012. Timeline for the 11 five-year plansis: first (1951–1956), second (1956–1961), third (1961–1966), fourth (1969–1974), fifth

**Table 13.1** Decadal percentage change under different land-use classifications. (Source: Computed by the author using land-use data from DES)

| Decade | Arable land area | Area under nonagricultural activities | Barren and non-arable land area | Forest land area |
|---|---|---|---|---|
| 1950–1960 | −3.027 | 1.668 | −0.684 | 4.128 |
| 1960–1970 | 0.720 | 0.498 | −2.368 | 2.975 |
| 1970–1980 | 0.943 | 0.949 | −2.485 | 1.104 |
| 1980–1990 | 0.006 | 0.454 | −0.173 | 0.105 |
| 1990–2000 | −0.524 | 0.811 | −0.580 | 0.620 |
| 2000–2009 | −0.301 | 0.736 | −0.213 | 0.061 |

ties of a country. For the first few five-year plans, government was the sole investor in various economic and social projects. The budget outlay allocation for different sectors became the dominating driver of land-use change. However, for the latter five-year plans, when the country had begun making economic development marks, the investments started to roll in from other sources as well. The country's development strategies then took stronger hold in directing programs and legislations having implications on land resource management.

Under the first and second five-year plan, over 30 % of the total budget outlay was allocated for agriculture and community development (which includes agriculture, animal husbandry, fishery, and forestry) and irrigation (agriculture and allied sectors (AASs)), and over 25 % was allocated to transport and communication sectors. The land area under nonagricultural uses thus grew due to increasing uses of land under transport sector and infrastructure projects to support services for agriculture sector.[6]

The third and fourth five-year plan continued to allocate substantial share (over 30 %) of budget outlay spending for the AASs. The industrial and transport sectors were starting to catch up with the AAS investments and accounted for about 20 % share in budget outlay during the period. The second decade also marked Green revolution. During fifth five-year plan, industrial sector also privileged government attention, as around 20 % of budget outlay was allocated to this sector. Among varied industries, fertilizer industry bagged close to 10 % share in outlay, which favored agriculture sector production and land conversions to arable land during the period. The continued high importance on agricultural and allied sector growth had led to the redevelopment of barren and fallow wasteland to arable land area[7].

The sixth five-year plan laid long-term objectives of poverty alleviation and self-reliance as development strategy for the country. As agriculture sustained the largest proportion of Indian population, agriculture sector development was priority agenda. In the course of seventh five-year plan, the government revived its strategies of development. In addition to agriculture sector, education and health sectors were

(1974–1979), sixth (1980–1985), seventh (1985–1990), eighth (1992–1997), ninth (1997–2002), tenth (2002–2007), and eleventh (2007–2012).

[6] Three irrigation projects (Mettur Dam, Hirakud Dam, and Bhakra Dam) were started during this period.

[7] The two major land development programs were launched during this period. Drought-prone Areas Program was launched in 1972–1973 and Desert Development Program in 1977–1978.

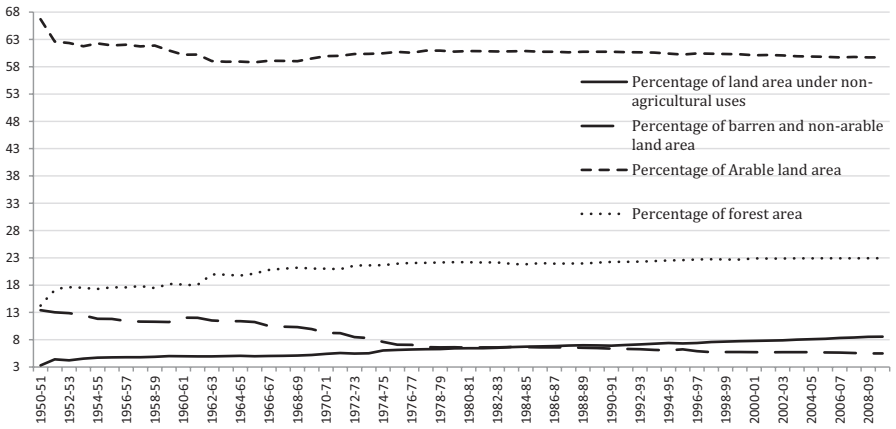



**Fig. 13.1** Land-use trends for the time period of over five decades. (Source: Data tables from DES)

also focused. Growth was to be achieved by providing favorable investment options. There was, however, not much change in land-use during this decade except for a rise in land area under nonagricultural uses.

Eighth five-year plan marked the launch of economic reforms in India. India opened up its investment to competition and adopted both domestic and liberalization policies. A significant rise in industrial and service sector investments implied reshuffling of resources to meet the changing components of national growth strategy. "A largely agrarian feudal economy at the time of independence has been transformed into one based on a well developed and a highly diversified infrastructure with immense potential for industrialization" (8th Five Year Plan Report). Consequently, infrastructural growth and land development for industrial, commercial, and residential purposes fueled the steady increase in the land under nonagricultural activities. As service sector boomed, urban regions became the hot spots for the production and consumption of goods and services. The tenth and eleventh five-year plans consistently raised concerns about *India being relatively less urbanized for a country on such steep developmental path*. Understandably, urbanization became a priority on the policy agenda for the country in the most recent decade, and as a result it became a major determinant for changing land-use pattern in the country. Jawaharlal Nehru National Urban Renewal Mission (JNNURM) was launched in 2005 with significant funds to manage and address the issues that cropped up due to rapid urbanization (Fig. 13.1).

## *Direction of Land-Use Change*

As country evolves economically, more land is diverted to nonagricultural uses. For the last two decades, urbanization has become priority in the country's development strategy which in part resulted in greater than average decadal increase in land area

**Table 13.2** Regression results

| Direction of land-use change | | | |
|---|---|---|---|
| Variable | Coefficient | Standard error | *p*-value |
| Barren and nonarable land area ($X_1$) | −0.142 | 0.0459 | 0.003 |
| Arable land area ($X_2$) | −0.0689 | 0.0217 | 0.002 |
| Constant ($\beta_0$) | 192.9306 | 37.65449 | 0.00 |
| Number of observations | | | 58 |

under nonagricultural activities as reflected in the figure. The percentage of land area under non-agricultural uses increased from 3.3% in 1950–1951 to 8.6% in 2008–2009. During the same period, barren and nonarable land fell from 13% to 5.5%. Arable land area has had ever-increasing trend except for the last two decades resulting in its decline from 66.7% in 1950–1951 to 59.7% in 2008–2009. The arable land area decline has made the direction of land-use change an interesting exercise. In order to understand how relationships among different land-use categories are placed in a given time framework, a simple time series regression model is run[8].

Time series regression is run for 58 years (from 1950–1951 to 2009–2010). To begin, a null hypothesis that any changes in land area under nonagricultural uses do not relate to the changes in barren and nonarable land area or arable land area is established ($\beta_i = 0$; for $i = 0,1,2$). As the *p*-value is less than 0.05 at 5% for all variables the null hypothesis is rejected implying that changes in land area under nonagricultural uses has bearing on the changes in arable land and barren and nonarable land area (Table 13.2). The sign of the coefficient will point to the direction of the relationship among the variables. The regression result gives

$$y_{(t-2)} = 192.93 - 0.142X_{1(t-1)} - 0.0689X_{2(t-2)}$$

*Y = land under nonagriculture uses*
$X_1$ *= barren and nonarable land area*
$X_2$ *= arable land area*

The results indicate that any increase in land area under nonagricultural uses at present time will accompany 6.8% decrease in arable land area and 14.2% decrease in barren and nonarable land area tomorrow. It points to the fact that arable land is affected immediately as land under nonagricultural uses increase. In order to bolster the argument that current policy focus prioritizing urbanization has partially resulted in greater increase in land area under nonagriculture activities that has immediate bearing on arable land area, six metropolitan regions are analyzed for the changes in land-use category for the latest decade, that is from 1998 to 2009. The analysis also helped to quantify the scale of these changes.

[8] Refer appendix.

## Land-Use Change in Selected Metropolitan Regions

The six metropolitan agglomerations namely Greater Mumbai, Kolkata, Delhi, Chennai, Bangalore, and Hyderabad constitute for over 50% of the total urban population of the country, which is expected to increase at faster rate in the following decade. Shaw (1999) pointed out that the six metropolitan cities have attracted more population growth and investment than any other city in the country. The six metropolitan cities were unique in the sense that they attracted investments for the adjoining districts in addition to their own urban cores[9]. Being prime sites of investments land-use conversions to nonagricultural uses are expected to yield most economic returns. In addition, the increase in land area under nonagricultural uses at these locations is driven by urbanization. Indeed, these are the most favorable sites to measure the scale of land conversion taking place due to urbanization momentum. Moreover, such an analysis becomes important for country which is showing preferences for urbanization discourse for development.

Land-use change is documented and analyzed for each metropolitan urban agglomeration (UA). As UA also encompasses regions from adjoining districts of a metropolitan city, the data from the metropolitan district and the adjoining districts are used to get fuller image of the land-use changes. Comparisons of the urbanization data for census years of 2001 and 2010 are made for quantifying the scale of urbanization-led land-use change. Due to limitation of data availability, the slight difference in the time frame of the analysis for urbanization data and land-use data is overlooked.

For National Capital Territory (NCT), there was an increase in the percentage of land area under nonagricultural uses and forestland. At the same time, there was substantial rise in the percentage of barren and nonarable land area at the expense of a decline in the percentage of arable land from 42.44 to 36.18%. Somewhat similar changes took place in five districts of the national capital region (NCR) except for the barren and nonarable land areas, which did not rise[10] (Fig. 13.2).

For Sonipat, the land under nonagricultural uses increased by 308% from 1998–1999 to 2009–2010, Faridabad had 155.3% increase in land area under nonagricultural uses, for Gautam Buddha Nagar (Noida) this land area increased by 74.2%, Gurgaon 63.9%, and Ghaziabad witnessed 21.3% increase in the proportion of land area under nonagricultural uses. For NCT as a whole, the land area under nonagricultural uses increased by 40.7%, which was accompanied by 4.7% growth in urbanization from 2001 to 2011 for Delhi metropolitan regions. Land-use changes of enormous magnitude in the adjoining districts accompanying comparative meager increase in urbanization of the whole metropolitan region reflect high-scale land-use changes due to urbanization in NCR. With the rise in land area under nonagricultural uses the five districts had witnessed fall in arable land area. Faridabad

[9] The adjoining districts of Kochi also received investments.

[10] NCR conceptualization is discussed in detail at the end of this section.

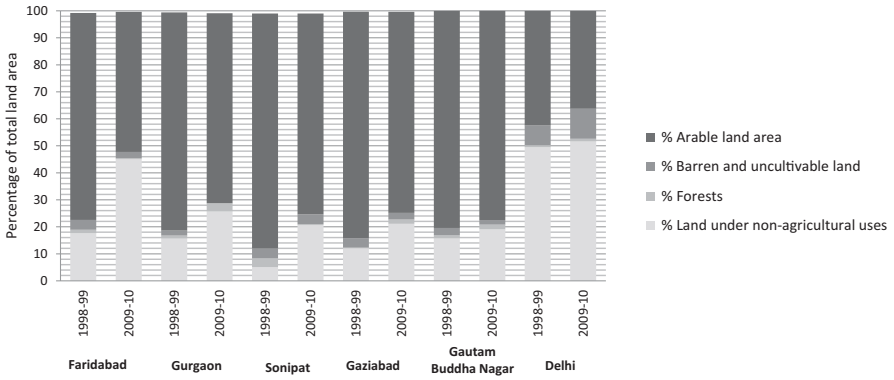



**Fig. 13.2** Land-use trends for the time period of over five decades. (Source: Data from DES)

experienced the highest dip of 24.5% in a decade. The arable land area was lost by all the districts by varied degrees.

The data for land-use for Mumbai metropolitan regions were only available for half of the decade, that is, from 1998–1999 to 2005–2006. It could however be argued that changes in land-use for half a decade are enough to project the figures for the next half of the decade as they follow the general trend of increasing land area under nonagricultural activities and fall of arable land area.

The two adjoining districts of Mumbai had witnessed rise in land area under nonagricultural uses with sharp fall in arable land area. The urbanization growth for Mumbai UA was 1.25% from 2001 to 2011, which was complemented by 14.4% increase in proportion of land area for nonagricultural uses for Raigad district from which Navi Mumbai was carved out. Thane had 4.4% rise in land under nonagricultural uses.

There has been rise in the percentage of barren and nonarable land area for both districts and this rise is fairly large considering that the change happened over a period of only half a decade (Fig. 13.3).

Chennai Metropolitan Agglomeration (CMA) adjoins the boundaries of two districts, Kancheepuram and Thiruvallur. District Thiruvallur (north) had 11% rise in the land under nonagriculture use while Kancheepuram had 4.2% rise with a proportionate fall in arable land. Chennai metropolitan has been urban city since long ago. The complementary decadal urbanization growth was 3.55% (Fig. 13.4).

For Bangalore on the other hand, the increase in land area under nonagriculture uses has been profound, 77.9% for rural and 45.3% for urban Bangalore district. During the period, Bangalore had 4.96% growth in urbanization. The barren and nonarable land area for the two declined marginally. Much of the increase in land area under nonagricultural uses has been compensated by the loss of forests land for rural Bangalore and loss of arable land area for urban Bangalore (Fig. 13.5).

In case of the Kolkata metropolitan regions, there is no barren and nonarable land area for any of its three districts. The increase in land area under nonagricultural activities could only have been accompanied by loss of arable land area (Fig. 13.6).

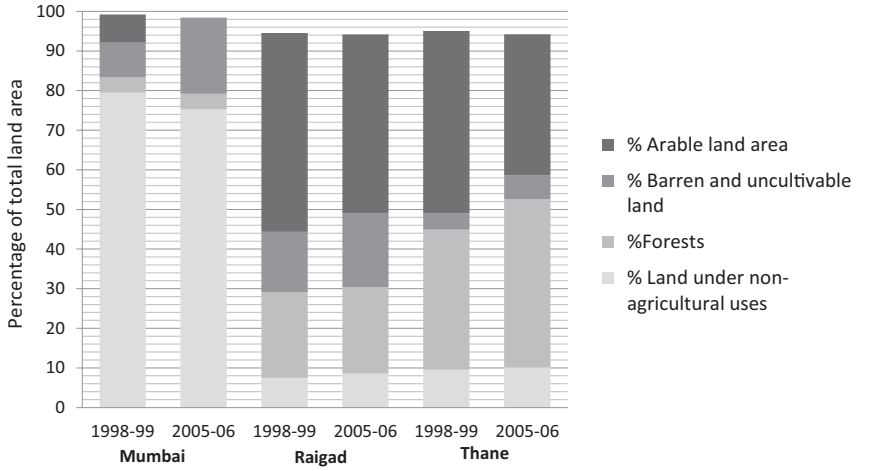
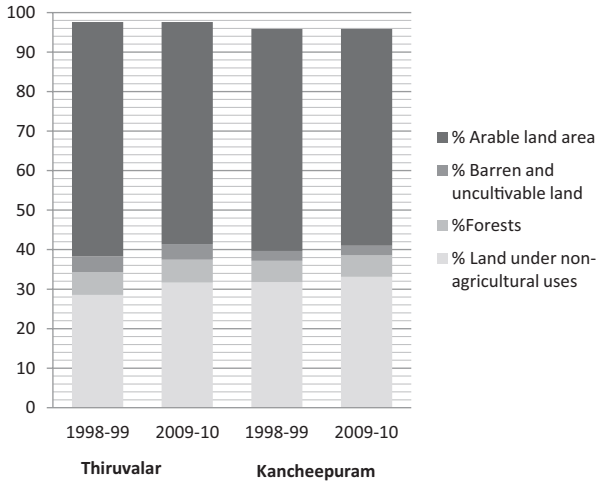



**Fig. 13.3** Percentage distribution of the land-use categories for Mumbai metropolitan region. (Source: Data from DES)

**Fig. 13.4** Percentage distribution of the land-use categories for Chennai metropolitan region. (Source: Data from DES)




Land area under nonagricultural uses for Howrah increased by 17, 13.5, and 2.3% for 24 North and South Paraganas districts, respectively, through a corresponding reduction in arable land area. The complementary urbanization growth was meager 0.68%.

The study of the six metropolitan cities points to proportionately large land-use changes in land area under nonagricultural uses achieved by the complementary reduction in arable land area accompanied by smaller growth in urbanization. Delhi metropolitan region had most disproportionate combination of urbanization and land-use change, while Chennai metropolitan region had modest land-use change in complementing to decent urbanization growth. In order to understand how such

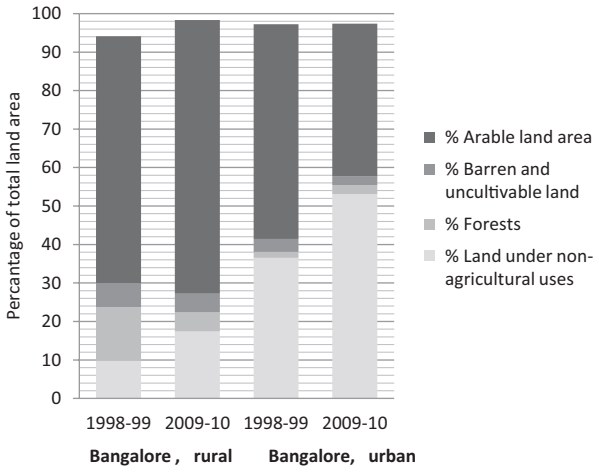



**Fig. 13.5** Percentage distribution of the land-use categories for Hyderabad metropolitan region. (Source: DES)

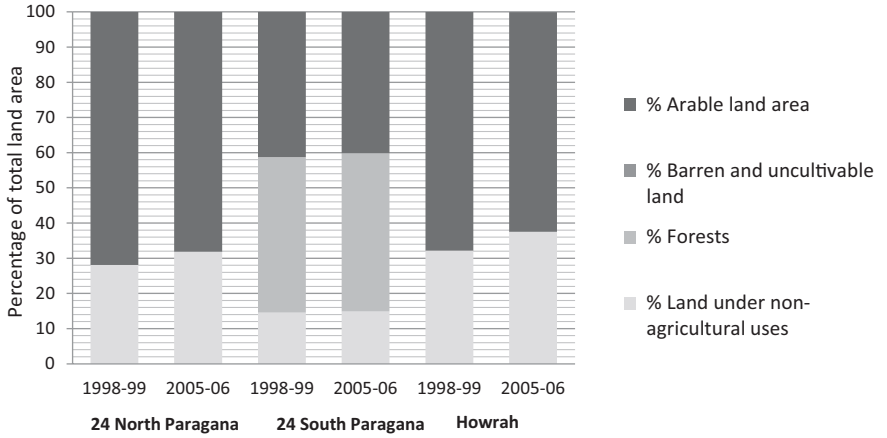



**Fig. 13.6** Percentage distribution of the land-use categories for Kolkata metropolitan region. (Source: Data from DES)

high magnitude of land-use change has come about in these metropolitan regions it is useful to look at the anatomy of UA growth.

Starting with Kolkata metropolitan region, the suburbs of Kolkata witnessed higher growth than the core city and currently Kolkata metropolitan region constitutes three municipal corporations, 38 municipalities, and many nonmunicipal towns as well as villages at its fringes. Shaw and Satish (2007) discusses the profound real estate activity of the metropolitan area under which more than 30 large private housing projects are coming up. Many of these are located along the eastern periphery that connects the city to the international airport. The strategic positioning of infrastructure project by the government, here airport, caused the surrounding town to witness suburbanization at the periphery.

In case of Delhi, the city has expanded its reach into towns and cities of districts of the surrounding states. In the process, a new UA has emerged. The Delhi government promoted interlinking of the surrounding towns and urban regions to create the NCR. The main objective of the creation of NCR Delhi region was to decongest Delhi by diffusing the population pressure toward its ring towns. The biggest share of land area under non-agricultural uses from these districts was allocated for residential development as the part of decongestion drive and the next biggest share of land was allotted for industrial development following the decision of relocating polluting industries from NCT to the surrounding peripheries (Delhi Metropolitan Area Report ND). Some of the NCR towns have expanded to the extent that the peripheral boundaries of the ring towns and NCT region appear blurred. As Delhi expanded into NCR, Mumbai yielded Navi Mumbai and Greater Mumbai city extended its territory into Thane and Raigad districts of Maharashtra. Shaw discusses in her book 'The Making of Navi Mumbai', the vision of planners in creating Navi Mumbai as a counter-magnet of Mumbai for investment and population pressure diffusion on mainland at its eastern side similar to the one adopted by Delhi government.

For Chennai, the master plan 2021 expands Chennai metropolitan agglomeration (CMA) boundaries into the neighboring districts of Kancheepuram and Thiruvallur. The expansion is brought into execution by merging 13 panchayat unions in Thiruvallur district and two municipalities, five towns, and 12 panchayat unions in Kancheepuram district, where airport location has been proposed under master plan 2026. Hyderabad UA expanded its boundaries into 12 peripheral municipalities, Secunderabad Cantoment, Osmania University, and other areas. In case of Bangalore, rural Bangalore is witnessing enormous increase in land area under non-agricultural uses. Land-use changes in rural Bangalore were triggered by the positioning of airport there which has also catalyzed suburbanization at the periphery of urban Bangalore. Nevertheless, each UA has expanded into adjoining districts for want of land for infrastructure development and real estate projects (Joshi 2009).

As the population movement into these cities was higher than other cities, resultantly there was congestion and crisis of adequate infrastructure for all of these metropolitan cities (Shaw 2003). The government promoted the concept of satellite towns closer to these metropolises in an attempt to decongest (Wang et al. 2010). In addition, the strategic placements of varied infrastructure projects in the peripheral regions of metropolitan cities made suburbs viable for varied economic activities that favored lateral expansion of metropolitan cities in adjacent rural regions. The farmers facing this opportunity of being able to make handsome money through selling of their land have begun to participate in this transition gladly and enthusiastically off recently[11]. This has led to land conversions at rapid pace which is in fact altering socioeconomic balances of the economy, affecting local ecology and living patterns at the same time. Sridhar (2004) and Sridhar (2007) examine in detail the extent of suburbanization in India's UAs and conclude that the suburbanization is occurring continually and the larger UAs are suburbanizing at greater magnitude.

[11] Paupers & Princes of Realty Deals. The Economics Times Magazine, February 17–23, 2013.

Apart from metropolitan master plan contribution to land conversions, certain urban land-use regulations which importantly include land development and redevelopment policies such as land distribution in metro master plans and floor area ratio/floor space index (FAR/FSI) ratio regulations are also partly responsible for the current land-use changes[12]. Presently, in most of these metropolitan cities FAR/FSI ratios are low at the core of the city, while higher FAR/FSI ratios are often permitted in the suburbs (Sridhar 2010; Brueckner and Sridhar 2012). Due to strict land development rules within the city, the city's capacity to support the migrating/moving population began to saturate early and the spilling over of population from the city into suburbs started to take place (Sridhar 2010).

## Issues and Concerns from Current Land-Use Change

There are several other issues and concerns that these trends throw up. The first relates to the type of land acquired by the government for urban development. As evident from the graphs and foregone analysis, most of the urbanization has invaded agricultural land. Indeed, the loss of arable land to urban development has become a nationwide phenomenon. This loss of arable land due to urbanization has implications on agro-economy of the country. Following this, another issue relates to the compensation for land acquisition. The initial acquisitions were performed by government under which farmer compensations were limited especially when compared to subsequent transactions. Many researchers have documented the resentment and dissatisfaction among farmers owing to the delayed and insufficient compensatory amounts for land acquired for infrastructure development. This has triggered the need for amendments and modification of Land Acquisition and Rehabilitation and Resettlement (LARR) Act.

There are two major constraints that hold back our agro-economy of which the primary factor is the nonavailability of adequate resources especially for irrigation (Sridhar 2012). Much of the land under agriculture still depends upon monsoon for irrigation. The second constraint is the size of population that agriculture sector sustains. Delhi metropolitan region is expanding into the heart land of Indian food grain supply belt with ample irrigation resources and has been expanding into the vast agriculture land. The loss of such fertile and irrigated land may become a threat to future agriculture security of the country. Kumar (2009) and Madan (2005) criticized government's pro-land-use-change policy for urban development.[13] India's food self-sufficiency takes care of the need of about 18 % of human population and plays an eminent role against high food grain price volatility in international

[12] Alan Bertaud has critiqued Indian metropolitan cities' low FAR/FSI ratios (2010).

[13] Madan (2005) discusses the government strategy to provide sustainable urban and economic growth at the prospect of the availability of cheap agricultural land availability for building around NCR. Kumar (2009) highlights that despite being aware of the fact that the agriculture land around NCR is fertile and productive, much land has been acquired for urban construction purposes.

market (Swaminathan and Vepa (2012).[14] Anything that has potential of altering the current status of India with respect to the international food market could make the latter highly volatile. M.S. Swaminathan in his recent article enlists the threats of global warming and climate change on yields of food grain, which are only worsened by diversion of farmland to other uses[15]. Although India has achieved laudable progress in food grain production and yield statistics, it still remains susceptible to food scarcity in the event of a natural calamity. Another outcome of the diversion of arable land area to nonagricultural uses could be the shift in grain production from traditional grain-producing areas to other regions[16]. In addition, the arable land conversions to land under nonagricultural uses have become a cause of the displacement of agrarian population who are now exploring job opportunities in other sectors, putting the pressure of the need of greater employment growth in these urban regions.

A major consequence of the lateral expansion is further weakening of already inadequate urban service delivery. As witnessed for all the six metropolitan regions, their boundaries have expanded into adjacent municipal regions. Many towns and village settlements have been engulfed under urbanization expansion. The lateral expansion of cities without ensuring adequate administration body in place for its governance has led to the transformation of most of these settlements into unplanned housing dwellings with minimal basic infrastructure[17]. One of the key reasons for inadequate service delivery outcomes in these regions is the overlapping administrative boundaries or the absence of any arrangement in function, roles, and responsibilities of the institutions resulting in poor accountability[18]. The absence of an effective coordination mechanism among municipal-, metropolitan-, and state-level agencies has implication for orderly spatial development, coordinated infrastructure provision, local economic growth, development management, service delivery, and expenditure effectiveness (JnNURM Report No Date).

Besides the socioeconomic aspects, there are also many ecological implications of the land-use conversions. As urbanization takes off, more land area is built; the sudden increase in builtup areas around the metropolitan region causes severe drainage problems, which is an everyday story of all the six metropolitan regions[19].

[14] The paper comments that international wheat prices swelled up when India entered the market as importer.

[15] Chen (2007) studies threats upon soil protection and food security due to urbanization in China.

[16] China has witnessed that urbanization led to an overall shift in grain production from traditional "grain bowls" to other regions (You et al. 2011).

[17] The scale of unauthorized dwellings is so high in Delhi that a notice dispatched by the government of Delhi in 2011 declared regularization of 733 unauthorized colonies. There are 72 nonmunicipal areas within Kolkata metropolitan region. Shaw in her book "Making of Navi Mumbai" also discusses unauthorized colonies with shamed administrative law and order in Mumbai metropolitan region.

[18] Shaw presents two case studies (from Bangalore and Kolkata) that discuss the issue of administration conflict resulting in poor service delivery.

[19] This points to failure of urban service delivery (in this case drainage system) in keeping pace with lateral expansion rate.

Urbanization also increases the risk of pollution through unsafe waste disposition and land degradation because of excessive land quarrying and waste that is released from the construction sites. The consequences increase in the barren and nonarable land area as seen in the case of Delhi, Mumbai, and Bangalore.

## The Way Forward

There are several policy choices that follow from the analysis undertaken in this paper. It is also obvious that policy correctives may have to be taken on multiple fronts and may require synchronization and specific sequencing. Some of these issues that merit attention are as follows.

First, the LARR bill should incorporate amendments to check the scale of land that can be acquired for nonagricultural activities. In addition, resourceful arable land diversion to the nonagricultural uses should be monitored. At the same time, there is also a need for adequate and timely compensations for those whose property has been acquired under the various land development processes by the government and other parties. This will help in an orderly management of urban land supply.

Second, it is required at urban town planning level to adjust FAR/FSI ratios for the cities so as to utilize the land resource to its optimum. It turns out that the land-use regulations could have a pronounced impact on the direction of urban region growth[20]. Land value continuously rose with ever-strict land-use laws and the real estate pricing in these metropolitan regions further fueled the lateral expansion. The residential value has risen faster than the agriculture value of land. For states like West Bengal that barely contains any barren and nonarable land area for urban development, the only alternative to address rising housing demands is to encroach upon the arable land area. The higher FAR/FSI ratios for such regions make all the more sense, so that arable land area is only encroached when the existing land is utilized to its optimum. However, creating more floor space via relaxation in FAR/FSI regulations will not be enough to address these issues and it is required to be acted upon differently in different metropolitan regions although, it could be a viable alternative for metropolitan cities with comparatively lesser density[21].

Third, the strategic placement of certain infrastructure project (while carving out the metropolitan master plans) could also guide future land-use changes in its surroundings; therefore, it is required that before exercising a decision for current

[20] Unlike any other metropolitan city in the country, Mumbai had vertical growth at the urban core region apart from the lateral expansion. Mumbai had topographical constraints of being an island that provided it a thrust for vertical growth. This growth was further favored by higher FAR/FSI ratio permits at the core of the city. However, soon enough while charting the master plan for Navi Mumbai the land-use regulation was revisited and reduced to match other metropolitan city regulations. Since then it has been laterally expanding like all other metropolitan cities. Mumbai has started sprawling toward the east under the master plan for building Navi Mumbai region.

[21] For example, Delhi could bear higher FAR/FSI ratio regulation; however, Mumbai faces issue of higher density that crosses benefits yielded of higher FAR/FSI ratios.

need of an infrastructure project, its capacity to influence future land-use changes be kept in mind and tools to address those changes and requirements be put in place well in time. The urban municipal structure has failed to keep up with the current urbanization pace. Resultantly, incoherency between municipal services demand and supply is greater than it was ever before. There is urgent need to ensure spatial and functional integration of service delivery process through innovative institutional arrangements including creative use of public–private partnership for achieving better service outcomes. The already stressed service delivery system of metropolitan cities is facing great inconveniences in keeping up the pace with increasing areal space of the metropolitan region. The lateral expansion has widened the area of administration under metropolitan municipal committees. Often the rhetoric argument put against low FAR/FSI ratio relates to the inadequate infrastructure of the cities, which would crowd up already crowded and chaotic living conditions for the existing residents if more floor spacing is created within the city. Therefore, "a widespread reform in governance and service delivery framework with a focus on metropolitan integration and co-ordination" (JnNURM Report No Date) is required.

As the lateral expansion has added a new segment to the local metropolitan economy that is villagers, who lost their agricultural land for the development of the metropolitan region, and who are now potential seekers of employment in nonagricultural sector, there is urgent need for growing metropolitan regions to generate enough economic opportunities in the nonagriculture sectors for the incoming population[22]. The per capita gross domestic product (GDP) of workers employed in the nonagriculture sectors is five times of those engaged in agriculture sector (Sen 2003; Bhalla 2005); urbanization, if planned systematically, could therefore become a golden opportunity for reducing this gap by decreasing the population dependence upon agriculture sectors. In summary, as country develops economically, more land will be utilized for nonagricultural uses. However, the direction and extent of these changes need to be closely monitored and checked such that it remains sustainable and benefit society at large.

## Appendix

The Fig. 13.8 shows scatterplot of land area under nonagricultural uses ($Y$) shows an upward trend and is nonstationary data series. Further, the scatter plot of barren and nonarable land area ($X_1$) shows a declining trend over time and thus is a nonstationary series. Scatter plot for arable land area ($X_2$) is also nonstationary. Therefore, the series is converted from nonstationary series to a stationary series through differencing.

[22] The failure to predict and act in tandem with shift in employment demand from agrarian to service sector among farmers participating in urban policy-driven land-use changes has led to much distress in these transient regions (Paupers & Princes of Realty Deals. The Economics Times Magazine, February 17–23, 2013).

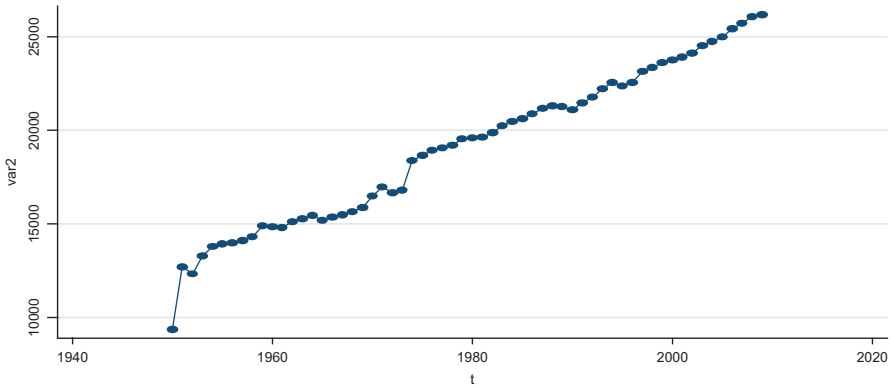



**Fig. 13.7** Time series data plot land area under nonagricultural uses ($Y$)

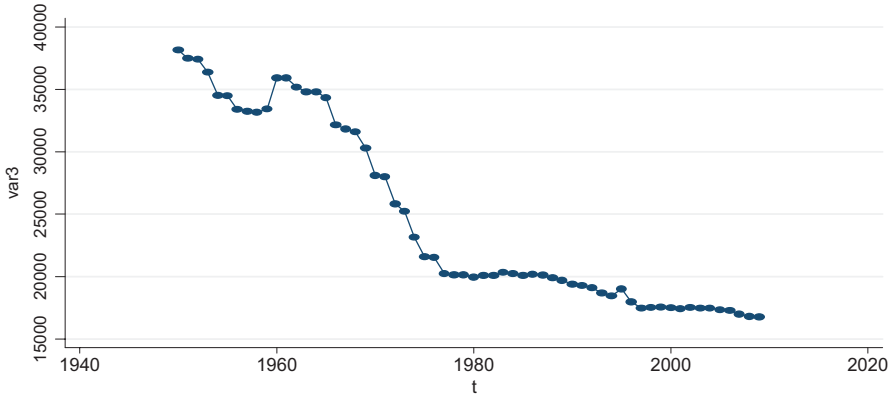



**Fig. 13.8** Time series data plot barren and nonarable land area ($X_1$)

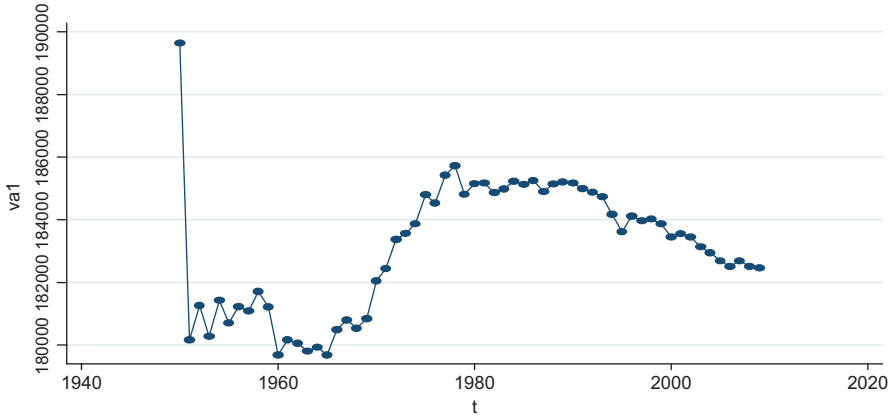



**Fig. 13.9** Time series data plot arable land area ($X_2$)

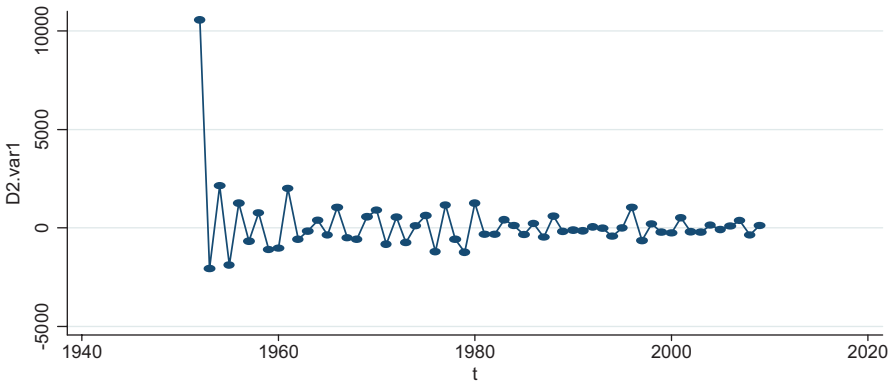



**Fig. 13.10** Scatterplot of first difference of land area under nonagriculture uses

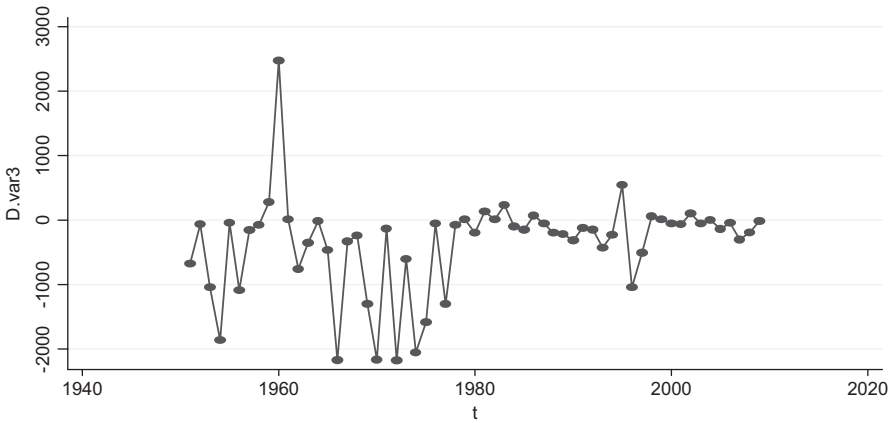



**Fig. 13.11** Scatterplot of first difference of barren and nonarable land

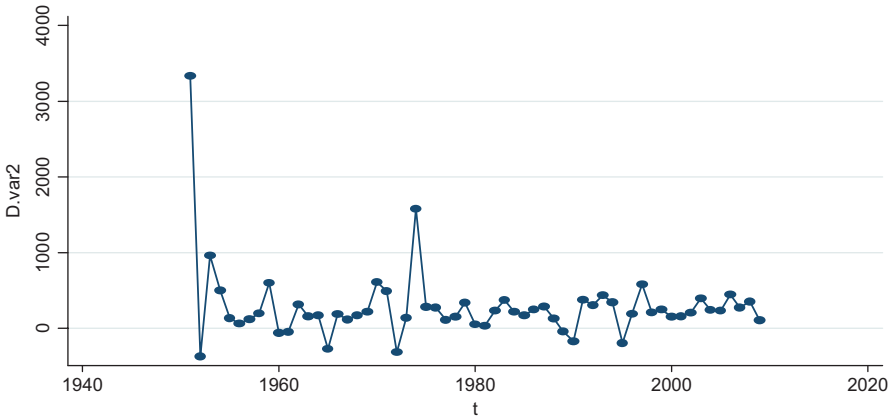



**Fig. 13.12** Scatterplot of second difference of arable land

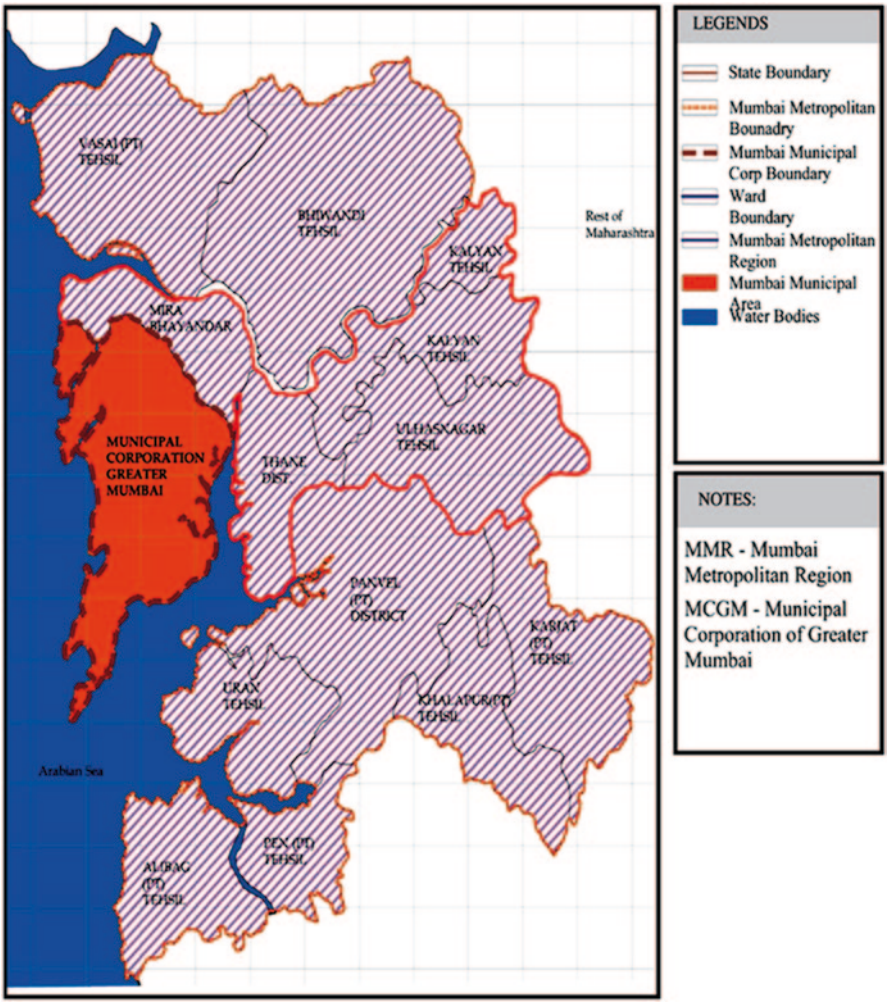



**Fig. 13.13** Map depicting Mumbai urban sprawl. (Source: School of Planning and Architecture, New Delhi)

The figures below are scatterplots of first difference of land area under non-agricultural uses ($Y$) which is constant in mean and variance, making it stationary. Similar second difference operation is applied for arable land area ($X_2$) and, first difference for barren and nonarable land area ($X_1$) that made second difference scatter plot a stationary series. Regression for $D_1 \cdot X_1$ and $D_2 \cdot X_2$ on $D_1 \cdot Y$ and the results are shown in Table 13.2.

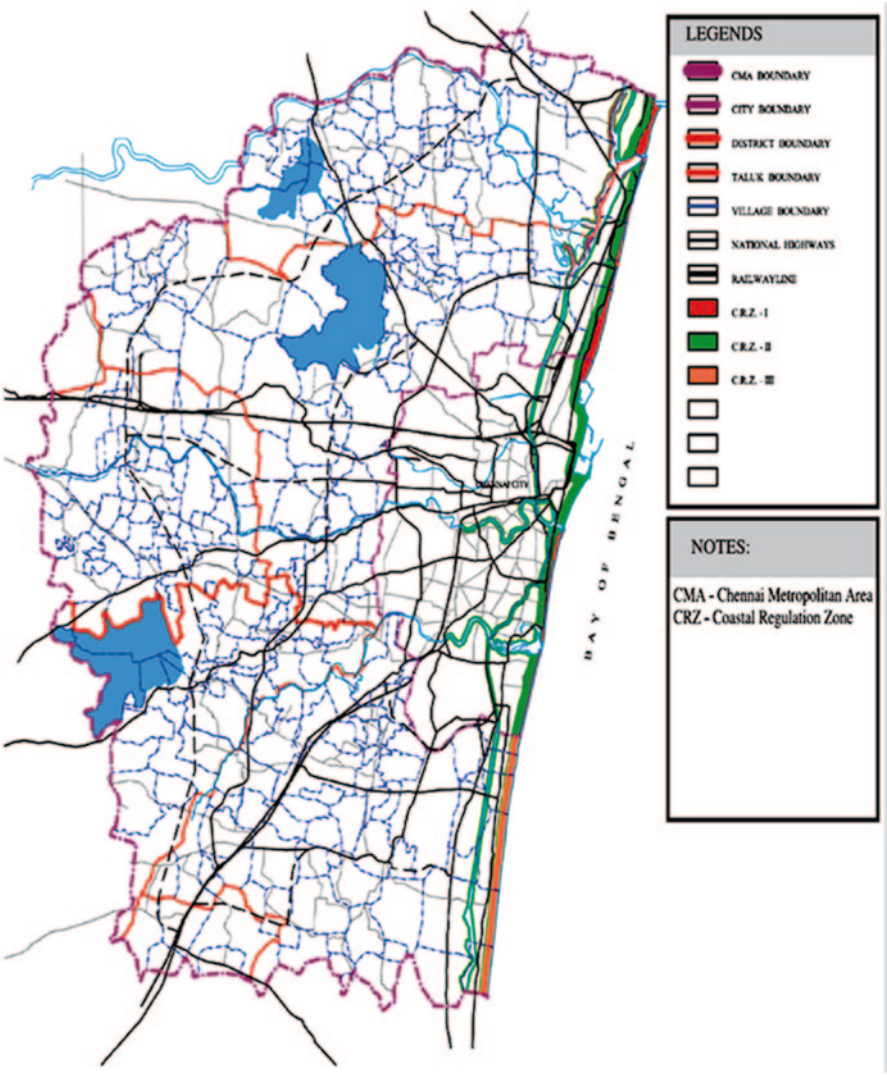



**Fig. 13.14** Map highlighting Chennai conurbation. (Source: Chennai Metropolitan Development Authority)

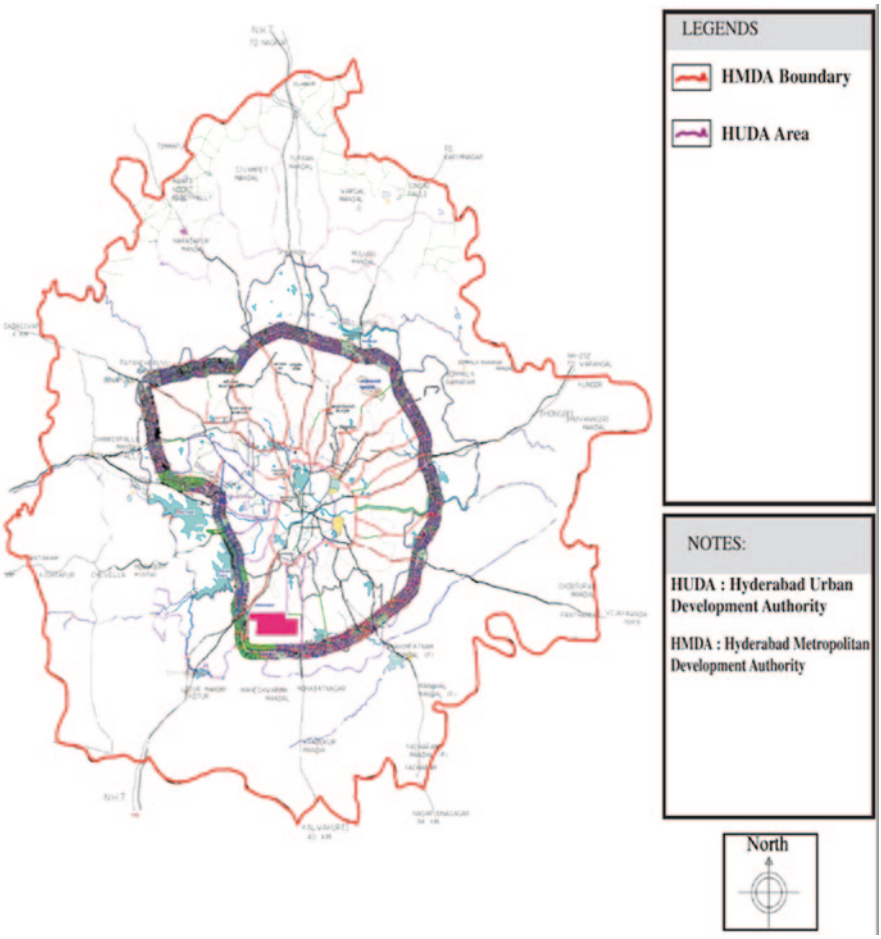



**Fig. 13.15** Map depicting Hyderabad urban sprawl. (Source: Hyderabad Urban Development Authority)

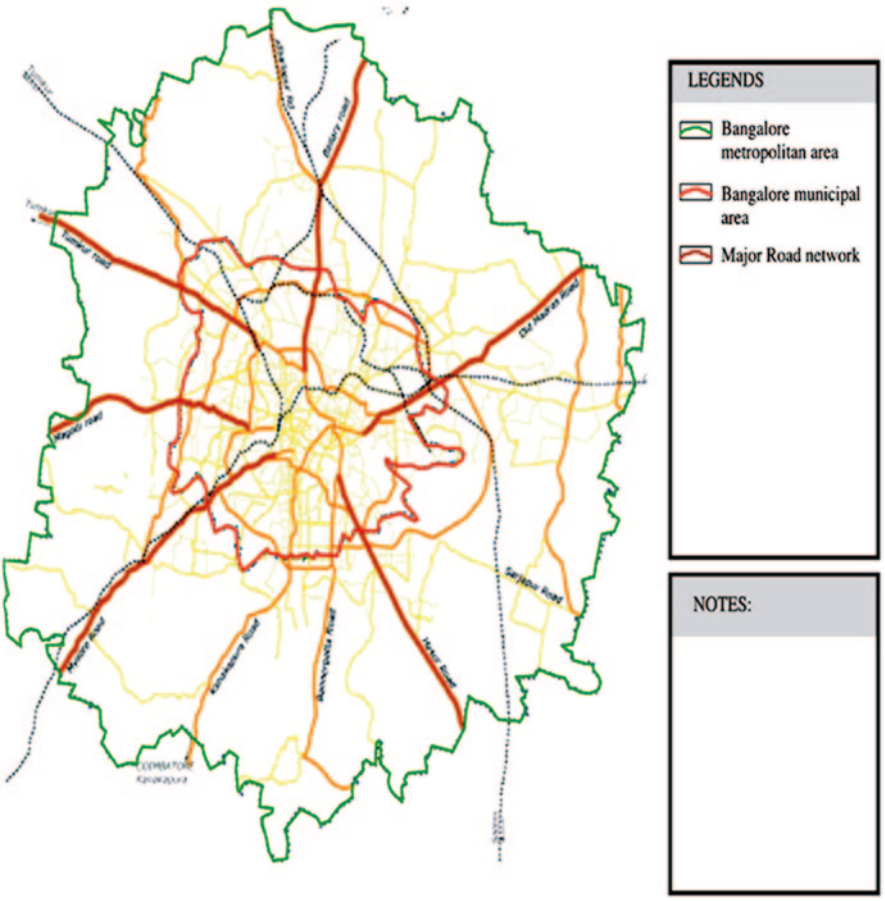



**Fig. 13.16** Map highlighting Bangalore conurbation. (Source: School of Planning and Architecture, New Delhi)

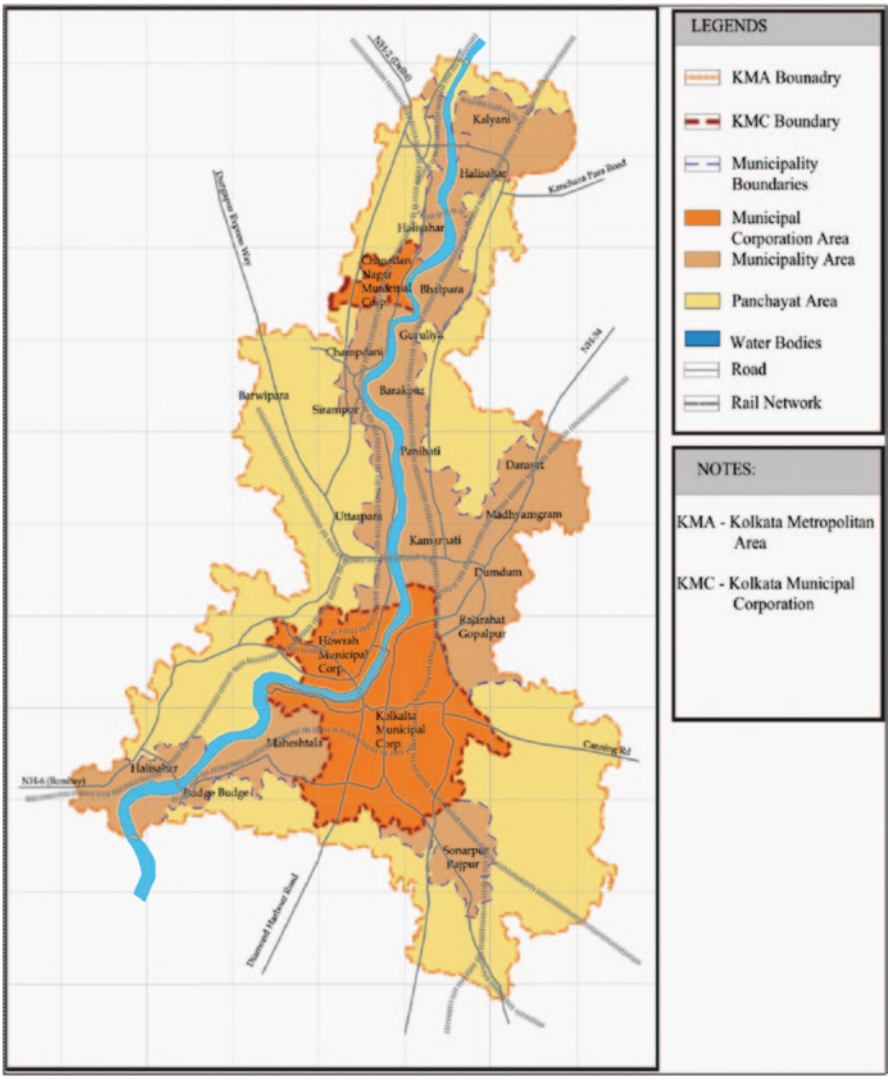



**Fig. 13.17** Map highlighting Kolkata conurbation. (Source: School of Planning and Architecture, New Delhi)

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# Chapter 14
# Urban form and Residential Energy Use in Bandung Indonesia

**Sigit D. Arifwidodo**

## Introduction

The balance between energy supply and demand has become more fragile in the last decade. The fossil fuels reserves are replenishing and the demand for more energy are increasing. Although oil substitutes are widely used in some sectors to fill the gap, they are still considered as expensive and more environmentally damaging than conventional oil (Cudmore 2011). To make things worse, there is now a scientific consensus that the earth is changing because of overconsumption of fossil fuels (Barnett and Adger 2003). Global temperature is expected to rise between 1 and 6 °C within this century, with higher temperature being commonly found in urban areas. With more people projected to live in urban areas, Urban Heat Island (UHI), the phenomenon where the average temperature in the urban area is higher than that in the suburban area, a different planning and design approach is needed to tackle such an important issue. Therefore, understanding energy consumption is becoming more and more important in the field of urban planning and development recently (Ewing and Rong 2008).

Although the urban area is seen as the main problem in relation to the climate change, it also provides the solution. Its advantages in terms of economies of scale, agglomeration and proximity, and high-density development can generate low-level energy consumption and carbon emissions. In Asian countries, while the impact of urban form on transportation energy use has been studied extensively, there are still few empirical evidences on residential energy use, especially in the city context. This is because the residential energy use usually accounts for only a small portion of total energy use compared to other sectors. Indonesia, a country with vast natural resources and significant reserves in oil, gas, and coal, is the only exception in residential energy use and facing an energy crisis. One of the reasons is because Indonesia is heavily dependent on fossil fuels, especially on oil. The major contributing

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**Table 14.1** Energy use by sector in Asian countries and the USA. (Baumert et al. 2005)

| Sectors | Country (% of total energy consumption) | | | | |
|---|---|---|---|---|---|
| | Indonesia | Singapore | Thailand | Japan | China |
| Industry | 19.8 | 37.4 | 38.1 | 35.9 | 40.0 |
| Transportation | 19.7 | 43.0 | 33.7 | 28.1 | 9.6 |
| Agriculture | 1.7 | 0.0 | 5.4 | 1.9 | 4.2 |
| Commercial | 1.8 | 9.3 | 4.6 | 16.9 | 3.7 |
| Residential | 56.1 | 5.2 | 16.1 | 13.6 | 38.2 |
| Other | 0.9 | 5.1 | 2.1 | 3.6 | 4.3 |
| Total[a] | 117,526 | 10,605 | 53,418 | 342,126 | 785,435 |

[a]in 1,000 metric tons of oil equivalent

sector in energy use in Indonesia is the residential sector, which consumes about 56.1 % of total energy use in the country (Table 14.1). Moreover, the elasticity and energy efficiency in Indonesia is relatively low (according to National Electricity Company of Indonesia, in 2008, elasticity is 1.84 and efficiency is 382), even compared to the neighboring Southeast Asian countries.

It is also important to give more attention to the study of the residential energy use because consumption in this sector has grown rapidly in the past few years in many Asian cities. As climate change and energy security become defining issues for the planning profession, planners will be looking for strategies to reduce energy consumption. Within this larger picture, it is important to understand the nature of residential energy use and whether urban form plays a significant role in determining household energy consumption. This study explores to what extent urban form affects the efficiency in residential energy use, using Bandung, Indonesia, as the case study.

## Residential Energy and Urban Form in Literature

Increasing residential energy use is often linked to trends in housing consumption. Bigger houses require more energy than smaller ones because there is more space to heat and cool, and detached houses require more energy than attached houses of the same size because there is more exposed surface area. Hardoy argues that low-income groups usually generate lower fossil-fuel energy level per person than middle- and upper-income groups because their total use of fossil fuels, of electricity derived from fossil-fueled power stations, and of goods and services with high fossil-fuel inputs in their fabrication and use is lower. Previous studies have shown that household energy consumption depends on such household characteristics as income, number of members, and ethnic background. It is also constrained by the availability and cost of residential land, construction cost, and other planning and regulation characteristics. On the supply side, constrained land supplies and land prices favor attached housings or larger houses on smaller lots. On the demand side, due to land prices, households reduce their demand for big houses because they

have less disposable income for housing needs, or otherwise, they may consume more housing because the transportation cost is lower, especially in compact areas.

Urban form is considered as a major factor as well. Although different notions have emerged in literature when defining urban form, it usually refers to the physical layout and spatial arrangement of the city (Engelke 2001). In the context of Asian cities, research on urban form is fairly sparse. Sridhar (2007) and Sridhar (2010) are examples of studies of urban form in the Indian context. Empirical evidences show that urban form is important in determining energy consumption, although the relationship is somehow complex (for example, see Newman and Kenworthy 1999). Urban form affects energy consumption in direct and indirect ways. Ewing and Rong (2008) argue that urban form can affect residential energy use through three causal pathways. The first is through direct electric transmission and distribution losses, the second is an indirect effect through the formation of urban heat islands (UHI), and the third is through the housing stock (housing size and type in the market). Other researchers use a more direct method to link urban form and residential energy use. For example, Gurin finds out that there is a significant relationship between residential density and GHGs (Greenhouse Gasses) emissions. Norman argues that low-density suburban development is more energy- and GHGs-intensive than high-density compact development on a per capita basis. Other studies, like Newman and Kenworthy (1999), argue that it is more meaningful to analyze the effect of urban form through the vehicle miles traveled than house size or type. Some may also argue that household energy use can be easily mitigated by increasing the efficiency of the building envelope, heating/cooling systems, appliances, and lighting. Still the query on the effect of compact urban development on the fast-growing housing energy consumption is important in our quest for more energy-efficient communities.

## Method

This study argues that urban form plays a significant role in determining the household energy consumption. The ideal way of measuring the effect of urban form is to follow the similar method of Ewing and Rong (2008). Because the necessary data are not available, this study focuses on the direct effect while controlling the indirect effect, such as housing stock. In linking household energy consumption to urban form, this study selected several attributes of urban form, which are considered important in the literature (for example, see Arifwidodo and Perera 2010). The complete variable is summarized in Table 14.2. Some variables are dropped from the analysis. For example, this study does not take into account the mixed land-use variable, because the nature of the land use in the city is mixed use. Therefore, it is difficult to precisely measure a degree of mixture in the urban land use. Due to the small number of samples, some variables are removed from the model because of multicollinearity. However, the variables are checked so that they are not statistically significant when included separately in the model. Nevertheless, we believe

**Table 14.2** Variables used in the study

| No. | Variable | Description | Mean (std. deviation) | % of 1s |
|---|---|---|---|---|
| 1 | INCOME | Gross household income, in IDR, calculated as the mid-point of the selected income bracket | 2,868,267.9 (2,072,872.7) | |
| 2 | HHSIZE | The number of persons living in household | 5 (2) | |
| 3 | HHTYPE | Type of housing, 1 if it is a detached housing, 0 otherwise | – | 23.7 |
| 4 | CONST | The year of housing construction, 1 if it is more than 10 years, 0 otherwise | – | 70.8 |
| 5 | FLOOR | Total floor area of the house, in sq.m | 49.7 (41.1) | – |
| 6 | DENSITY | Gross district density, in sq.km | 16,623 (7,731.18) | – |
| 7 | DISTANCE | 1 if house is located in city center, 0 otherwise | – | 21.8 |
| 8 | SCHOOL | The number of schools (from elementary to high school) in the subdistrict. | 75.66 (20.516) | – |
| 9 | HOSPITAL | The number of hospital and clinic available in the subdistrict | 1.095 (1.303) | – |
| 10 | URBFAC | The factor score of the result from principal component analysis of HOSPITAL and SCHOOL | 0 (1) | – |
| 11 | NEIGHBOR | Type of neighborhood, 1 if it is a planned residential development, 0 otherwise | – | 46.2 |
| 12 | HOUSES-TAT | 1 if a member of the respondent's household owns the house, 0 otherwise | – | 56.5 |
| 13 | ENERGY | Primary energy use in the household in kWh; energy consumption for lighting, heating, cooling, cooking, etc | 257.41 (196.5496) | – |

that the variables used in the analysis are sufficient to generate solid inferences on the effect of urban form.

The empirical analysis in this study is based on two data sets, which differ with respect to the level of aggregation. The first data set is extracted from the 2007 socioeconomic census carried out by Local Bureau of Statistics, which has the basic statistical unit of subdistrict (*kecamatan*). The second data set is obtained from a survey questionnaire for 400 households in Bandung. The budget of the research is the main factor that dictates the sample size. Therefore, to reduce the impact of such a drawback, the sample is chosen using a stratified random sampling technique with subdistrict as the unit of analysis. This study obtained a list of registered households and their addresses from the subdistrict office as a sample frame, and randomly selected the respondents proportionally based on the number of population in each subdistrict. The data used in the analysis are weighted to account for different probabilities and survey responses. Finally, because the estimates combine data at differ-

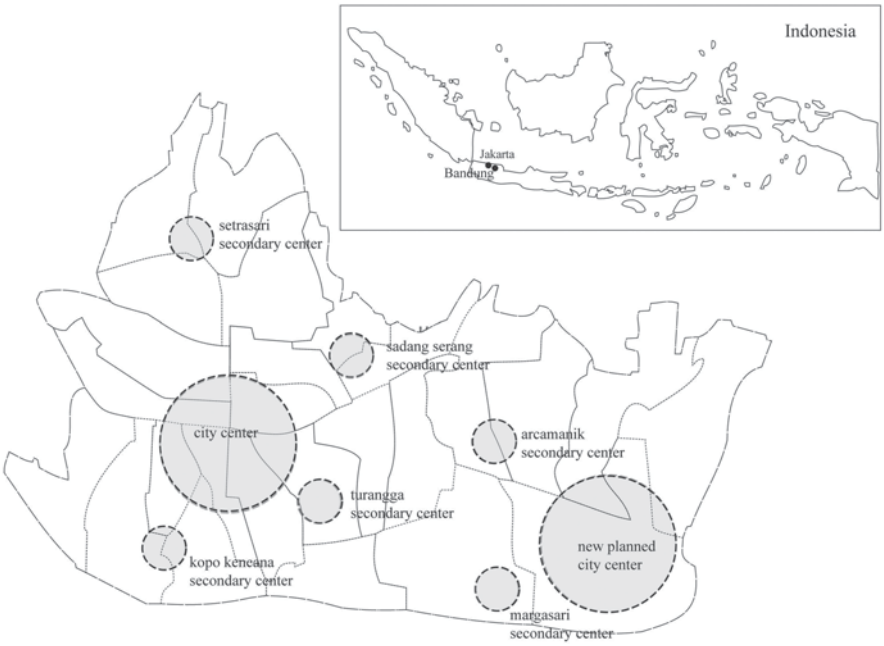


**Fig. 14.1** Bandung as study area

ent levels of disaggregation (individual, village, and subdistrict), the standard errors in all estimates are corrected for clustering (Moulton 1990).

## Result

The analysis is focused on Bandung, Indonesia (Fig. 14.1). The city is divided into 26 *kecamatan* (subdistrict) and 136 *kelurahan* (village). According to the socioeconomic census in 2007, the total population of Bandung is 2,296,548 with population density around 138 persons per hectare (Arifwidodo and Perera 2010).

Presently, Bandung is one of the largest growth centers in Indonesia with mixed land use and a concentric urban structure. Being one of the national and regional centers of economic, social, political, and administrative activities, Bandung has been experiencing dramatic changes in its landscape. Many critical urban issues relating to urbanization, such as urban infrastructure and basic service provision, decent housing and settlements, and land for housing, are few of the things that urban planning in the city needs to tackle. Rapid land-use changes, unmanageable traffic conditions, uncontrolled population growth, and environmental deterioration in the city center have been some of the externalities that urban planning and management in Bandung have not been able to make an adequate response to (Arifwidodo and Perera 2011).

There are no explicit policies at the city level regarding carbon emissions and energy consumption in Bandung. Energy-related policies are available at the national level only, with lack of implementations from both national and local government. However, there are some policies in Bandung that can directly influence the energy use in the residential sector. For example, there is an energy safety program policy at the ministry of energy and natural resources, but its objective is to raise awareness on energy efficiency. There is also a gasification of cooking fuel program, which encourages households to switch from kerosene to LPG. This program is mainly targeted for low-income households. Generally, the program works very well, because it also subsidizes LPG so it is cheaper than kerosene. Local government also tries to implement compact development policies into a master plan of the city. It also tries to revise the building code to follow the energy-efficiency principles. The aforementioned examples show that more policy focus on the subject is needed to ensure the success of making household energy use more efficient. In summing up, Bandung as a case study represents the current typical conditions of Indonesian cities. The findings from this study can, to some extent, be generalized to understand what the current status of the development process in the cities of developing countries is, especially in the Southeast Asian cities.

The profile of our respondents is as follows. The sample appears biased toward the relatively higher-income group. The average income of the sample is above the average in the socioeconomic survey conducted by Bandung Statistical Agency in 2007. The average income from our survey is 2,868,267.9 IDR, while that in the socioeconomic survey is 711,138 IDR. The locations of the respondents are distributed throughout the city, with 21.8 % of the respondents located more than 4 km from the city center. The original data on health and education facilities show that most of the facilities are located in the city center and its vicinity. This is due to the high number of inhabitants in the area. In terms of the type of neighborhood, the sample represents a balance between a traditional settlement (*kampong*), which is mostly located in the urban center and a planned residential development, in which many are located in the suburban area. Many respondents' houses are being constructed for more than 10 years. This is because there is a decline in housing development in the last 5 years, due to the economic recession in Indonesia. Table 14.3 summarizes the housing development in Bandung in the past 20 years.

The household energy use of the sample is as follows. On an average, households in the study area spend 163,455 IDR per month as electricity expenditure and 86,588 IDR as cookingfuel cost. Most households (78 %) use LPG as the main source of energy for cooking. In addition, most of the respondents live in detached housing with permanent construction (76.3 %). Table 14.4 summarizes the profile of the respondents.

The energy profile of the respondents shows that the energy use is higher than that estimated in the socioeconomic survey of 2007. This is probably because the sample is biased toward the higher-income group. The higher number of detached housing types also confirms the argument. The large number of houses being constructed for more than 10 years from the survey shows that many of the respondents have been living in the city for a long time. Some of them even occupied houses obtained by inheritance.

**Table 14.3** Number of residential housing development in Bandung (1981–2006). (Arifwidodo and Perera 2011)

| Period | Number of houses built | Area (sq. km) | |
|---|---|---|---|
| | | Corresponding period | Cumulative |
| 1981–1990 | 8829 | 783.00 | 1,022.00 |
| 1991–2000 | 16743 | 5,213.00 | 6,235.00 |
| 2001–2006 | 3285 | 519.00 | 6,745.00 |

**Table 14.4** Energy profiles of the respondents in Bandung

| Parameter | Value |
|---|---|
| Average electricity expenditure (IDR/month) | 163,455 IDR |
| Cooking energy expenditure (IDR/month) | 86,588 IDR |
| Main source of energy for cooking | LPG: 78%, Kerosene: 12%, Others: 10% |
| Housing type | Detached house: 76.3%<br>Attached house: 23.7% |
| Construction year | Less than 10 years: 70.8%<br>10 years or more: 29.2% |

**Table 14.5** Result of OLS regression on residential energy use in Bandung

| Variable | Coefficient | Std. Error |
|---|---|---|
| Income | 1.471E-9[a] | 5.7224E-10 |
| Household size | +0.457[b] | 0.1246 |
| Household type | +0.51 | 0.0367 |
| Year of house construction | +0.763[c] | 0.3381 |
| Total floor area of the house | +0.143[b] | 0.115 |
| District density | −3.623E-6[b] | 0.000 |
| Distance from city center | −0.230[b] | 0.1361 |
| The availability of urban facilities in the neighborhood | −0.198 | 0.2250 |
| Type of neighborhood | +0.284[c] | 0.132 |
| Housing status | +0.149 | 0.1179 |
| $F = 2.999^a$ | | |
| Adjusted $R^2 = 0.080$ | | |

a = sig. 0.001, b = sig. 0.05, c = sig. 0.1

Table 14.5 summarizes the result of OLS regression analysis on the selected variables. After controlling for other variables, the result shows that several independent variables significantly contribute to the residential energy use in Bandung, Indonesia. Several major findings emerge from the analysis. The number of schools and hospitals in the subdistrict is correlated. Therefore, a principal component analysis is done to eliminate such multicollinearity, resulting in a new variable called urban facility (URBFAC).

After we control for other influences, the estimate shows that income is relatively the most important variable in influencing the residential energy use. Energy demands increase with increasing monthly household income. Old houses are less energy-efficient than new houses, and bigger houses consume more energy than smaller houses.

The result shows that the housing type has no influence on energy consumption. Previous empirical evidences show that detached houses consume more energy than attached houses (Ewing and Rong 2008). But this is not the case in Bandung. The fact that the standard deviation of floor area ratio of the house (FLOOR) is 41.1 sq.m shows that the housing type in the sample varies considerably. This finding may mean two things. The first is that there are similar effects of local warming in the whole of Bandung. In other words, there is a similar effect of Urban Heat Island (UHI) in Bandung. We do not include the variables to measure the influence of UHI, because no data related to UHI are available at the city level. The common argument is that a city center experiences more UHI occurrences than a suburban area, because in a more compact area, there are less green spaces to absorb heat, which in turn affects energy use for cooling. However, in Bandung, the building code limits the height of a building in the city up to only the fourth floor due to the mountainous geographical location. This limitation can cause spatial expansion of the city and promote suburbanization (Brueckner and Sridhar 2012; Sridhar 2010). Planned residential development areas are scattered in the urban fringe, which lack good infrastructure, especially green infrastructure that makes the city center less exposed to the UHI. The second is that the behavior of the residents of Bandung regarding energy use is quite similar, regardless of the housing type. The fact that the energy price in Indonesia is cheaper than the neighboring countries supports this argument. It can be inferred that many people in Indonesia have little awareness of conserving energy. Either of the arguments seems plausible and immediate government measures and interventions are needed to improve the current condition.

Selected urban form variables were found to be significant in the model. Density was found to be correlated with residential energy use. Residential energy consumption is low in a high-density area. This may mean two things. The first is that the housing type in a high-density area is considerably smaller, and therefore needs less energy. This finding extends the argument of Newman and Kenworthy (1999) that compact urban form consumes less energy, in both transportation and residential sectors. It also confirms that smaller houses require less energy. The second is related to the land prices in the city center. We had to drop the land prices variable from the estimate because of multicollinearity, but we were able to include the distance from the city center as a proxy variable for land prices. The fact that the distance from the city center is also significant confirms the influences of land prices in the household energy consumption (Redfearn 2009). Although housing type is not significant, the type of neighborhood also shows significance in the estimate. This is because mostly, the type of housing in the planned residential development has bigger total floor area than in the nonplanned residential area. It implies that planned residential development in Bandung, which is mostly a leapfrog development, does influence the energy consumption. This finding has a result similar to that of Ewing et al. (2002), who found that urban sprawl is a significant factor in influencing residential energy use.

The above findings confirm the influences of urban form attributes in the residential energy use in Bandung, Indonesia. In fact, the direct and indirect effects of

urban form, such as housing stock, significantly influence the residential energy consumption. But these effects are weaker than the housing effect, which can inflate residential energy consumption and associated greenhouse gas emissions regardless of location. However, urban form variables, especially the district density and the type of neighborhood, show that a compact urban form is more desirable in terms of creating an energy-efficient city. Since the indirect effect of urban form, which is through the effect of housing stock, is stronger than the direct effect, one possible measure and adaptation is changing the housing design and building regulation. Combining the energy-efficient building design guidelines and regulation will contribute to a more compact urban form and, in turn, will influence better solutions for creating a more energy-efficient city.

## Concluding Remarks

This paper explores whether urban form has a significant effect in household energy use. A survey questionnaire of 400 randomly selected respondents was conducted to explain the empirical part of this study. A multivariate OLS model is used to establish the effect of selected attributes of urban form on residential energy use. After controlling for other influences, it is found that urban form has significant effects on residential energy use in Bandung, Indonesia. The direct effects include variables such as the district density and distance from the city center, and the indirect effects include the housing stock. Both effects indicate that dispersed land use brings about larger houses and more detached units, which consume more energy than smaller houses and attached units typical of more compact communities. This finding suggests that a more compact urban form has a lower residential energy use.

While it is tempting to generalize the result, it needs to be mentioned that this study has several limitations. First, the sample did not demographically representing the population of Bandung and was biased toward middle- and high-income groups of the population. There is always a possibility that using a more representative sample, the effect of urban form on household energy consumption could be less pronounced. This is because the most important factor in determining the household energy use is the household income (Ewing and Rong 2008). Second, this study did not take into account the household energy use from transportation, which can be very significant in determining the impact of urban form (Newman and Kenworthy 1999). Although the findings cannot yet be generalized with confidence, the result can plausibly represent the preliminary evidence of the importance of a compact urban form in increasing energy efficiency. Many theoretical and empirical works still need to be done to understand energy efficiency and its spatial effects. Investigation on the matters may reveal different patterns and broaden the current discourse toward energy-efficient cities.

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# Chapter 15
# Urbanization and the Environment: An Asian Perspective

**Guanghua Wan and Matthew Kahn**

## Introduction

Few developing countries actively promote urbanization despite the well-researched finding of much higher urban productivity. According to a survey by the United Nations (UN), many national governments attempt to contain migration or expansion of cities (Quigley 2008). This can be attributed partly to the perception that urbanization is associated with worsening environment. Some may even view urbanization as synonymous with pollution, congestion, noise, and so on.

Is urbanization always bad for the environment? Answering this question is quite important for policy makers as well as for the research community. Slowing down urbanization by governments implies a loss of efficiency and growth potential. If it does not really help improve the environment, such a policy stance leads to a loss–loss outcome. On the other hand, it seems that little analytical work has been undertaken to explore the urbanization–environment nexus although normative discussions and speculations abound.

The purpose of this chapter is to offer a balanced assessment on the relationship between urbanization and the environment from the Asian perspective. As background information, unique features of Asia's urbanization will be outlined in the next section. This is followed by Sect. 3 which describes the environmental challenges Asia already faces. In Sect. 4, the beneficial impacts of urbanization on the environment are discussed, and the modeling results of the urbanization–environment nexus are provided. Finally, Sect. 5 summarizes the chapter.

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**Table 15.1** Urbanization level and changes (actual and projected). (Source: Authors' estimates based on UN 2012)

| Region | Level of urbanization (%) | | | Percentage point change (%) | |
|---|---|---|---|---|---|
| | 2000 | 2010 | 2050 | 2000–2010 | 2010–2050 |
| Europe | 70.8 | 72.7 | 82.2 | 1.9 | 9.5 |
| Latin America and the Caribbean | 75.5 | 78.8 | 86.6 | 3.4 | 7.8 |
| Northern America | 79.1 | 82.0 | 88.6 | 2.9 | 6.6 |
| Africa | 35.6 | 39.2 | 57.7 | 3.6 | 18.5 |
| Asia | 35.5 | 42.5 | 62.9 | 7.0 | 20.4 |
| China, People's Republic of | 35.9 | 49.2 | 77.3 | 13.3 | 28.1 |
| India | 27.7 | 30.9 | 51.7 | 3.3 | 20.8 |

## Urbanization in Asia: Unique Features

In a process similar to that much earlier in Europe, Latin America, and Northern America, Asia has been urbanizing for many years now and the process is projected to gain momentum in the coming decades. Unlike other regions, however, Asia's urbanization is different in several key aspects.

*First, urbanization in Asia has been occurring rapidly and will continue to do so in the foreseeable future.* Table 15.1, which is based on data and projections of the UN (2012), tabulates the level of urbanization and its change for different regions and two Asian economies. The last two columns of Table 15.1 show the total percentage point increase in the level of urbanization for the periods 2000–2010 and 2010–2050. While Asia increased its urbanization level by 7 percentage points in 2000–2010, Africa—the second fastest urbanizing region during the same period—only experienced a 3.6 percentage points increase. Similarly, during 2010–2050, Asia is projected to increase its urbanization level by 20.4 percentage points, but the projected increase for Africa is only a total of 18.5 percentage points.

More revealing is a comparison of the number of years from the start of a region's urbanization, when about 10% of its population was urban, to when about 50% of its population is urban. Figure 15.1 shows that this process lasted 210 years in Latin America and the Caribbean (from 10% in 1750 to 49.3% in 1960), 150 years in Europe (from 12% in 1800 to 51.3% in 1950), and 105 years in Northern America (from 9% in 1825 to 51% in 1930), and it will take 95 years or less in Asia (from 11% in 1930 to 51% in 2025). For countries within Asia, this process lasted only 61 years for the PRC and is estimated to last 55 years for Bhutan, 60 years for the Lao People's Democratic Republic, 65 years for Indonesia, and 90 years for Vietnam.

*Second, the absolute increase in city population in Asia is unprecedented*, partly due to its large population base and partly due to its fast speed of urbanization. Since the 1950s, Asia has added more than 1.4 billion people to its cities (Fig. 15.2). Almost 537 million were added during the 35-year interval of 1950–1985. However, in the following 15 years, 1985–2000, 465 million were added. More strik-

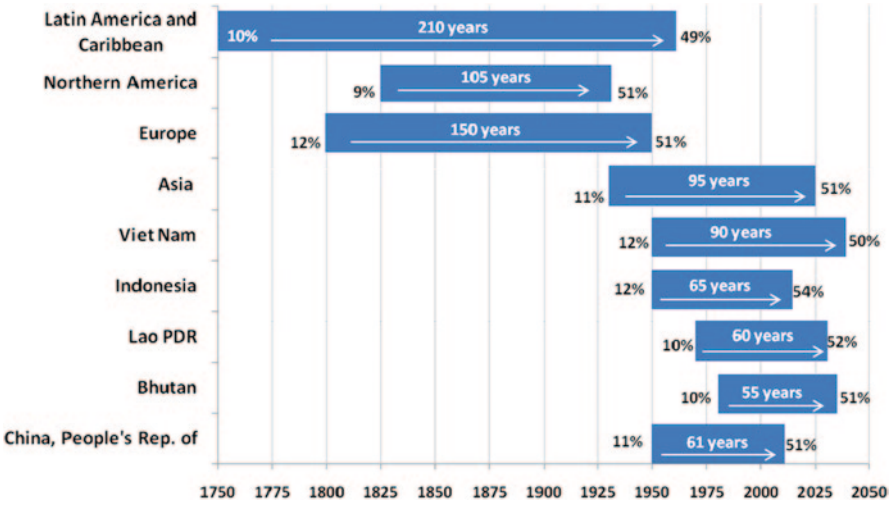


**Fig. 15.1** Number of years from about 10 to 50 % of urbanization. Note: Extrapolation and interpolation were used to estimate urbanization level and corresponding starting years for Latin America and the Caribbean and Northern America. (Source: Authors' estimates based on Bairoch 1988 and UN 2012)

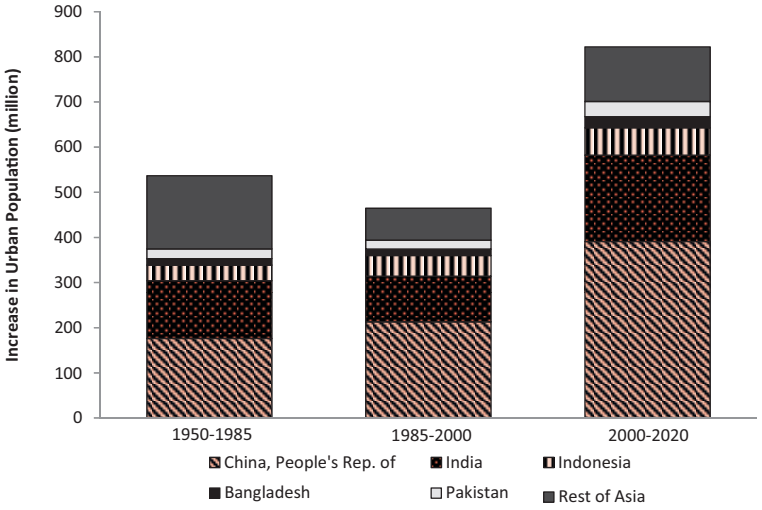


**Fig. 15.2** Increase in urban population in Asia. Note: Data for 2010–2020 are based on projections of UN World Urbanization Prospects, 2011 Revision. (Source: Authors' estimates based on UN 2012)

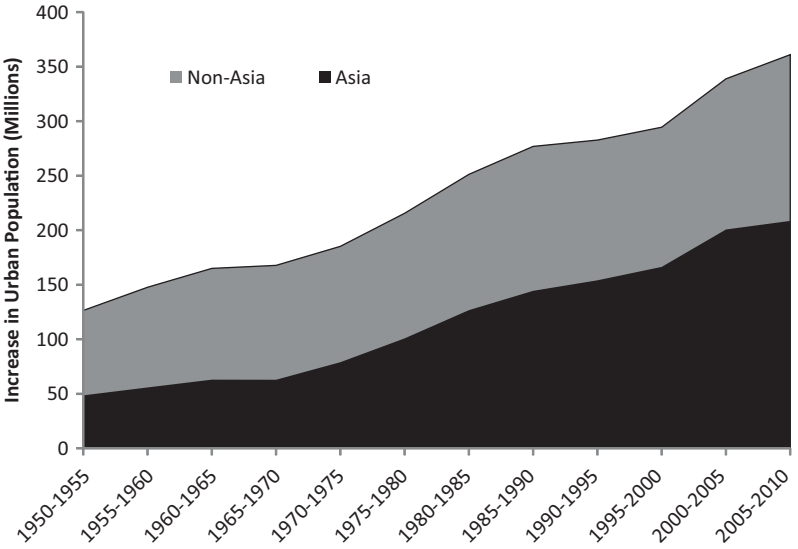


**Fig. 15.3** Increase in urban population, 1950–2010. (Source: Authors' estimates based on UN 2012)

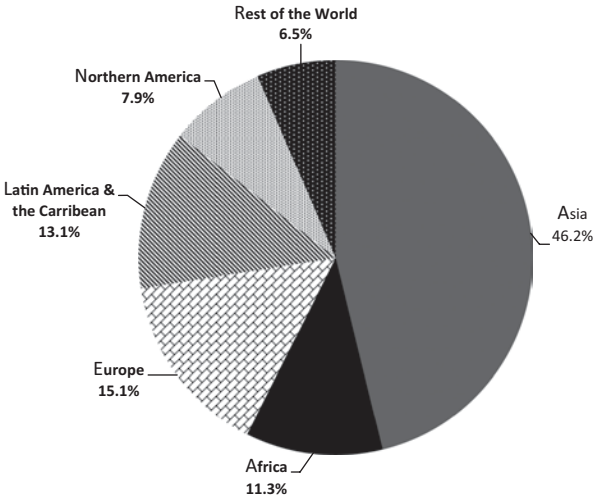


**Fig. 15.4** Regional shares of global urban population, 2010. Northern America = Canada and the USA. (Source: Authors' estimates based on UN 2012)

ingly, from 2000 to 2020, a total of 822 million will be added. Figure 15.2 also provides geographic breakdowns of these numbers. Clearly, most of these increases are from Bangladesh, the PRC, India, Indonesia, and Pakistan, Asia's most populous countries.

To some extent, global urbanization is largely an Asian phenomenon (Fig. 15.3). Since the early 1980s, Asia has added more people to the global urban population than all the other regions combined. By the latest available statistics, Asia is now home to almost half of the total urbanites on earth (Fig. 15.4)—Asia's urban popu-

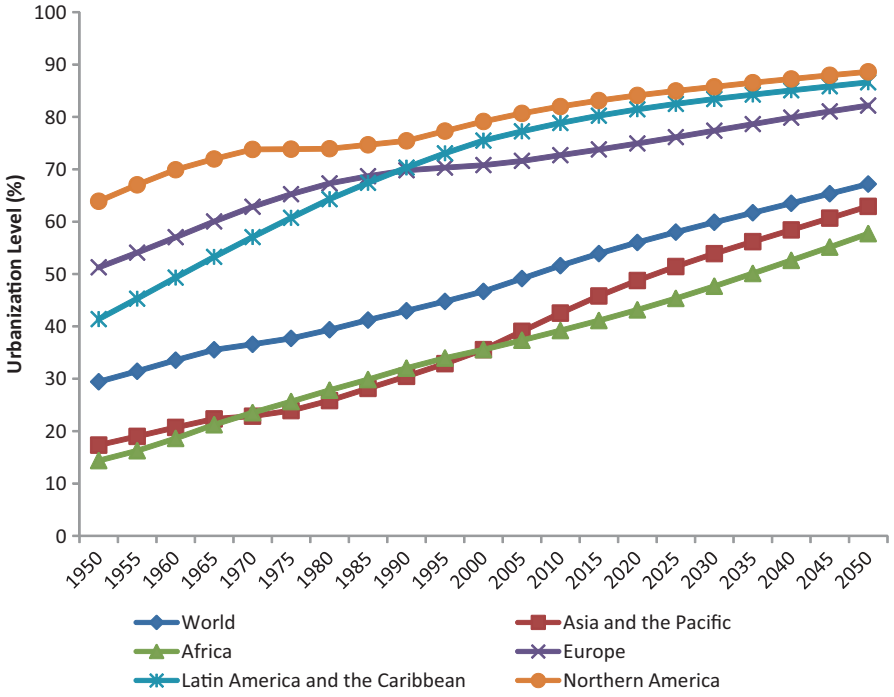


**Fig. 15.5** Level of urbanization by region. Northern America = Canada and the USA. (Source: UN 2012)

lation is more than three times that of Europe, the second largest region in terms of urban population (UN 2012).

*Third, contrary to the unprecedented expansion of city population, Asia's level of urbanization is still low*. As shown in Fig. 15.5, the level of Asia's urbanization (i.e., the share of its population living in urban areas) has been lower than that of the world at least since 1950. Across regions, Asia was the least urbanized, even less than Africa, during 1970–2000. In 1960, only 20.7% of Asia's population was urban versus 33.6% for the world. In 2000, 46.7% of the world's population lived in cities while only 35.5% of the population in Asia did so. In 2010, these urbanization shares moved to 52% and 43%, respectively. Thus, the urbanization gap between Asia and the rest of the world has narrowed but remains large.

The gap in the urbanization level between Asia and the world will narrow further (UN 2012). By 2050, while 62.9% of Asians will live in cities, this percentage will be 67.2 for the world. Asia's level of urbanization will be higher than Africa's (57.7%), but still lower than Europe's (82.2%), Northern America's (88.6%), and Latin America and the Caribbean's (86.6%).

*Fourth, Asia is home to most of the world's megacities and its share has been increasing*. There were only two megacities in the world in 1950: New York, with a population of 12.3 million, and Tokyo, with 11.3 million. By 1980, two more

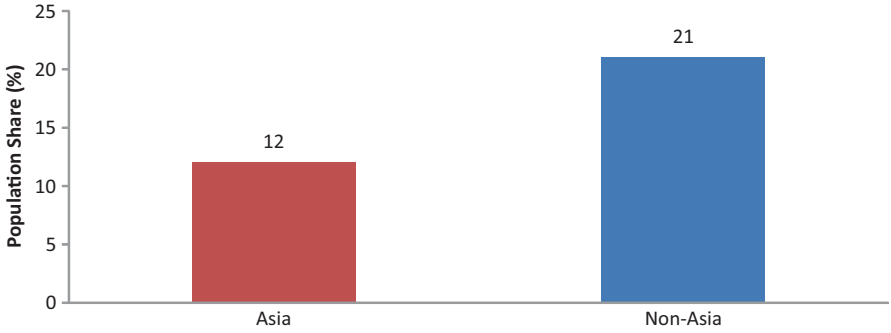


**Fig. 15.6** Population share of largest cities of individual countries, 2009 (% of total urban population). (Source: Authors' estimates based on UN 2012)

megacities had emerged: São Paolo, with a population of 12.1 million, and Mexico City, with 13 million. However, by 2010, Asia had 12 of the world's 23 megacities. The UN (2012) predicts that these numbers will increase to 21 and 37, respectively, by 2025.[1] Cities such as Chongqing, Guangzhou, Jakarta, Lahore, and Shenzhen are expected to pass the 10-million mark soon. The large cities expected to grow the most include Dhaka, Lahore, Karachi, Kolkata, Manila, Mumbai, and Shanghai. Thus, while the majority of the world's megacities are in Asia, even more are emerging.

Although megacities are growing and their numbers are increasing, the largest city of each country in Asia is home to a smaller share of the total urban population than is the case in other regions. "Urban primacy" is indicated by the share of the country's urbanites who live in the largest city of the country. Relative to the rest of the world, Asia shows a much lower level of urban primacy (Fig. 15.6), indicating that its urban populations are less concentrated in the largest city of each country. In 2009, roughly 12 % of Asia's urban population lived in their country's largest cities, while outside of Asia, this share was 21 %. This suggests that the size of Asia's primate cities is likely to increase. Therefore, although Asian cities are already large, some of Asia's megacities are likely to become larger still, even relative to medium- and small-sized cities in the same country.

*Fifth, Asia's cities feature much higher population densities than cities elsewhere in the world.* The world's three most densely populated large cities are in South Asia, and 8 of the top 10 are in Asia (Fig. 15.7). The average urban area (settlements of 5,000 or more people) has 720 people per square kilometer in Asia, compared with about 500 in Africa, the region with the second highest urban density. Kenworthy (2008) notes that wealthy Asian cities have an average density of 150 people per hectare compared to 15 in Australia, New Zealand, and the USA.

[1] The raw data can be downloaded at esa.un.org/unpd/wup/CD-ROM/WUP2011-F17a-City_Size_Class.xls.

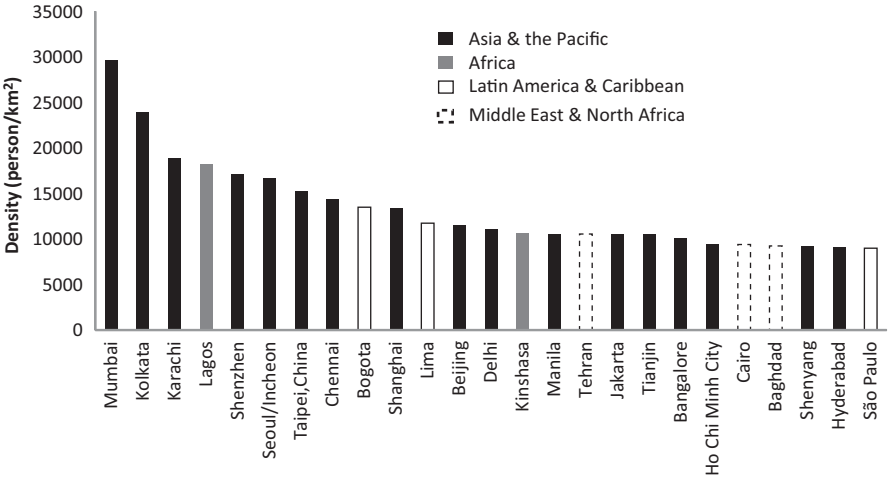


**Fig. 15.7** Top 25 cities ranked by population density, 2007. (Source: City Mayors 2007)

*Sixth, significant heterogeneity exists across subregions in Asia and across economies in terms of urbanization level and speed*. For example, the level of urbanization is much higher for developed countries in Asia (Japan, Australia, and New Zealand). Their level of urbanization was 90.2% in 2010, 49.6 percentage points higher than developing Asia as a whole. At the subregional level, East Asia was less urbanized than Central and West Asia and Southeast Asia until the late 1990s. Since 2005, however, East Asia has been the subregion with the highest level of urbanization, reaching 50.7% in 2010 (Fig. 15.8). The PRC and the Republic of Korea exhibit faster urbanization than others (Fig. 15.9). The speed of urbanization in Bangladesh is also high.

Until 1995, the least urbanized developing subregion had always been the Pacific island countries and the most urbanized had been Central and West Asia. The difference in urbanization rates between the two subregions has been fairly stable, at about 15%. However, in both subregions, urbanization has progressed slowly while Southeast Asia, South Asia, and particularly East Asia (basically, the PRC) have been urbanizing faster.

Thus, Asia's level of urbanization started from a relatively low base compared to the rest of the world, but it has been proceeding rapidly and on a vast scale. This is likely to continue at least until 2050, with an increasing formation of megacities and expansion of most cities. In addition, the population densities of Asian cities, already high, are likely to increase. These prospects raise daunting issues for Asia, not least of which are the environmental implications of this massive human and economic clustering.

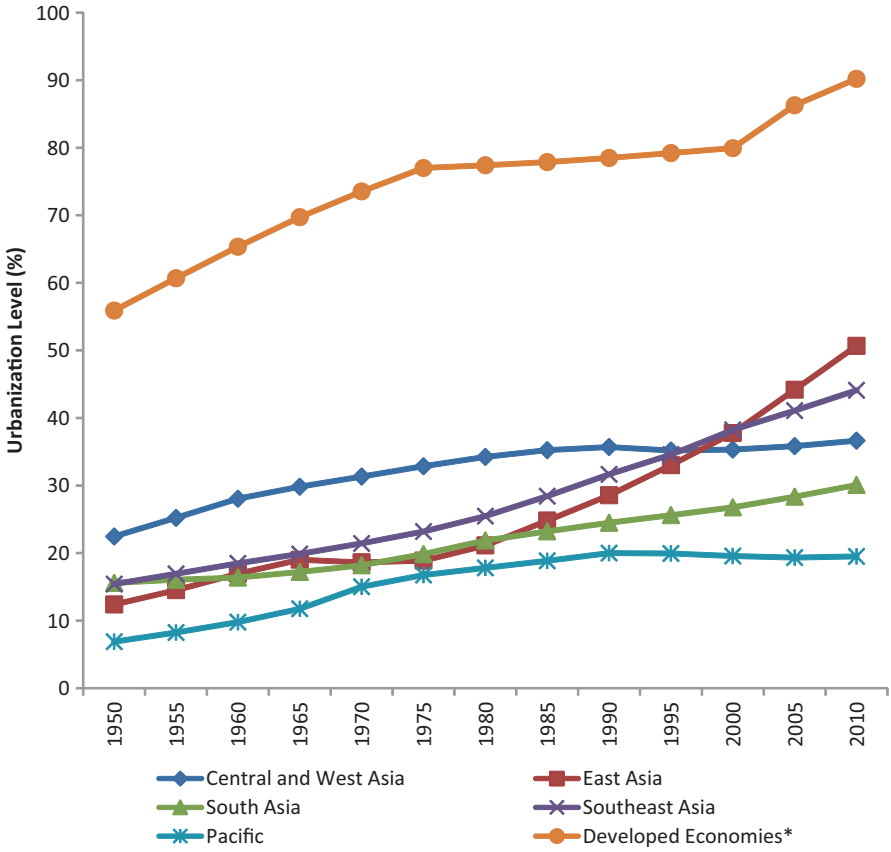


**Fig. 15.8** Urbanization levels, ADB subregion. Note: * Developed economies include Australia, Japan, and New Zealand. (Source: UN 2012)

## Environmental Implications of Urbanization in Asia

Urbanization-related challenges include high crime rates, unequal income distribution, and environmental challenges such as urban air pollution, increasing greenhouse gas (GHG) emissions, access to clean water and sanitation, and vulnerability to climate change-related risks. As shown in Fig. 15.10 and the recent Asian Development Outlook (ADB 2012a), inequality is generally greater in urban areas than in rural areas, so that urbanization may aggravate the problem of unequal income distribution. Even in the PRC, where inequality had been lower in urban than in rural areas, urban inequality has been growing faster and surpassed rural inequality in 2008.[2]

[2] The lower urban inequality in the PRC was largely due to the urban bias, which has gradually faded away but still exists (Wan and Zhang 2011).

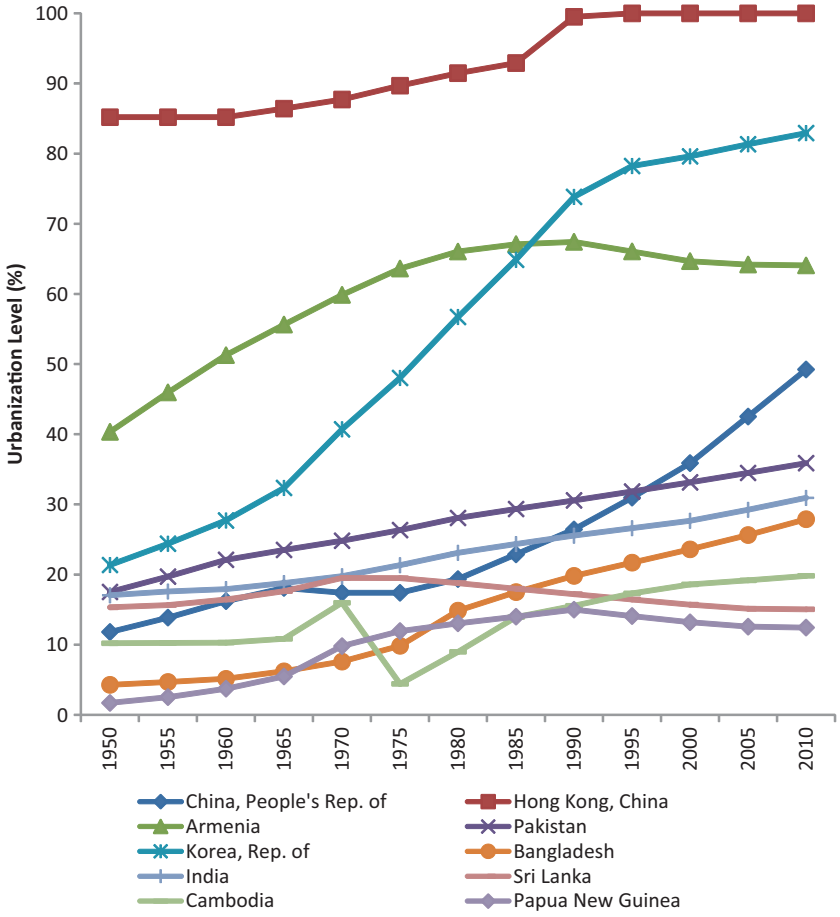


**Fig. 15.9** Urbanization levels, selected Asian Economies. (Source: UN 2012)

New entrants to cities are likely to be poorer than incumbent residents and to live in slums or city fringes. In addition, because the cost of criminal activity is usually lower and gains larger in cities than in the countryside, urbanization may be accompanied by elevated local crime levels. Figure 15.11 is a scatterplot of the theft rate (number of theft incidents per 100,000 population) and level of urbanization using worldwide data. Clearly, the two variables are positively correlated. In addition, homicide rates are higher in cities than in most of the corresponding national averages (Fig. 15.12).[3]

[3] Other indicators of crime than theft and homicide rates are not available for a rural–urban comparison.

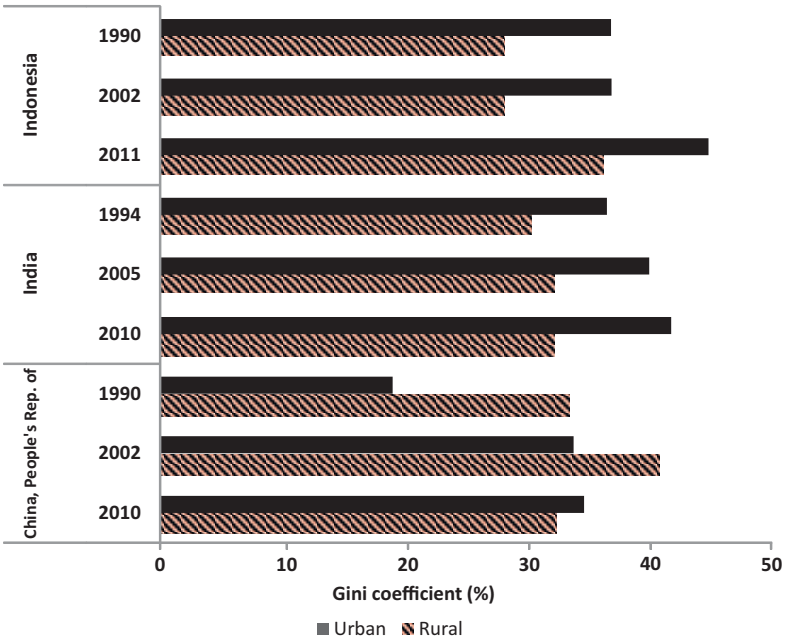


**Fig. 15.10** Urban and rural inequality in Asia. (Source: Authors' 2012a and Authors' estimates)

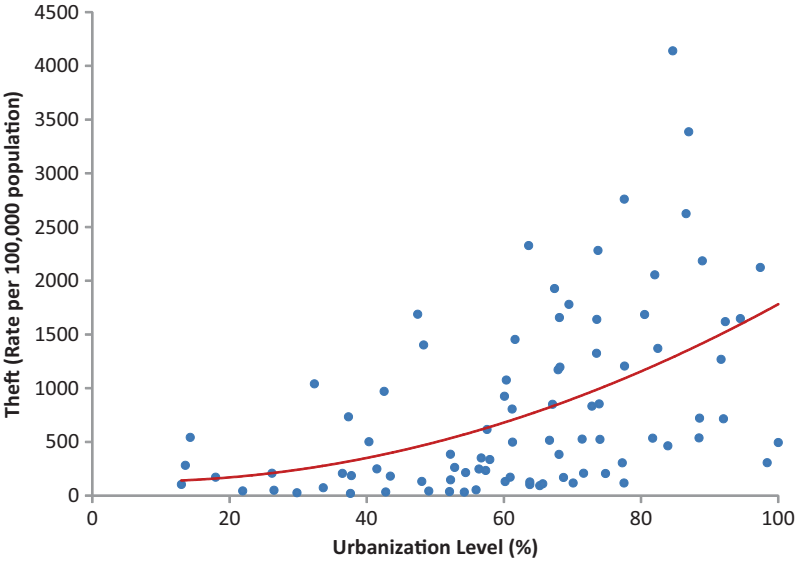


**Fig. 15.11** Theft rate versus level of urbanization: Global data. (Source: UNODC 2012 and World Bank 2012)

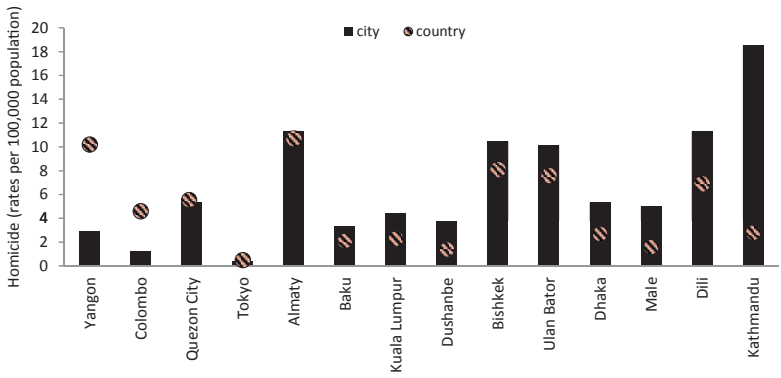


**Fig. 15.12** Intentional homicide rates in selected countries. (Source: UNODC 2012)

Challenges to city life are numerous and include higher costs of housing, education, and health care. This chapter will focus on environmental issues in the context of urbanization. This focus is a response to the rising importance of the environment in sustaining growth, the unprecedented urbanization in the region, and the formidable environmental challenges faced by Asia. There is also a growing awareness that in future, for cities to have a competitive edge, they will have to be "green economies" (OECD 2011). Finally, while urbanization is often assumed to be associated with environmental degradation, little research has been done so far on this linkage.

## *Urban Air Pollution in Asia*

While no two cities are the same, many of Asia's cities face common challenges, including a sharp increase in the number of registered vehicles, rising levels of industrial production, and to some extent a reliance on coal-fired power plants. All of these contribute to air pollution, and, in Asia, air pollution contributes to the premature death of half a million people each year (ADB 2012b).

From a public health perspective, particulate matter (PM) and carbon monoxide levels[4] are considered to be more associated with elevated morbidity risk than are ozone levels (Chay and Greenstone 2003, Currie and Neidell 2005). Data on PM10 are available from the World Health Organization and are used to rank cities that have an average PM10 level of 100 micrograms per cubic meter ($\mu g/m^3$) or higher. Of the world's 57 most polluted cities, 34—or almost 60%—are in Asia (Fig. 15.13).

[4] Particulate matter (PM)—also known as particulates or suspended particulate matter (SPM)—is solid matter suspended in air or liquid. PM10 refers to particulate matter with diameter of 10 micrometers or less. Carbon monoxide is a colorless, odorless, and tasteless gas that is slightly lighter than air. It can be toxic to humans and animals when encountered in higher concentrations. In the atmosphere, however, it is short-lived and spatially variable, as it combines with oxygen to form $CO_2$ and ozone.

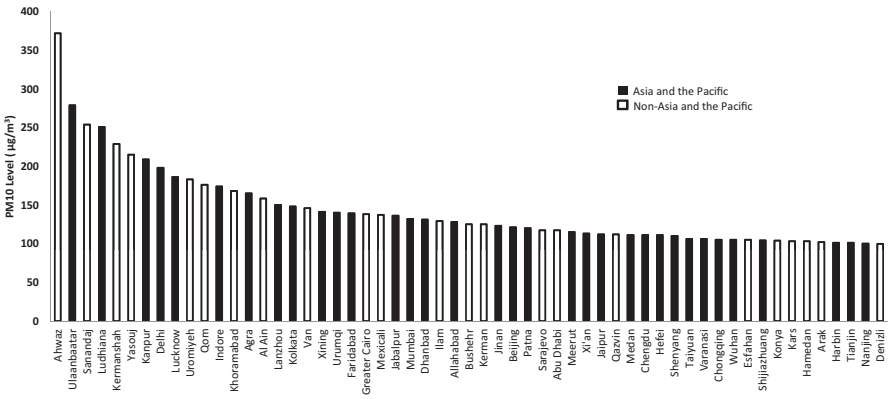


**Fig. 15.13** Cities with PM10 above 100 μg/m$^3$, 2008–2009. (Source: WHO 2012)

Figure 15.14 plots PM10 kernel density using observations for Asia and non-Asian cities.[5] Three interesting findings can be discerned. First, the density plot for Asian cities clearly lies to the right of the non-Asian cities, indicating that many of Asia's cities have much higher levels of pollution than cities in other regions. Second, the mode (most common value) of PM10 for non-Asian cities is only about 20 μg/m$^3$ but is almost double that—nearly 40 μg/m$^3$—on average in Asian cities. Third, if the European Union's air quality standard of 40 μg/m$^3$ is used as the benchmark, less than 11 % of non-Asian cites do not meet the standard but a staggering 67 % of Asian cities fail to meet it.

The PRC has 12 of the world's 20 most polluted cities (World Bank 2007a). The World Bank (2007b) reported that, in 2003, 53 % of the 341 cities monitored—accounting for 58 % of the PRC's urban population—had annual average PM10 levels above 100 μg/m$^3$, and 21 % of these cities had PM10 levels above 150 μg/m$^3$. Only 1 % of the PRC's urban population lives in cities that meet the European Union's air quality standard of 40 μg/m$^3$.

In Metropolitan Manila, depending on the year, 13 or more stations have monitored total suspended particulate (TSP) levels since 2000. Figure 15.15, plotting the distribution of the ambient (outdoor) pollution readings, shows that some parts of Manila have tremendously elevated TSP levels. In 2010, TSP levels were twice as high in Pasay City as in Mandaluyong City, largely due to differences in the traffic volumes. In 2011, 77 % of the monitoring stations' readings exceeded the nation's air pollution standard of 90 μg/m$^3$.

In Thailand, the Bangkok data contain observations on ambient PM10, ozone, and carbon monoxide from 1997 to 2011. Using the ambient PM10 data and a simple econometric model with fixed effects for monitoring stations, one can show that ambient ozone (from automobile exhausts) has increased by 4.3 % per year in Bangkok. Thailand's State of Pollution Report 2010 also shows that the country's ambient ozone levels have increased over time. As the numbers of both vehicles and residents continue to increase, health costs can be expected to rise.

[5] Loosely speaking, a kernel density plot depicts the frequency of occurrence of a variable.

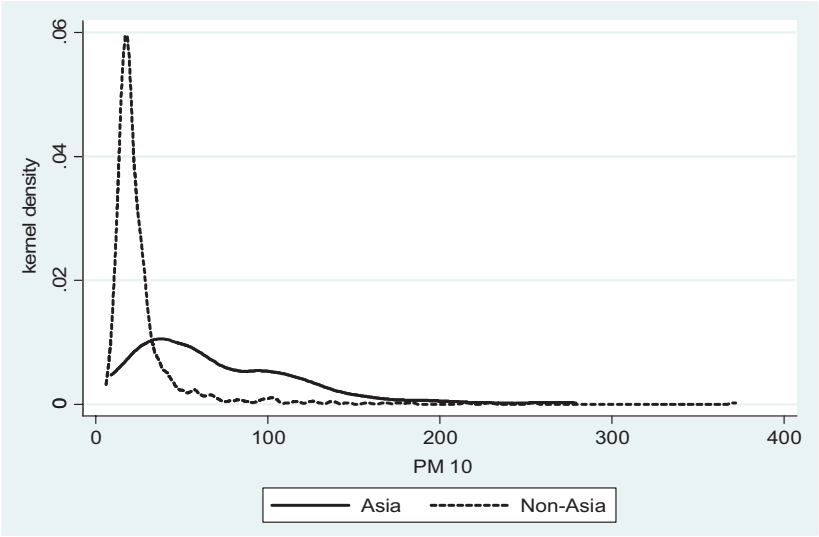


**Fig. 15.14** PM10 kernel density, 2008–2009. (Source: Authors' estimates based on WHO)

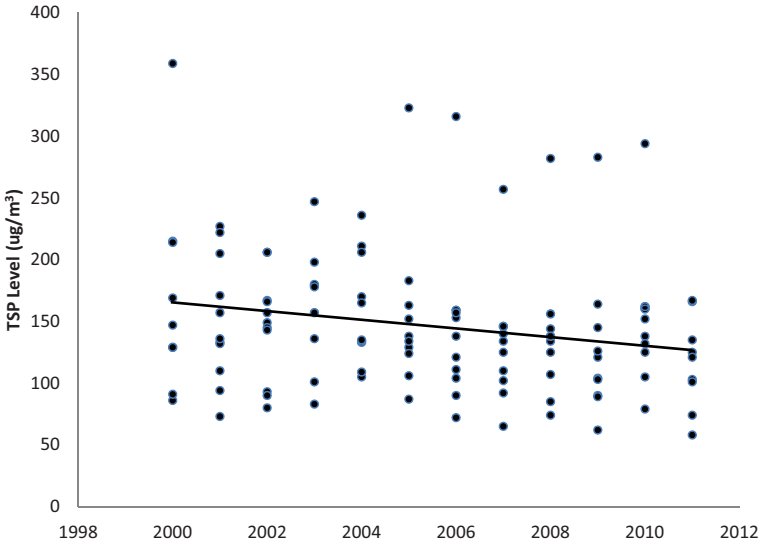


**Fig. 15.15** Total suspended particulates at Manila sites. (Source: Environmental Management Bureau 2002, 2009)

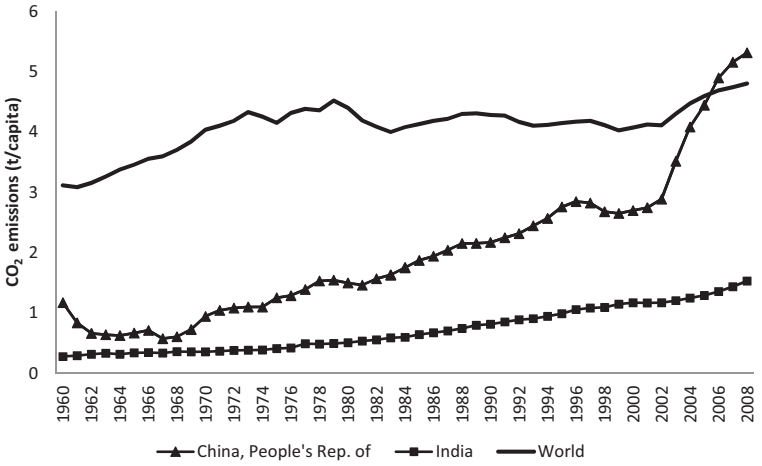


**Fig. 15.16** $CO_2$ emissions. (Source: World Bank 2012)

## *Greenhouse Gas Emissions*

Because urbanization raises per capita incomes and richer people consume more fossil fuels, urban growth and GHG emissions appear to be directly linked. As there is no global price on carbon, polluters (ranging from vehicle owners to electric power plants) face little incentive to economize on emissions. Thus, the increasing trend in GHG emissions is of utmost concern, although on a per capita basis the current level of carbon emissions in Asia is lower than that in developed countries. For example, on a per capita basis and during 2000–2008, the regional average emission for Asia grew by 97% while that for the world grew by only 18%.

Asia certainly faces enormous challenges in terms of its total volume of $CO_2$ emissions. By this criterion, three of the top five emitting countries are in Asia: the PRC, India, and Japan. This is not surprising, as the total volume of any pollutant is a product of population and per capita emission. While per capita emissions tend to rise over time as economies grow, the enormous population base in many Asian nations also presents a key contributor to this challenge.

In terms of per capita $CO_2$ emissions, Fig. 15.16 shows the time series trends for the world, the PRC, and India. The PRC's amazing growth in emissions, starting in the early 1990s and becoming more rapid from early 2000, is clear and has been concentrated in cities. If the PRC's per capita emissions were to reach the levels of the USA, global carbon emissions would increase by more than 50%. As India continues to grow and urbanize, its per capita emissions are likely to rise as well (Sridhar 2010).

The rise in the number of private vehicles and their increasing use in Asia have contributed significantly to rising GHG emissions. The number of vehicles per 1,000 people in the PRC increased from 10 in 1998 to 37 in 2010, while in the Philippines the increase was from 9 in 1990 to 33 in 2007 (ADB 2011). Because private

vehicles offer flexibility and often move faster than public buses, the demand for private vehicles will likely continue to rise as Asia's cities grow richer (Zheng et al. 2011). According to some estimates, the income elasticity of demand for vehicles is unitary. This means that a 10% increase in per capita income is associated with a 10% increase in a nation's per capita vehicle ownership rate. When combined with the high density in Asian cities, the result could be serious traffic congestion and pollution. Solutions to this high-density-related congestion problem include aboveground rail projects, as in Bangkok, and underground transit, as in the PRC and Delhi.

Increasing demand for electricity is another source of GHG emissions, particularly for nations that rely on coal for power. According to the Asian Development Bank (ADB 2011), 79% of the PRC's electricity is generated by coal, and India uses coal to generate 69% of its electricity. The carbon emissions factor of natural gas is 50% lower than that of coal, while wind and solar have zero carbon emissions factors. These enormous differences highlight how the global GHG emissions associated with electricity consumption vary depending on the energy source. Unfortunately, across Asia today, renewable sources provide only a tiny share of overall power generation, although they are becoming a dominant destination for investment in power generation (Newman and Wills 2012a, 2012b). For example, in 2006, the PRC set a 2020 target of 8% share of primary energy to come from renewable sources but reached this so quickly that they raised the target to 15% by 2020. In 2010, the PRC invested $48.9 billion in renewables, making it the world leader in renewable energy investment (UNEP and Bloomberg New Energy Finance 2011).

## *Access to Clean Water and Sanitation*

A key determinant of a city's "greenness" is whether it can supply clean water and sanitation, and properly dispose of solid waste. Such service delivery will reduce infectious disease rates and lower infant mortality, and should translate into increased life expectancy. The challenges that Asia's poor cities now face resemble the challenges that Western cities faced in the early twentieth century (Cain and Hong 2009, Cain and Rotella 2001, Ferrie and Troesken 2008). In 1880, the average urbanite in the USA lived 10 years less than the average rural resident (Haines 2001). Dirty water was the primary cause, and urban growth exacerbated this problem.

The current status of water and sanitation in Asia is disturbing. By the latest estimate, almost 1.9 billion Asians are without basic sanitation, representing over 70% of the global total (ESCAP, ADB, and UNDP 2012). Only 22% of India's population had access to flush toilets in 1992, and progress in raising that share is slow (Bonu and Kim 2009).

Worse still, except in Southeast Asia, all other subregions in Asia will not meet their sanitation targets as set in the Millennium Development Goals (MDGs). Given that the MDG target is merely to halve the 1990 number of people without access

to water supply and sanitation by 2015, a country that had a 20% access rate in 1990 would still have 40% of its residents without basic sanitation by 2015 even if it manages to achieve the MDG target. Current projections indicate that more than 290 million people in India may still live without basic sanitation in 2015 (ESCAP, ADB, and UNDP 2012).

Turning to water, more than half (approximately 400 million) of the world's people who are deprived of safe drinking water reside in Asia. To supply water to 400 million people requires huge investments that the countries may not be able to afford. Worse still, low-income countries in the region are projected not to meet the water MDG. In many parts of Dhaka, water is supplied for only 2 hours a day; in some areas, the quality is poor and people complain of receiving straw-colored, sticky, and smelly water. The situation is even worse for slum dwellers, who in many cases have no access to piped water supply even if they are willing and able to pay for it (Wan and Francisco 2009). For example, Dhaka Water Supply and Sewerage Authority officials note that, by law, water can be supplied only to legal landholders (Wahab 2003).

Further, in many Asian countries water is still heavily subsidized. Thus, it is questionable whether the current water supply is economically sustainable even for people who already have gained access. In addition, rivers in Asia are heavily polluted, which adds to the growing scarcity of freshwater sources.

Garbage collection in Asia is another major challenge, especially because people who earn more usually consume and dispose of more (Beede and Bloom 1995). Richer cities may be able to invest in the collecting and disposing of solid waste but poorer cities often lack the resources to do so. For example, in some of India's cities, an estimated 30–35% of total waste remains uncollected from the city roads (Sridhar and Mathur 2009). Kolkata and Mumbai dump or burn all their garbage in the open. Chennai and Delhi dispose 100% and 95%, respectively, of their waste in sanitary landfills (Zhu et al. 2008). Although a higher proportion of urban residents have access to these basic services than do rural residents, Asian cities are hard pressed to raise funds and ensure such service delivery to their rapidly expanding populations.

## *Resilience to Climate Change*

Urbanization increases vulnerability because life and asset losses are much larger in cities than in the countryside when a disaster strikes. In this context, the issue of climate change becomes particularly relevant to cities. Climate change is recognized to have caused extreme weather and rising sea levels. While there are many unknowns about the extent and timing of these impacts, the consensus is that the challenge is real and imminent, and that different cities will face different but urgent challenges (Kahn 2010).

Among the consequences of climate change are an increase in the intensity and frequency of floods and sea-level rise. Poorer cities that are below sea level are the

**Table 15.2** Urban population at risk of coastal flooding by region, 2000. (Source: Authors' estimates based on McGranahan et al. 2007)

| | Total urban population (million) | Urban population at risk (million) | Share of population at risk (%) | Total urban land area ('000 km$^2$) | Urban land area at risk ('000 km$^2$) | Share of land area at risk (%) |
|---|---|---|---|---|---|---|
| Africa | 280 | 32 | 11 | 310 | 18 | 6 |
| Asia | 1,390 | 251 | 18 | 1,167 | 129 | 11 |
| Latin America | 312 | 24 | 8 | 663 | 42 | 6 |
| Europe | 571 | 40 | 7 | 800 | 56 | 7 |

most susceptible. This is especially relevant for Asian nations such as Bangladesh and the Pacific island countries, though data for the latter are often unavailable. Many Asian cities, and especially some megacities, have been built in the deltas of major rivers where ports could link the cities to the global economy.

Therefore, it is not surprising that many Asian cities are flood prone. Some such cities may have extensive experience dealing with floods. For example, Dhaka has an elaborate set of mud banks for protection. However, increased flooding induced by climate change may well push these cities' infrastructures beyond their current capacities, as it occurred in Bangkok in late 2011. Developing further coastal engineering protection will place an increasing burden on the resources of such cities.

In 2000, 18% of Asian urbanites were at risk of coastal flooding (Table 15.2), versus 11% for Africa, 8% for Latin America, and 7% for Europe. In terms of total urban population, 251 million Asians were exposed to this risk, compared with 40 million Europeans, 32 million Africans, and 24 million Latin Americans. Similar high comparative proportions of total and urban land are found in low-lying coastal areas of Asia relative to other continents. These areas are at greater risk of not only a future sea-level rise but also coastal flooding arising from more frequent and intense storms.

Using the proportion of urban population that is exposed to flooding risks as a measure of vulnerability, vulnerability to inland or coastal flooding differs significantly across subregions and countries. In terms of coastal flooding (Table 15.3), the region's vulnerability is 19.6%, with Southeast Asia being most vulnerable (36.1%) followed by East Asia (17.5%) and South Asia (14.3%). At the country level, the most vulnerable economies are the Maldives (100%), Vietnam (73.9%), Thailand (60%), and Bangladesh (50.3%).

Turning to inland flooding (Table 15.4), the overall vulnerability for Asia is 15.1%, moderately lower than the coastal flooding vulnerability. East Asia is most vulnerable (19.8%), followed by Southeast Asia (14.7%) and South Asia (14.2%). At the country level, about three-quarters of the urban population of Cambodia are at risk of inland flooding. The vulnerability is 38.6% for Vietnam, 35.7% for Bangladesh, 34% for the Lao PDR, and 29% for Thailand. One-fifth of the urban population of the PRC and 12% of India's urbanites, in total more than 120 million people, are at risk of inland flooding. Even landlocked countries have substantial

**Table 15.3** Population and area at risk of coastal flooding, 2000. (Source: Balk et al. 2012)

| Country | Urban population at flood risk | % population at flood risk | Urban land area ($km^2$) at flood risk | % urban land area at flood risk |
|---|---|---|---|---|
| *Central and West Asia* | | | | |
| Georgia | 230,982 | 7.5 | 159 | 4.9 |
| Pakistan | 2,227,119 | 4.6 | 364 | 1.5 |
| *Subtotal* | *2,458,101* | *4.8* | *523* | *1.9* |
| *East Asia* | | | | |
| China, Rep. of | 78,277,824 | 18.5 | 33,243 | 13.4 |
| Hong Kong, China | 811,925 | 14.1 | 104 | 14.2 |
| Korea, Rep. of | 2,034,832 | 5.3 | 1,369 | 7.4 |
| Taipei, China | 3,022,216 | 21.4 | 2,604 | 21.3 |
| *Subtotal* | *84,146,796* | *17.5* | *37,320* | *13.4* |
| *South Asia* | | | | |
| Bangladesh | 15,428,668 | 50.3 | 4,522 | 45.9 |
| India | 31,515,286 | 10.5 | 11,441 | 5.9 |
| Maldives | 6,421 | 100.0 | 3 | 100.0 |
| Sri Lanka | 961,977 | 22.8 | 744 | 22.5 |
| *Subtotal* | *47,912,352* | *14.3* | *16,710* | *8.1* |
| *Southeast Asia* | | | | |
| Brunei Darussalam | 24,965 | 11.2 | 256 | 24.2 |
| Cambodia | 281,944 | 15.0 | 137 | 21.3 |
| Indonesia | 22,720,666 | 27.9 | 8,176 | 26.4 |
| Malaysia | 3,687,052 | 26.5 | 3,775 | 28.1 |
| Myanmar | 4,512,823 | 36.2 | 1,087 | 24.2 |
| Philippines | 6,807,578 | 27.4 | 1,872 | 22.8 |
| Singapore | 550,057 | 14.0 | 62 | 12.0 |
| Thailand | 12,471,874 | 60.0 | 9,207 | 34.8 |
| Vietnam | 12,862,429 | 73.9 | 3,877 | 66.4 |
| *Subtotal* | *63,919,387* | *36.1* | *28,448* | *31.1* |
| *The Pacific* | | | | |
| Timor-Leste | 1,369 | 4.2 | 7 | 5.3 |
| *Developed Member Economies* | | | | |
| Japan | 29,022,184 | 25.7 | 17,322.81 | 17.5 |
| *Asia* | *227,460,189* | *19.6* | *100,332* | *14.3* |

Global Rural–Urban Mapping Project (GRUMP) estimates for urban population and urban areas are used in the computation of percentages of population and area at risk (http://sedac.ciesin.columbia.edu/gpw)

vulnerability: Tajikistan (16.4%), Bhutan (14.5%), Afghanistan (12.5%), and Kyrgyz Republic (12%).

Tables 15.5 and 15.6 list the 40 most vulnerable cities in Asia that have a population of 1 million or more (as measured in 2000). Focusing on coastal flooding (Table 15.5), half of the 40 most vulnerable cities are in the PRC. Among the 11 cities with a vulnerability of more than 90%, 8 are in the PRC, including Shanghai and Tianjin—the PRC's largest cities. The other three are Bangkok in Thailand, Khulna in Bangladesh, and Palembang in Indonesia. Another 13 cities have vulnerability levels between 60% and 89%, notably including Kolkata and Ho Chi Minh City.

**Table 15.4** Population and area at risk of inland flooding, 2000. (Source: Balk et al. 2012)

| Country | Urban population at flood risk | % population at flood risk | Urban land area ($km^2$) at flood risk | % urban land area at flood risk |
|---|---|---|---|---|
| *Central and West Asia* | | | | |
| Afghanistan | 540,078 | 12.5 | 430 | 23.8 |
| Armenia | 198,941 | 7.4 | 192 | 12.9 |
| Azerbaijan | 254,474 | 6.0 | 526 | 9.1 |
| Georgia | 319,048 | 10.4 | 369 | 11.4 |
| Kazakhstan | 860,190 | 9.8 | 1,561 | 13.9 |
| Kyrgyz Republic | 189,534 | 12.2 | 367 | 12.6 |
| Pakistan | 3,092,548 | 6.4 | 2,230 | 9.0 |
| Tajikistan | 286,229 | 16.4 | 408 | 11.6 |
| Turkmenistan | 64,777 | 3.2 | 620 | 11.1 |
| Uzbekistan | 813,736 | 8.5 | 1,615 | 10.9 |
| *Subtotal* | *6,619,555* | *7.7* | *8,318* | *11.1* |
| *East Asia* | | | | |
| China, Rep. of | 90,700,145 | 21.4 | 45,610 | 18.4 |
| Korea, Rep. of | 2,920,496 | 7.6 | 1,010 | 5.5 |
| Mongolia | 176,968 | 12.2 | 190 | 16.5 |
| Taipei, China | 890,354 | 6.3 | 668 | 5.5 |
| *Subtotal* | *94,687,963* | *19.8* | *47,478* | *17.0* |
| *South Asia* | | | | |
| Bangladesh | 10,954,609 | 35.7 | 3,721 | 37.8 |
| Bhutan | 21,504 | 14.5 | 30 | 15.5 |
| India | 36,056,326 | 12.0 | 25,564 | 13.3 |
| Nepal | 160,508 | 5.9 | 214 | 8.5 |
| Sri Lanka | 792,244 | 18.8 | 442 | 13.4 |
| *Subtotal* | *47,985,191* | *14.2* | *29,971* | *14.4* |
| *Southeast Asia* | | | | |
| Brunei Darussalam | 1,634 | 0.7 | 14 | 1.3 |
| Cambodia | 1,428,121 | 76.0 | 641 | 100.0 |
| Indonesia | 4,394,972 | 5.4 | 2,417 | 7.8 |
| Lao PDR | 302,825 | 34.0 | 276 | 26.1 |
| Malaysia | 495,254 | 3.6 | 749 | 5.6 |
| Myanmar | 2,361,353 | 19.0 | 1,050 | 23.4 |
| Philippines | 3,713,398 | 14.9 | 968 | 11.8 |
| Thailand | 6,070,291 | 29.2 | 7,002 | 26.5 |
| Vietnam | 6,716,973 | 38.6 | 1,893 | 32.4 |
| *Subtotal* | *25,484,820* | *14.7* | *15,010* | *16.3* |
| *The Pacific* | | | | |
| Timor-Leste | 869 | 2.7 | 6 | 4.6 |
| *Developed Member Economies* | *179,484,278* | *15.1* | *105,799* | *14.0* |
| Japan | 4,705,880 | 4.2 | 5,016 | 5.1 |
| *Asia* | *179,307,311* | *15.1* | *105,610* | *14.0* |

Global Rural–Urban Mapping Project (GRUMP) estimates for urban population and urban areas are used in the computation of percentages of population and area at risk (http://sedac.ciesin.columbia.edu/gpw)
*Lao PDR* Lao People's Democratic Republic

**Table 15.5** Top 40 Asian cities (>1 million population) in vulnerability to coastal flooding. (Source: Balk et al. 2012)

| Country | City | Population at flood risk (million) | % of city population | City area at flood risk ($km^2$) | % of area at risk |
|---|---|---|---|---|---|
| China, People's Rep. of | Tianjin | 5.5 | 100.0 | 2081 | 100.0 |
| China, People's Rep. of | Panjin | 1.0 | 100.0 | 690 | 100.0 |
| Bangladesh | Khulna | 1.1 | 99.9 | 394 | 99.8 |
| China, People's Rep. of | Nantong | 1.0 | 99.8 | 286 | 99.9 |
| China, People's Rep. of | Changzhou | 2.0 | 99.0 | 362 | 99.0 |
| China, People's Rep. of | Jiangyin | 1.2 | 96.8 | 492 | 96.8 |
| China, People's Rep. of | Suzhou | 1.3 | 95.8 | 368 | 91.2 |
| Indonesia | Palembang | 1.3 | 94.2 | 473 | 89.5 |
| Thailand | Bangkok | 8.8 | 93.3 | 4805 | 80.2 |
| China, People's Rep. of | Wuxi | 1.3 | 91.1 | 397 | 91.0 |
| China, People's Rep. of | Shanghai | 14.0 | 90.8 | 2416 | 98.2 |
| India | Kolkata | 14.0 | 89.0 | 1441 | 62.9 |
| China, People's Rep. of | Ningbo | 1.7 | 85.6 | 779 | 85.6 |
| Indonesia | Ujung Pandang | 1.2 | 85.4 | 295 | 68.7 |
| Vietnam | Ho Chi Minh | 4.4 | 79.3 | 890 | 72.6 |
| Indonesia | Surabaya | 3.8 | 76.3 | 777 | 55.4 |
| Bangladesh | Chittagong | 2.4 | 72.5 | 517 | 61.7 |
| Japan | Niigata | 1.0 | 68.5 | 1244 | 49.9 |
| Myanmar | Yangon City | 2.8 | 66.9 | 587 | 69.9 |
| China, People's Rep. of | Wuhu | 0.8 | 66.3 | 210 | 72.4 |
| India | Palwancha | 0.8 | 66.2 | 937 | 67.6 |
| China, People's Rep. of | Taizhou | 1.2 | 65.3 | 423 | 66.4 |
| China, People's Rep. of | Shantou | 3.6 | 63.8 | 1084 | 63.6 |
| India | Surat | 2.2 | 61.0 | 300 | 19.2 |
| Indonesia | Pekalongan | 0.9 | 59.2 | 335 | 50.3 |
| India | Kochi | 0.9 | 57.3 | 260 | 44.6 |
| China, People's Rep. of | Hangzhou | 3.1 | 55.4 | 931 | 62.2 |
| Bangladesh | Dhaka | 5.0 | 55.0 | 874 | 61.5 |
| China, People's Rep. of | Wenzhou | 2.0 | 53.8 | 755 | 53.7 |
| Malaysia | Georgetown | 0.6 | 50.8 | 456 | 43.0 |
| China, People's Rep. of | Putian | 0.6 | 49.2 | 176 | 39.1 |
| China, People's Rep. of | Huaiyin | 0.5 | 48.7 | 203 | 46.9 |
| Indonesia | Tegal | 0.5 | 47.2 | 175 | 41.4 |
| India | Mumbai | 8.1 | 46.3 | 848 | 40.1 |
| China, People's Rep. of | Dandong | 0.5 | 42.9 | 219 | 51.9 |
| China, People's Rep. of | Yingkou | 0.7 | 42.7 | 431 | 42.7 |
| China, People's Rep. of | Haikou | 0.6 | 41.4 | 246 | 41.1 |
| Vietnam | Hanoi | 1.1 | 40.6 | 429 | 64.5 |
| China, People's Rep. of | Shenzhen | 11.0 | 38.2 | 4319 | 49.2 |
| Indonesia | Semarang | 0.8 | 37.9 | 344 | 42.2 |

Turning to inland flooding at the city level (Table 15.6), again the vulnerability level is lower than that for coastal flooding. The top three cities are Phnom Penh (99%), Wuhan (82%), and Palembang (80%). Of the top 40 most vulnerable cities, 19 are in the PRC. Some of the large cities that are vulnerable to inland flooding include Dhaka (60%), Ho Chi Minh City (50%), and Bangkok (46%).

**Table 15.6** Top 40 Asian cities (>1 million population) in vulnerability to inland flooding. (Source: Balk et al. 2012)

| Country | City | Population at flood risk (million) | % of city population at risk | City area at flood risk ($km^2$) | % of area at risk |
|---|---|---|---|---|---|
| Cambodia | Phnom Penh | 1.0 | 98.5 | 204 | 98.8 |
| China, People's Rep. of | Wuhan | 5.3 | 81.8 | 956 | 81.8 |
| Indonesia | Palembang | 1.1 | 80.2 | 257 | 48.6 |
| India | Patna | 1.1 | 72.4 | 436 | 72.3 |
| Bangladesh | Dhaka | 5.4 | 59.7 | 680 | 47.9 |
| China, People's Rep. of | Nanjing | 2.2 | 56.0 | 749 | 55.6 |
| Vietnam | Ho Chi Minh | 2.8 | 50.4 | 306 | 25.0 |
| China, People's Rep. of | Tianjin | 2.8 | 50.1 | 795 | 38.2 |
| China, People's Rep. of | Huangshi | 0.6 | 49.6 | 170 | 45.5 |
| China, People's Rep. of | Huainan | 0.6 | 49.5 | 277 | 49.4 |
| China, People's Rep. of | Wuhu | 0.6 | 46.8 | 140 | 48.4 |
| Thailand | Bangkok | 4.4 | 46.2 | 2165 | 36.1 |
| China, People's Rep. of | Bangbu | 0.5 | 44.0 | 198 | 44.5 |
| India | Guwahati | 0.5 | 43.8 | 159 | 34.6 |
| India | Allahabad | 0.7 | 42.2 | 230 | 43.2 |
| Myanmar | Mandalay | 0.5 | 40.2 | 167 | 41.4 |
| China, People's Rep. of | Panjin | 0.4 | 38.3 | 208 | 30.1 |
| China, People's Rep. of | Changsha | 1.2 | 37.2 | 187 | 28.0 |
| Bangladesh | Khulna | 0.4 | 37.0 | 131 | 33.1 |
| India | Vijayawada | 0.5 | 36.0 | 141 | 21.4 |
| Vietnam | Hanoi | 0.9 | 33.2 | 252 | 38.0 |
| India | Varanasi | 0.6 | 32.6 | 211 | 33.6 |
| Indonesia | Surakarta | 0.4 | 32.6 | 96 | 24.1 |
| China, People's Rep. of | Nanning | 0.4 | 30.4 | 173 | 30.4 |
| China, People's Rep. of | Hengyang | 0.3 | 28.6 | 94 | 28.1 |
| India | Kolhapur | 0.7 | 28.6 | 1035 | 29.2 |
| China, People's Rep. of | Xinxiang | 0.5 | 27.7 | 146 | 23.4 |
| China, People's Rep. of | Nanchang | 0.7 | 27.1 | 196 | 24.6 |
| China, People's Rep. of | Shanghai | 3.7 | 24.5 | 292 | 11.9 |
| Korea, Rep. of | Pusan | 1.2 | 24.5 | 196 | 12.6 |
| India | Bhubaneswar | 0.3 | 23.4 | 141 | 22.2 |
| India | Palacole | 0.3 | 23.2 | 385 | 27.8 |
| China, People's Rep. of | Yichang | 0.3 | 22.8 | 137 | 20.2 |
| China, People's Rep. of | Qiqiha'er | 0.3 | 22.0 | 110 | 22.0 |
| India | Kanpur | 0.3 | 21.5 | 171 | 20.5 |
| China, People's Rep. of | Harbin | 0.7 | 21.1 | 270 | 22.0 |
| China, People's Rep. of | Luoyang | 0.3 | 20.6 | 93 | 20.4 |
| Philippines | Quezon City | 2.9 | 20.4 | 198 | 9.1 |
| China, People's Rep. of | Jinan | 0.6 | 20.3 | 156 | 20.2 |
| Bangladesh | Chittagong | 0.7 | 20.2 | 104 | 12.4 |

Our research results show that coastal flooding is more concentrated than inland flooding. Both are serious in South Asia, Southeast Asia, and the PRC. Several megacities face high vulnerability to coastal flooding and moderate vulnerability to inland flooding at the same time, such as Kolkata (89% coastal and 15% inland) and Shanghai (91% coastal and 25% inland). A number of large cities feature more

than 50% of vulnerability to both types of flooding: Dhaka, Bangladesh; Ho Chi Minh City, Vietnam; Palembang, Indonesia; and Tianjin, the PRC.

Asia has more than 750 urban settlements (of at least 5,000 people, most much larger), the population of which is fully in low-lying zones with 100% vulnerability to coastal flooding, and about half as many with 100% vulnerability to inland flooding. These smaller cities and towns are especially noteworthy because their populations are growing fast. Further, some of them are close to vulnerable large cities. Agglomeration economies have many benefits for growth, but any flood risks they share need to be accounted for in planning.

The size of population affected by flooding risks in Asia is enormous. A study commissioned by ADB (Balk et al. 2012) estimates that over 303 million Asian urbanites were at risk of coastal flooding in 2010 and this is projected to increase to 410 million in 2025. In terms of inland flooding, about 245 million urban Asians were found to be at risk in 2010, and by 2025 this number will reach 341 million. While it is not possible to predict the damage such floods will do to property or to predict the loss of life, poor cities will face greater challenges than rich ones in adapting to this new reality.

## *Loss of Natural Ecosystems and Amenities*

The loss of biodiversity in the Asian region has been well documented as urbanization proceeds (Millennium Ecosystem Assessment 2005). Asian cities are much more densely populated than most other cities and hence do not take up proportionately as much rural land and natural ecosystems. However, their densities provide less opportunity for green spaces within the cities. Thus, many Asian cities are struggling to provide sufficient natural amenities—access to "green spaces" for environmental and human health, rivers, parks and wildlife corridors; green space for recreation-related activities; and green elements in the urban landscape. The resolution of this issue is being addressed with new design approaches and technologies to enable both greater biodiversity and natural amenities. One of these approaches is "biophilic urbanism" (Newman et al. 2008). A biophilic city brings landscaping into and onto every element of the built environment, such as buildings, walls, and roads (Beatley 2010).

## *Urban Slums and Urban Poverty*

Asia has the largest share of the world's slum-dwelling population. In 2010, the region was home to 506 million slum dwellers, more than 61% of the world's total. Some subregions within Asia are far worse affected than others. East and Southeast Asia harbor 55% of the slum dwellers in the region, and South Asia alone hosts almost 38% of the region's slum dwellers (UN-HABITAT 2008).

In many low- and middle-income nations, urban poverty is growing compared to rural poverty. Urban residents are more dependent on cash incomes to meet their essential needs than rural residents are, and income poverty is compounded by inadequate and expensive accommodation, limited access to basic infrastructure and services, exposure to environmental hazards, and high rates of crime and violence.

## *Asia's Environmental Challenges: The Environmental Kuznets Curve*

Clearly, Asia is already facing tremendous urbanization-related challenges. As far as the environment is concerned, air pollution is serious and GHG emissions have been increasing. Natural amenities either are lost or must be compensated for as cities grow. Pressures are mounting to provide water, sanitation, and waste disposal to very fast-growing urban populations, and cities are becoming more vulnerable.

Worse still, most of the special features of Asia's urbanization highlighted earlier exacerbate the environmental challenges. First, a low level of urbanization implies that Asia still has some way to go in dealing with these challenges. Ignoring or deferring action on issues such as environmental degradation is not an option because it risks consequences in the near term and vastly greater expenses in the medium to long run. Second, the fast pace of urbanization means little time for adjustment or learning. Many countries have been insufficiently prepared for the changes urbanization requires in urban planning, development of appropriate skills, and urban financing. Third, bigger cities are certainly harder to manage and more of them can only add to the challenges as Asia's megacities expand in population and grow in numbers. Finally, a high density makes cities more vulnerable to catastrophic events and disease. Especially in poor cities such as Delhi, Dhaka, Wuhan, and those in the Pacific island countries, such events can mean serious loss of lives and assets (ADB 2012c).

To gauge the environmental outlook as Asia continues its growth, the Environmental Kuznets Curve or EKC is a useful tool. While there are alternative views regarding the theoretical foundation and empirical robustness of the EKC, many studies have found an inverted U-shape relationship between environmental indicators and gross domestic product (GDP) level. Grossman and Krueger (1995) and De Bruyn (1997) state that the inverted U-shape is driven by a combination of forces: the level of output or scale of economic activity (scale effect), the composition of output (structural effect), and the state of technology (technical effect). Holding everything else constant, increasing output leads to more environmental damage, shifting resources and production to less-polluting or less-emitting industries such as services helps improve environment, and finally technology advance is beneficial to environment. As different countries experience or prioritize different forces at different development stages, the EKC naturally differs between countries and periods. Underlying the priority setting are personal and institutional preferences for environmental quality versus material outputs.

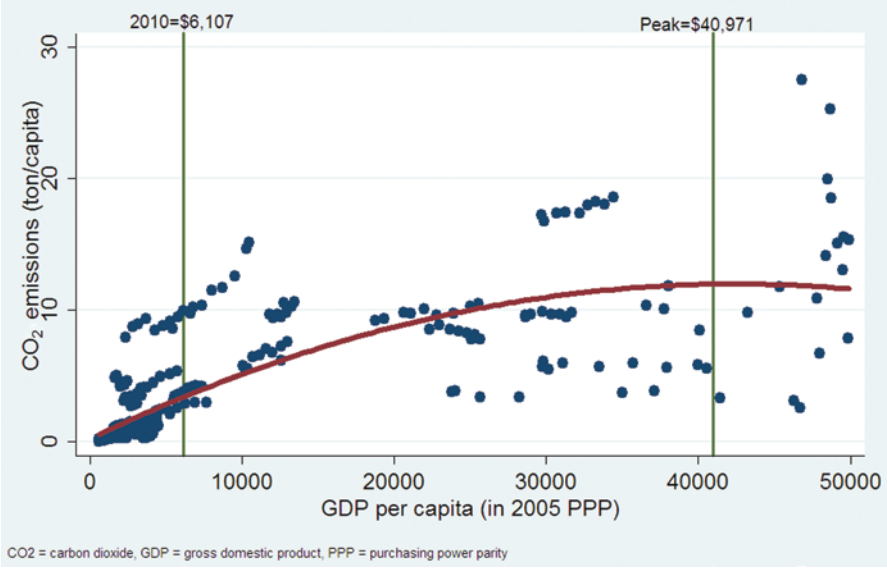


**Fig. 15.17** Scatterplot of $CO_2$ emissions (t/capita) and GDP per capita (in 2005 PPP). *PPP* purchasing power parity. (Source: Authors' estimates based on World Bank 2012)

Not only does the EKC differ across countries and time, but it also differs with various environmental indicators. Typically, local pollutants are more likely to display an inverted U-shape relation with income, while global impacts such as $CO_2$ are less likely to do so. This is understandable as both ordinary citizens and policy makers are likely to consider local impacts as more important than global ones. Consequently, the peaks of the inverted U-curves are found to correspond with significantly different income levels. For example, the sulfur emissions peak corresponds with income levels ranging from $ 3,137 to $ 101,166 at 1990 prices (Stern 2003), whereas $CO_2$ peaks correspond with $ 19,100 (Selden and Song 1995) or $ 25,100 (Cole et al. 1997).

Where does Asia stand on the EKC? If the findings cited above are used to make inferences, Asia is still on the rising side of the curve, as the average income in Asia is roughly $ 3,900 at 1990 prices. At the current stage of Asia's development, millions of people move to cities and firms locate there to employ them. The sheer scale of activities associated with urbanization and industrialization (such as transport, building construction, garbage and waste disposal, and power generation) could contribute to environmental degradation. Thus, in the absence of appropriate interventions, Asia's environment is likely to become worse before it gets better.

To properly assess the environmental outlook for Asia, it is necessary to estimate Asia's EKC. Using data from the World Development Indicators, Fig. 15.17 presents a scatterplot of per capita GDP against per capita $CO_2$ emissions. The trend line clearly resembles a standard EKC. To formally estimate an EKC for Asia, 374

**Table 15.7** The environmental Kuznets curve for Asia. (Source: Authors' estimates)

| Independent variable | Coefficient | Standard error |
|---|---|---|
| Ln(GDP per capita) | 5.48*** | 0.502 |
| Ln(GDP per capita)$^2$ | −0.251*** | 0.029 |
| Constant | −27.54*** | 2.169 |
| Observations | 374 | |
| $R^2$ | 0.753 | |

*** significant at 1%

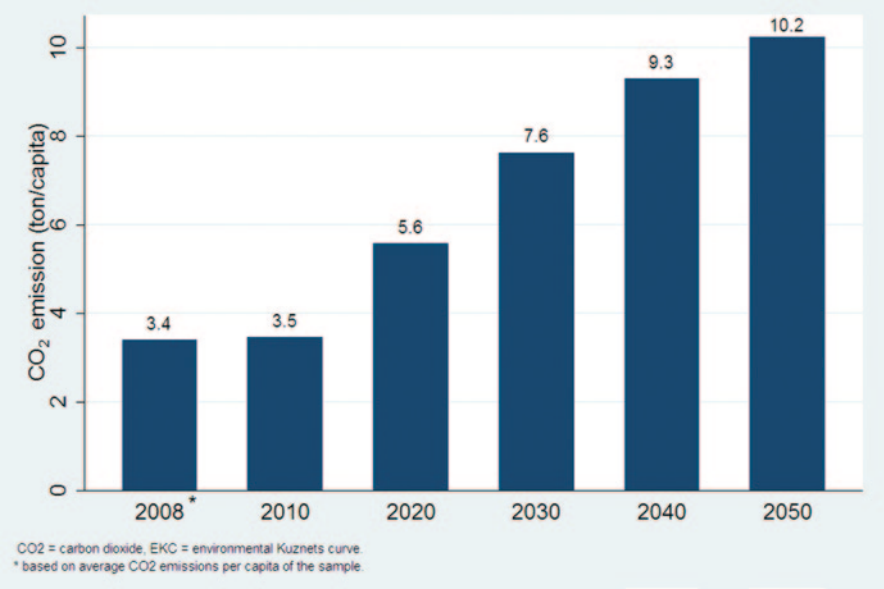


**Fig. 15.18** Projected per capita $CO_2$ emissions based on estimated EKC. (Source: Authors' estimates)

observations from 42 ADB member countries were used to produce the modeling results in Table 15.7. Based on this model, the peak of the inverted U-curve corresponds to a GDP level of $ 40,971 (at 2005 price levels). Clearly, the GDP per capita of most developing Asian countries is far from the "$CO_2$ turning point."

Using the estimated EKC, the future level of per capita $CO_2$ can be simulated using GDP projections of Kohli et al. (2011). Figure 15.18 presents the "business-as-usual" scenarios: per capita $CO_2$ would rise from the 2008 level of 3.4 tons to 7.6 tons in 2030 and further to 10.2 tons in 2050. These scenarios imply a disastrous future for Asia and the globe. Clearly, action is needed and interventions must be found and implemented.

## The Environment–Urbanization Nexus in Asia

The conventional EKC is a relationship between GDP and an environmental indicator. Owing to the positive correlation between urbanization and GDP (Fig. 15.19), the EKC could be used to infer that urbanization in Asia may lead to environmental degradation. However, this inference is problematic as the urbanization–GDP curve is far from being a good fit. In reality, a country can achieve the same level of per capita GDP with different levels of urbanization. On the other hand, countries with the same level of urbanization can have quite different GDPs per capita. For example, many countries in sub-Saharan Africa have been as urbanized as those in Asia for many years, yet they have been much poorer. For decades, the urbanization level in Latin America was as high as that in Europe, but Europe always enjoyed higher income. As shown in Fig. 15.19, there are vast deviations of data from the fitted lines.

Therefore, it is inappropriate to rely on the EKC to infer an urbanization–environment relationship and conclude that the environment will further degrade as Asia urbanizes. Indeed, urbanization can produce beneficial environmental outcomes as it facilitates improved productivity, development of the service sector, and access to environment-related infrastructure; promotes green innovation and technology; prompts traditional manufacturing to relocate away from city centers; nurtures middle class and property owners who are more pro-environment than the general populace; and leads to lower fertility rates and higher educational levels.

### *Urban Agglomeration Helps Improve the Environment*

Urban agglomeration in itself is benign for the environment. First, it comes with higher productivity due to the positive externalities and scale economies. For Asia as a whole, urban productivity is more than 5.5 times that in the rural areas (UN-HABITAT 2010). Thus, the same level of output can be produced using fewer resources with urban agglomeration than without. In this sense, urbanization helps reduce the ecological footprint.

Second, development of the service sector is closely associated with urban agglomeration. The tertiary sector could not prosper without urbanization because most services require a certain degree of concentration of clients. As service production generally pollutes and emits less than manufacturing activities, urbanization enhances the beneficial structural effect underlying the EKC, as discussed in the previous section.

Third, environment-related infrastructure and services such as piped water, basic sanitation, and solid waste disposal are much easier and more economical to construct, maintain, and operate in an urban than a rural setting. In other words, urbanization facilitates the supply of the relevant facilities and services to a larger share of the population. On the other hand, urbanization promotes growth that helps enhance affordability and demand. It is thus not surprising that many more urban

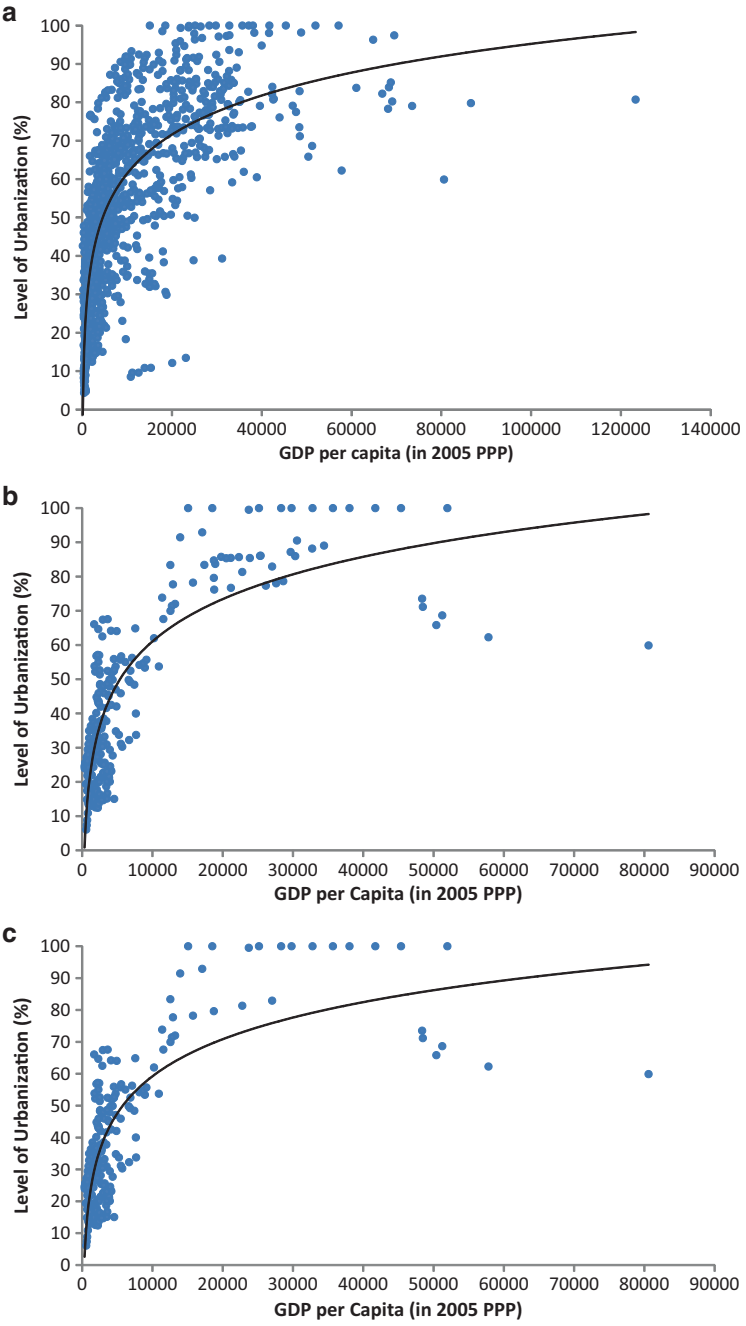


**Fig. 15.19** GDP per capita and level of urbanization, 1980–2010. **a** All countries, **b** Asia and the Pacific, **c** For developing member countries. (Data source: World Bank 2012)

residents have access to infrastructure and other services than rural residents (Wan and Zhang 2011, ESCAP, ADB, and UNDP 2012). For example, city residents in India have much greater access to flush toilets—60 % in 1992 (relative to a national average of 22 %) and this increased to 79 % by 2006 (Bonu and Kim 2009).

Fourth, urbanization facilitates innovations, and this applies to green technologies as well. In the long run, the environment-friendly equipment, machines, vehicles, and utilities determine the future of the green economy, and Asia's cities are likely to play a key role in producing and exporting low-cost, high-quality, renewable power generation equipment and electric vehicles. When new forms of industry open, firms usually cluster in cities featuring high levels of human capital. When the technology is mature, they decentralize and relocate to low-wage regions for mass production (Duranton and Puga 2001). As a consequence, Asian urban growth and openness to global markets facilitates the rise of the global green economy.

Green innovations accompanying urbanization in Asia will be helped by the vast size of Asia's own market. In the presence of fixed costs, the scale of the market is a key determinant for developing new products. The billions of people who seek to purchase energy-efficient products will create a huge opportunity for entrepreneurs who can serve them. Acemoglu and Linn (2004) demonstrated this in the case of new drug development, and their logic holds for green products. If billions of people seek energy-efficient air conditioners to offset hot summers, there will be significant incentives to invest in developing such products. Some of the producers will succeed and, in a globalized world market, the payoff will be huge.

Many Asian economies already export green technology. Sawnhey and Kahn (2012) note that developing countries' exports of renewable energy products have grown significantly. For example, the PRC's share in the US imports of core wind and solar energy equipment, including solar panels, cells, and blades, has increased steadily. In particular, the PRC's share of US imports of solar modules grew from 0 to 43 % during 1989–2010, and India's share of US imports of wind turbines grew from 0 to 10 % during 1996–2010.

Fifth, for any given population, high density associated with urban agglomeration can benefit the environment. The urban economics literature shows that compactness is one of the most important determinants of energy use (Glaeser and Kahn 2004). In this volume, the chapter by Arifwidodo provides evidence of this from Indonesia. High density can create greater viability for public transport and entail less or shorter travel. It also facilitates walking and cycling rather than driving or taking public transport (Newman and Kenworthy 1999).

Finally, the enhanced economic freedom arising from urbanization allows people to improve their standard of living in many ways, including through better food, shelter, and health care. Urbanization benefits education and can help increase a population's health and robustness in the face of disease. Urban growth also generates revenues that fund infrastructure projects, reducing congestion and improving public health.

## *Manufacturing Relocation and Rise of the Middle Class and Property Owners*

Urbanization can help alleviate environmental problems by prompting relocation of traditional manufacturing away from major city centers. This is partly attributable to rising land prices in city centers as urbanization proceeds. In fact, Sridhar and Reddy (2010) provide evidence from the potential of land as a tool for financing urban infrastructure. The development of infrastructure such as ports and highways also facilitates such movements (Henderson 2002). Manufacturing firms recognize that by choosing a less centralized location they can pay lower wages and land prices while still enjoying access to consumer markets and intermediate input suppliers. As Asia's nations invest in better transport infrastructure, manufacturing can move further from the major cities and these jobs will be replaced by knowledge economy and service jobs with lower ecological footprints. For example, in 1970, Seoul's shares of population and manufacturing in the Republic of Korea were 62% and 61%, respectively. However, by 1993, while Seoul's population remained at 61% of the country's total, its manufacturing share had fallen to 30%. Between 1983 and 1993, Seoul's share of national manufacturing jobs fell from 21 to 14% and Pusan and Taegu's shares fell from 23 to 14% (Henderson 2002). These examples echo the trend of decentralization of manufacturing employment that has taken place elsewhere (Glaeser and Kahn 2004).

The migration of heavy industry away from major cities has generated large public health benefits through improved air and water quality in many cities around the world (Kahn 1999, 2003). In a case study of the 2008 Summer Olympics in Beijing, Chen et al. (2011) found significant improvements in ambient air quality as the authorities changed transport patterns and shut down factories. Kahn (2003) documents the sharp reduction of pollution in the Czech Republic and Poland as they closed energy-inefficient manufacturing plants that were built under communism.

The economic damage caused by exposure to pollution is a function of the number of people exposed and is reflected by their willingness to pay to avoid pollution. When a factory moves from a major city to a less populated area, the aggregate damage caused is likely to decline because fewer people are exposed to the pollution. As an older factory closes at the origin and a new factory with better technology is built at the new destination, emissions per unit of output are also likely to fall.

Urbanization also helps nurture the middle class and raises private ownership of properties in cities. The expanding middle class will demand a better environment, and property owners are a powerful interest group with a stake in enacting policies to curb environmental degradation. They directly gain from improvements in the local quality of life, not least because the improvements will lead to higher local real estate prices. Put simply, land is more valuable in nicer areas with natural and human amenities, which is well documented in many real estate studies (see Gyourko et al. 1999 for a review; and Zheng and Kahn 2008 on the PRC). Zheng and Kahn (2008) document that real estate prices are higher in low-pollution parts of Beijing that feature green space and are close to public transit stations.

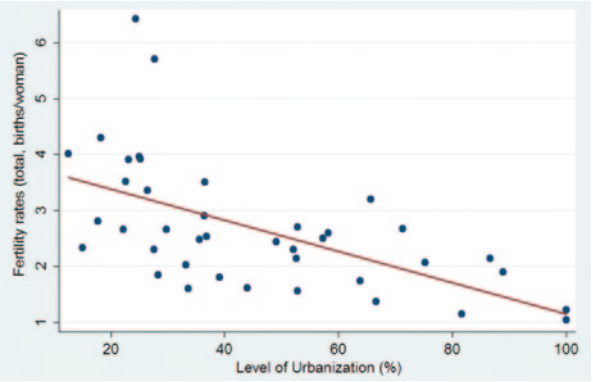


**Fig. 15.20** Fertility rates versus level of urbanization in Asia. (Source: World Bank 2012)

## *Declining Fertility and Increasing Educational Attainment*

Urbanization is also beneficial to the environment due to its close association with declining fertility.[6] The economics of demography offers a simple explanation (Becker 1991). Women who live in cities have more opportunities for education and to work in the labor force than rural women. Consequently, urban women respond by working more, marrying later, and having fewer children. As young women anticipate that they will have the opportunity to work in cities, they invest more in their education as teenagers and this further encourages them to work in the marketplace. The net effect is to slow population growth, which means less adverse environmental consequences than would otherwise be the case.

Anecdotal evidence from Asia supports the above arguments. In nations such as Vietnam, the fertility rate has declined dramatically, from the 1980 level of 5.4 to 1.8 in 2010 (World Bank 2012). In rich cities in the PRC such as Shanghai, the birth rate has fallen below the population replacement rate. Around the world, the same correlation is observed. Figure 15.20 highlights this negative correlation for Asian nations.

Using 1980–2010 data from 31 Asian countries (194 observations), total raw fertility can be regressed on levels of urbanization, GDP per capita, and education. Literally interpreted, the modeling results indicate that every 1 percentage point increase in the urbanization level led to 5 fewer births per 100 women who are of reproductive age.[7] To directly assess the impact of urbanization on population growth, an econometric model is fitted to cross-country data from Asia. The empirical results tabulated in Table 15.8 imply that every 1 percentage point increase in the urbanization level led to a 0.02 percentage point reduction in the net population growth rate. This translates into a total reduction of 169.28 million in the population increase that might have happened without urbanization during 2010–2050, more

[6] The fertility rate is the ratio of live births per woman of reproductive age in a given year.

[7] This result is not shown in any table but is available upon request.

**Table 15.8** Population growth and urbanization. (Source: Authors' estimation)

| Independent variable | Coefficient | Standard error |
|---|---|---|
| Urbanization | −0.019*** | 0.005 |
| GDP per capita | 0.000*** | 0.000 |
| Education[a] | −0.049*** | 0.015 |
| Constant | 2.534*** | 0.250 |
| Observations | 194 | |
| $R^2$ | 0.1623 | |

*** significant at 1 %

[a] Education refers to percentage of complete tertiary schooling attained in female population

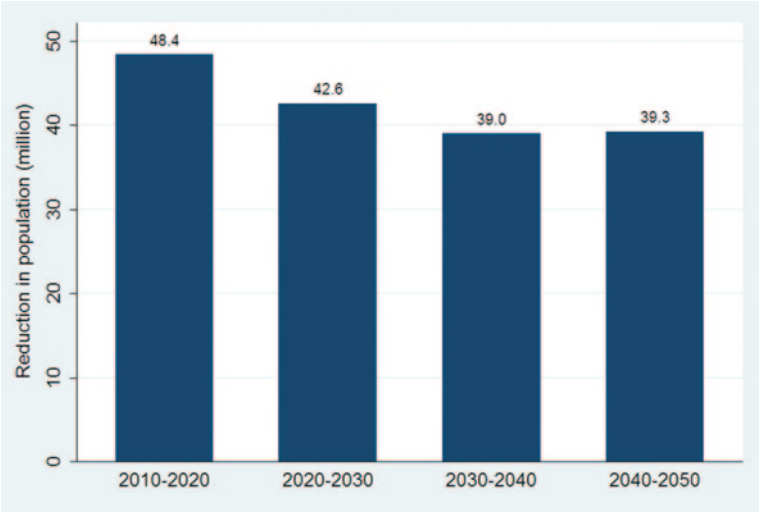


**Fig. 15.21** Reduction in projected population due to urbanization. (Source: Authors' estimates)

or less evenly distributed over different decades (Fig. 15.21). Under the "business-as-usual" scenario of Fig. 15.18, this amounts to an additional 1,727 million tons of $CO_2$ in 2050, 65 million tons more than the combined emissions of India and Vietnam in 2009 (Howes and Wyrwoll 2012).

As discussed earlier, one major function of cities is to gather intellectual capital so people can become more educated by learning from and interacting with each other. Intensified competition in cities also motivates urbanites to accumulate human capital. In addition, cities offer better and more opportunities for learning. The positive association between urbanization and education is evident in Fig. 15.22.

Improved educational attainment, in turn, can affect the environment at least in two ways. First, similar to urbanization, education helps lower fertility, as reflected by the negative and significant coefficient of the education variable in Table 15.8. Second, the more educated often opt for a better living environment by voting for environmental regulation (Kahn 2002). They are also more willing to sacrifice con-

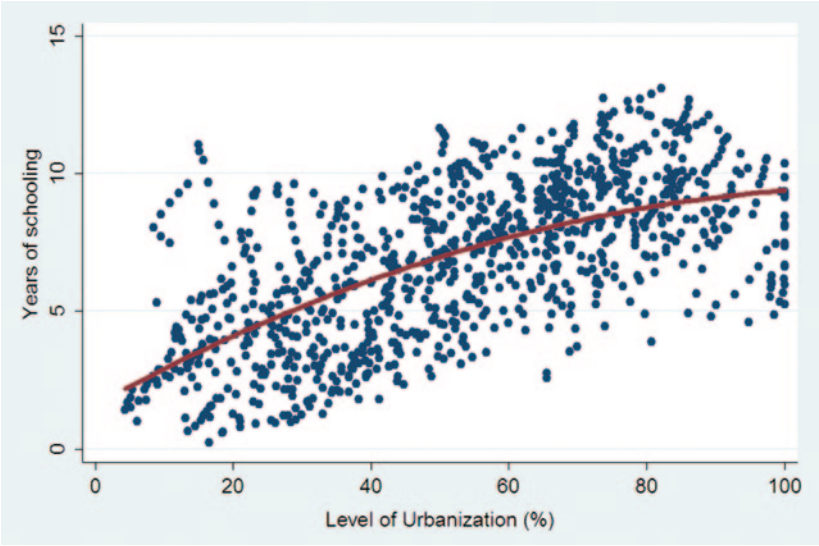


**Fig. 15.22** Education versus urbanization in Asia, 1980–2010. (Sources: UN 2012 and Barro-Lee 2010)

sumption today for returns in the long run (Moretti 2004a, Becker and Mulligan 1997). In addition, politicians are likely to respond by supplying policies that urban voters desire.

Are the educated in Asia also pro-environment? The World Values Survey offers the opportunity to address this question. The survey data allow one to observe the personal priorities of people who are of the same age but live in different nations. For Asia, the data cover the PRC; India; Indonesia; the Republic of Korea; Malaysia; Taipei,China; Thailand; and Vietnam. In 2007, the survey focused on four attitudinal questions regarding whether respondents (1) prioritize environmental protection over economic growth, (2) are willing to sacrifice income to protect the environment, (3) would pay higher taxes to protect the environment, and (4) support greater regulation to protect the environment.

Table 15.9 reports the results. The top rows focus on Asian respondents and stratify the data by educational attainment. A positive correlation between educational attainment and prioritizing green issues is clearly shown. For example, 47% of respondents in Asia who have at least a university education prioritize the environment over economic growth, while only 32% with no formal education have this prioritization. As another example, while less than 50% of those without a formal education are willing to sacrifice personal income for environment, this percentage is as high as 81% for university graduates.

The bottom two rows of Table 15.9 compare the attitudes of all respondents versus those who live in Asia. The data show that respondents from Asia are more willing to sacrifice personal income to protect the environment (72%) than the world average (62%). They are 7 percentage points more likely to support higher taxes for

**Table 15.9** Percentage of respondents' willingness to support environmental protection (Source: Authors' estimates based on World Values Survey data)

| Population subgroups | Sacrifice growth (%) | Sacrifice income (%) | Pay higher taxes (%) | Support regulation (%) |
|---|---|---|---|---|
| *By educational attainment* | | | | |
| No formal education | 32.3 | 49.5 | 43.2 | 42.1 |
| Less than secondary education | 42.4 | 68.7 | 58.3 | 60.4 |
| Secondary education | 45.2 | 75.3 | 62.8 | 60.8 |
| At least some university education | 46.8 | 80.8 | 67.7 | 61.0 |
| World | 49.3 | 61.8 | 53.3 | 67.2 |
| Asia | 43.4 | 71.8 | 60.4 | 58.5 |

environmental protection, although relatively more Asians prioritize growth over environment. In other words, they do not want to see growth slow in the region but are willing to sacrifice personal income for better environment ex-post. These findings suggest a culture in Asia that is forging greener urbanism.

## *Quantifying the Environment–Urbanization Nexus*

The channels and mechanisms through which urbanization affects the environment, as discussed in this chapter, imply that the relationship between urbanization and the environment may differ from the conventional EKC. While it is difficult to pin down the impacts of each channel, econometric models may be used to estimate a relationship. In doing so, it is crucial to control for GDP in the model so that the effects of urbanization on environmental indicators can be properly identified and quantified. Thus, the model to be estimated takes the following form:

$$\text{Ln } CO_2 \text{ or Ln PM10} = \alpha_0 + \alpha_1 \text{Ln GDP} + \alpha_2 (\text{Ln GDP})^2 + \beta_1 \text{Urb} + \beta_2 \text{Urb}^2 + \beta_3 (\text{Ln GDP})^* \text{Urb} + u,$$

where *Ln* = natural logarithm; $CO_2$ = average emission of carbon dioxide (tons per capita); *PM10* is measured in micrograms per cubic meter; *GDP* = GDP per capita in 2005 PPP; *Urb* = level of urbanization; *u* is the usual disturbance term; and α's and β's are parameters to be estimated.

The model is fitted separately to 1990–1999 and 2000–2008 data for Asian economies from the World Development Indicators (World Bank 2012). The interactive term was found to be highly insignificant in all models except one. Table 15.10 summarizes the estimation results. Despite the parsimonious specification, the models fit the data well and are of good quality in terms of the usual statistical and economic criteria.

Based on the modeling results, the environment–urbanization curves are plotted in Fig. 15.23. The plots show an inverted U-pattern, similar to the conventional EKC in shape. Thus, environmental degradation occurs in the early stage of urbanization when productivity gains and agglomeration effects are low, which can be

**Table 15.10** The environment–urbanization model. (Source: Authors' estimation)

| Models for | 1990s | | 2000s | |
|---|---|---|---|---|
| Independent variables | Coefficient | Standard error | Coefficient | Standard error |
| | Ln ($CO_2$) | | | |
| Ln(GDP per capita) | 1.781*** | 0.415 | 6.922*** | 1.088 |
| Ln(GDP per capita)$^2$ | −0.064** | 0.025 | −0.414*** | 0.083 |
| Urbanization | 0.102*** | 0.006 | −0.082* | 0.049 |
| Urbanization$^2$ | −0.001*** | 0.000 | −0.001*** | 0.000 |
| Ln(GDP per capita)* urbanization | | | 0.026*** | 0.008 |
| Constant | −12.381*** | 1.700 | −31.214*** | 3.610 |
| Observations | 370 | | 374 | |
| $R^2$ | 0.829 | | 0.821 | |
| | Ln (PM10) | | | |
| Ln(GDP per capita) | −1.161*** | 0.345 | −1.870*** | 0.482 |
| Ln(GDP per capita)$^2$ | 0.046** | 0.021 | 0.101*** | 0.028 |
| Urbanization | 0.027*** | 0.006 | 0.033*** | 0.007 |
| Urbanization$^2$ | −0.0002*** | 0.000 | −0.0004*** | 0.000 |
| Constant | 9.746*** | 1.408 | 11.670*** | 1.979 |
| Observations | 310 | | 304 | |
| $R^2$ | 0.359 | | 0.241 | |

* significant at 10%; ** significant at 5%; *** significant at 1%

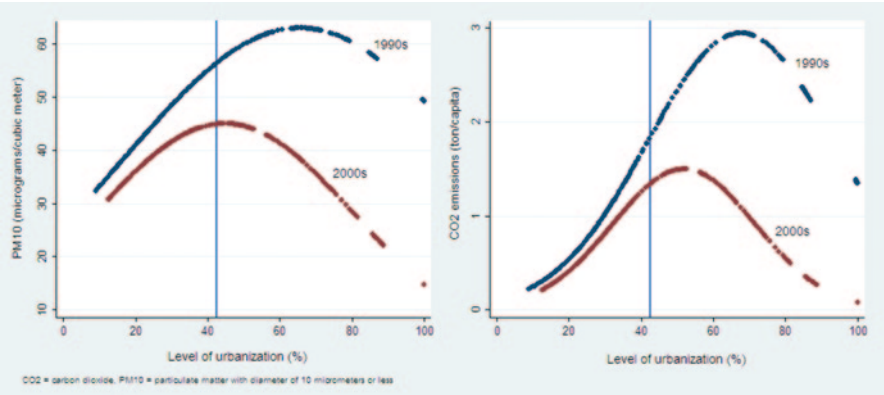


**Fig. 15.23** Environment-urbanization relationship in Asia. (Source: Authors' estimates)

overweighed by its negative effects. After reaching a certain level when agglomeration and productivity improvement become significant, urbanization leads to reductions in pollution and emissions.

An important and interesting finding emerges when the urbanization–environment curves for the 1990s and 2000s are compared. Figure 15.23 shows that over time the curves for $CO_2$ emissions per capita and PM10 (μg/m$^3$) shifted down and to the left. Shifting down means much lower emissions and pollution at the same level of urbanization. Shifting left means the peak of the inverted U-curve comes sooner

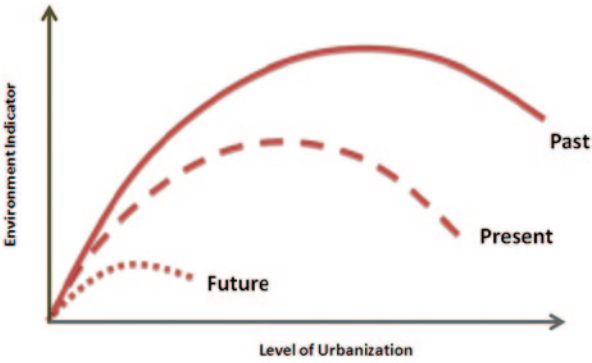


**Fig. 15.24** Illustrative environment–urbanization curve. (Source: Authors' illustration)

under the technologies and policy environment of the 2000s. For example, the peak of the 1990s curve for $CO_2$ emissions occurs at a 68% urbanization level, while that of the 2000s curve occurs at 52%. For PM10, the peak under the 2000s curve corresponds to a 45% level of urbanization rather than 66% under the 1990s curve. These results are consistent with the literature, which indicates that local pollution usually starts to decline earlier than nonlocal pollution.

The shift of the environment–urbanization curve, like the conventional EKC, is primarily driven by technology advances, structural changes, and regulations. The gap between the two curves corresponding to the same urbanization rate measures the impact of the shifts on pollution or emissions. At the 2010 level of urbanization for Asia, the impacts amounted to 20% reductions for PM10 ($\mu g/m^3$) and 27% for $CO_2$ emissions per capita, forcefully demonstrating the large impacts of technology and government policies.

Thus, urbanization can significantly decrease the amount of environmental degradation. Holding everything constant, including technology and policy, by 2050, $CO_2$ emissions per capita will be halved and the PM10 ($\mu g/m^3$) level will be cut by 37% even if nothing else but urbanization changes. Because technology keeps improving and pressures from various sources are mounting, the environment–urbanization curve will almost certainly continue to shift down and left, as illustrated in Fig. 15.24. Therefore, the future of Asia's environment will most likely be bright as urbanization proceeds, with careful management.

## Summary

Asia is fast urbanizing and rapid urbanization poses significant quality-of-life challenges such as rising inequality and crimes. In particular, it adds tremendous pressure on the local and global environment. Today, Asia has some of the world's most polluted cities and most steeply rising GHG emissions. In addition, most of the unique features of Asia's urbanization tend to aggravate environmental problems.

Despite these challenges, there are reasons to be optimistic, as urbanization can help address environmental degradation. It leads to declining fertility rates, increasing levels of education, growing support for "greening," relocating industry away from city centers, and advancing technology. Also, by nurturing the urban middle class and property owners, urbanization can help ameliorate adverse environmental impacts as educated, informed urban middle-class members and property owners are usually pro-environment and they tend to support "low-carbon" products—products that enable a reduction in carbon emissions. The combined effects of these forces can lead to better environmental outcomes as Asia urbanizes, as reflected by the shift of the environment–urbanization curve.

As such, it would be counterproductive for governments to contain urban expansion even for environmental concerns. However, Asia has not reached the peak of its EKC, which indicates a grim outlook in the absence of well-designed interventions. Thus, the development and implementation of policies promoting green cities is urgently needed. In the long run, interventions to facilitate the use of renewable and adoption of new technologies are indispensable. In the short or medium term, policies such as congestion pricing and increasing block water/electricity tariffs can be implemented to help reduce resource consumption. For developing economies to avoid "brown" development now that must be cleaned up later at a vast cost, timely introduction and enforcement of environmental regulations are essential. Finally, urban planning must consider the irreversible nature of urban investment by embracing new urban forms such as compactness, transit-oriented development, and green cities.

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