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ORIGINAL PAPER

Financial management and service delivery: a nonparametric analysis for Indian cities

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Abstract The main objective of the paper is to assess the performance of urban local governments in India taking the physical levels of services provided by them as the 'outputs' and the expenditures on resources to provide these services as 'inputs' in an integrated framework and pinpoint some possible sources of mis-utilization of resources. We use nonparametric two-stage data envelopment analysis technique to derive the efficiency scores, with a subsequent analysis of slacks associated with the optimization exercise which quantifies the extent of mis-utilization of resources. The main findings suggest that the city governments can provide the same levels of services by using resources lesser by 27 % of what they currently use. We also find that the extent of unproductive spending and under-provision of services are more pronounced in smaller cities. Mis-utilization of resources in factors like establishment and laborcost is more pronounced as the establishment expenditures and contractual payments in the laborcost component involve more leakages.

JEL Classification C6 · H4 · H7 · R1 · R5 · R15

1 Introduction

The major economies in south Asia have witnessed rapid growth in urbanization. Investment in infrastructure has played an important role in this growth, but the increasing demands related to growth have also resulted in widening shortfalls in the quantity and quality of infrastructure. This acts as a binding constraint on accelerating growth

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further. These problems are particularly acute in an emerging economy like India (Rao and Bird 2010, 2011).

About 377 million Indians comprising about 31 % of the country's population live in urban areas, with an average annual addition of 8 million (Census of India 2011). The share of persons living in urban areas in India rose by 3.4 % in the decade 2001–2011 compared to 2.1 % in the decade 1991–2001. Recent projections show that by 2031, about 600 million Indians will reside in urban areas, an increase of over 200 million in just 20 years (GOI 2012).

Key indicators of the major urban services reveal that there is a failure to achieve even moderate success in service delivery. 70.6 % of the urban population has individual water connections with duration of water supply ranging between 1 and 6 h a day. Most Indian cities do not have water metering systems with non-revenue water accounting for 50 % of water production. 4861 out of 7935 towns are not covered by even partial sewerage network. Thirteen percentage of urban households do not have any form of latrine, less than 20 % of the road network is covered by storm water drainage, and scientific disposal of solid waste is not there in most of the cities (GOI 2012).

The Report of High Powered Expert Committee for Estimating the Investment Requirements for Urban Infrastructure Services estimates Rs. 3.92 million crores as the investment needs to provide urban services conforming to national benchmarks for urban infrastructure over a period 2012–2031. The operations and maintenance costs would amount to another Rs. 2 million crores (HPEC 2011).

Estimates by the Central Statistical Organisation, available for a few years, indicate that the share of the urban sector in GDP of India increased from 38 % in 1970–1971 to 52 % in 2004–2005. The mid-term appraisal of the Eleventh Five-Year Plan projected the urban share of GDP at 62–63 % in 2009–2010, which is at present around two-thirds of the GDP, and it is likely to become 75 % in 2021 (GOI 2008).

However, municipal revenues constitute a minimal share in India's GDP. According to Thirteenth Central Finance Commission of India, the ratio is recorded at 0.94 % in 2007–2008. The municipal tax to GDP ratio is a meager 0.5 % as compared to central tax to GDP ratio at 12 % and states' tax to GDP ratio at 5.6 % for 2007–2008, while Property tax to GDP ratio is only 0.25 %. The share of municipal revenues in combined state and central revenues has declined from 3.71 % in 1990–1991 to 2.43 % in 2000–2001 (Mohanty et al. 2007).

With a huge contribution of the urban sector in the GDP of India but minimal revenue collections by urban local governments and under-provision of services and infrastructure, research in this area mostly focuses on the estimation of revenue potentials for Indian cities, their expenditure needs, and fiscal gaps.

Studies have attempted to provide empirical estimations of underutilization of revenue potentials. Bandyopadhyay and Rao (2009) on the basis of five major agglomerations in India, viz. Kolkata, Delhi, Chennai, Pune and Hyderabad which constitute 15 % of India's urban population finds that all the agglomerations have unutilized potential for revenue generation. The potential for the central cities of the agglomerations are estimated to be 79 % more than the revenues actually generated, while that in the smaller cities is estimated to have 25 % more. Bandyopadhyay (2011) estimates the revenue potential for urban local bodies (ULBs) in the state of Jharkhand to be

77 % more than what is actually generated. Another study (NIPFP 2009) based on 36 municipal corporations, accounting for 35 % of the urban population in the India, shows that property tax revenues could increase to an extent of three times as high as the present collections by bringing all cities to an 85 % coverage level from an average coverage ratio of 56 and 85 % collection efficiency from an average collection efficiency of 37 %.

Studies have estimated the shortfalls of actual expenditures from expenditure requirements. A recent study on the ULBs in the state of Jharkhand (Bandyopadhyay and Bohra 2010) based on Ramanathan and Dasgupta (2009) norms estimates that the actual revenue expenditures can cover only 41 % of the revenue expenditures requirements. Actual capital expenditures can only cover 3 % of the capital expenditure requirements on urban services. According to Mohanty et al. (2007), on an average for the period 1999–2000 to 2003–2004, actual spending in 30 large municipal corporations in India is only about 24 % of the requirements prescribed by the Zakaria Committee (1963). While there was considerable variability in the sample, the extent of 'under spending' on urban services was over 75 % in 17 municipal corporations, and indeed over 50 % in all of them except for three: Pune (31.6 %), Nagpur (30.8 %), and Nasik (35.5 %).

Estimates of fiscal gaps for five major agglomerations in India are attempted in Bandyopadhyay and Rao (2009). The main findings suggest that, except for five small ULBs in Hyderabad, the others are not in a position to cover their expenditure needs by their present revenue collections. All the agglomerations have unutilized potential for revenue generation; however, with the exception of Hyderabad, they would fail to cover their expenditure needs even if they realize their revenue potential. Except Chennai, larger corporations are more constrained than smaller ULBs.

Various ways of augmenting the resources of the municipal bodies in the country, including reforms in the property tax system and adequate exploitation of user charges and fees for various services delivered as well as ways of strengthening and improving central and state transfers to urban local governments, are explored in Rao and Bird (2010, 2011). With respect to financing urban infrastructure, judicious use of development charges and effective collections from public lands are recommended in general. In addition, development of the municipal bond market is also advocated for financing capital expenditures.

Most of the above studies on Indian cities address the issue of service delivery requirements through resource requirements. While inadequacy of resources could be one important reason for under-provision of services, judicious use of available resources also has to be ensured. Until date, no Indian study provides an integrated framework analyzing services as outcomes and resources as the means to achieve these outcomes, as a rigorous model which can also address the issue of mis-utilization of available resources in service provision. The present study is an attempt to fill up this gap. Our model not only attempts to provide efficiency scores in terms of the relative performances of cities, but also tracks the sources of mis-utilization of resources. Estimates of the quantum of resources that could be saved providing the same levels of services are also generated. The novelty of our model lies in the fact that it fulfills the twin responsibility of generating estimates of efficiencies of Indian cities and those of the overspending of resources to achieve these efficiencies, which could actually undermine the efficiency scores, simultaneously.

In this study, we choose Karnataka which is one of the better performing states in India to attempt a detailed analysis on evaluation of cities' performance in service provision and financial management. The main reason for choosing Karnataka is that the state is one of the pioneers in undertaking the service level benchmarking[1] exercise mandated by the Ministry of Urban Development of India as a special drive on tackling poor service delivery conditions in Indian cities. The service level benchmarking framework designed by the ministry is an outline of performance evaluation procedure for ULBs. Till now, no systematic analysis has been attempted on the performance of local governments of the state of Karnataka.

The main objective of the study is threefold. First, we deal with issues related to provision of local services and expenditure requirements. We review in detail the service delivery scenario in the cities of Karnataka, to estimate the shortfalls in physical levels of services and their operations and maintenance (ONM) expenditures from the physical and financial norms, respectively, which are prescribed for Indian cities (HPEC 2011). Some estimations of ONM expenditure requirements are also attempted. Second, we analyze issues related to resource adequacy. Own revenues sources and the expenditures heads in these cities are compared and estimates of shortfalls of resources are derived to assess the extent of self-reliance in the cities. Some estimations of own revenue capacities are also attempted. Third, we evaluate the performance of the cities taking the service levels as the outcomes with the resources spent on different heads as the determinants of these outcomes in an integrated framework and pinpoint some possible sources of mis-utilization of resources.

The organization of the paper is as follows. Section 2 spells out the main issues related to service delivery and expenditure requirements; Sect. 3 deals with financial performance indicators and addresses the issues related to adequacy of resources and estimation of maximum revenue potential; Sect. 4 would bring in service delivery and the finances together to build up a model to assess the performance of the ULBs; Sect. 5 gives the concluding remarks.

2 Service delivery and expenditure requirements

This section gives a detailed account of service delivery in the ULBs of Karnataka. The objective is to estimate the service-wise shortfalls from physical and financial norms and derive the expenditure requirement estimates of the ULBs on basic services. For actual expenditures and service levels provided, we use the data for the year 2009–2010 collected from the individuals by the Directorate of Municipal Administration (DMA) of Karnataka followed by subsequent enquiries. We consider 213[2] ULBs of

[1] http://www.urbanindia.nic.in/programme/uwss/slb/slb.htm.

[2] Actually the study comprises of 215 urban local governments but data for two ULBs were not sufficient to apply the methodology.

Karnataka excluding the cantonment boards, census towns, and notified area for our analysis.[3]

We would mainly consider five major services, viz. water supply, sewerage/sanitation, roads, street lighting, and solid waste management for our analysis. These are the most essential services provided by local bodies across nations. Some indicators of the cities of different size classes in Karnataka are summarized in Table 1 below. A detailed discussion on the physical and financial norms on these services is given in Bandyopadhyay (2012).

We estimate some parameters related to service delivery in the ULBs of Karnataka. First, we analyze basic summary statistics of the *physical levels of services provided* and *the shortfalls from the norms of these services*. We consider the median as the average levels and the coefficient of variation (CV) as a measure of 'spread' within a size class. For water supply, we consider the per capita levels of water supply, number of days of water supply in a week and number of hours of water supply in a day. For solid waste management, we consider collection and transportation efficiencies, which, respectively, can be defined as the percentage of garbage *collected* of total amount of garbage *generated* and the percentage of garbage *transported* of total garbage *collected*. For roads, we take the *urban road density* as the indicator for analysis which is defined as the *road length per square feet area* of the ULB.

Second, we analyze some summary statistics for the actual expenditures on these basic services and the shortfalls from O&M norms for each service and also for all the services together. The expenditure requirements, taken together for all the services for one ULB, would give a simple measure of expenditure needs on service provision for that ULB. The norms from HPEC (2011) are taken for comparisons.[4]

Table 2 above summarizes the physical levels of services and their coverages/shortfalls compared to the respective norms in different size classes of cities and the state as a whole. We find that there is no pattern across the size classes as far as physical levels of water supply is concerned, the median for the state as a whole being 901 per capita per day (lpcd) and the highest being recorded in the smallest size class at 102 lpcd. A look at the CVs imply that for the smallest class, the distribution of the average is the most scattered implying that there is a wide range of service levels in this size class. This supply covers 69 % of the norms prescribed. On an average, Karnataka ULBs get water supply for 3 days a week and each day has a 1 h supply of water which is also uniform across size classes but variations differ in each size class a little and the CV increases with size class, the highest variation being recorded in

[3] Census towns and notified areas are small but separate 'geographical entities' in urban areas, but they are not separate units of 'urban local governments' who perform certain functions for the citizens. As a result of Footnote 3 contiuned
this, they do not have budgets or statements to expenditures. Similarly, there are certain geographical areas—mostly having military establishments—called cantonment areas governed by a board–which function in a very different way than a town or a city. These boards are centrally administered by Ministry of Defense. There is only one cantonment board in the state of Karnataka. Keeping in mind these considerations, we can rationalize the omission of these units.

[4] It is to be noted that the analysis is subject to some data constraints. We cannot verify the street lighting physical norms as the data on distance between two poles for the ULBs are not available. For financial norms, we only confine ourselves to O&M norms as the capital expenditure data as annual expenditures are not recorded as they are lumpy in nature and are incurred generally on specific project-related outlays.

Table 1 Some indicators (average) in the ULBs of Karnataka: socio-demographic, services, and infrastructure

Categories	Indicators	CB	CMC	CT	M CORP	NAC	TMC	TP
Socio-demographic/cost	No. of ULB	1	40	44	6	8	80	89
	Population (no.)	23,779	113,509.5	7823.5	588,974	8297.5	32,990	17,923
	Number of households	4150	22851	1621.5	116365.5	1886.5	6348	3318
	Household size	5.7	4.8	4.7	4.6	4.7	5.1	5.2
	Area (km^2)	7.2	34.41	4.455	149.355	6.6	11.18	5.55
	Density (persons per km^2)	3302.6	3707.4	1943.4	5178.3	1546.3	3369.3	3524.8
	Literacy (%)	77.85	70.58	72.10	75.72	73.90	66.07	64.52
Services	Road length per 1000 population (km)	–	1.06411	–	1.20994	2.33299	1.15875	1.11170
	Street lights per 1000 population (no.)	33	31	29	32	44	29	27
	Households having closed drainage (%)	39.1	24.7	7.9	52.9	66.6	9.2	6.7
	Households having tap as source of drinking water (%)	60	81.6	56.9	78.5	96.8	78.9	80.5
Infrastructure	Domestic and non-domestic connections per 1000 population	186.97	227.10	326.41	255.18	195.64	198.30	187.18
	Non-domestic connections to total connections (%)	15.05	18.49	21.25	23.32	4.76	20.66	18.67
	Banks (no.)	5	17	2	89	1	5	4.5
	Banks per km^2	0.69	0.49	0.45	0.60	0.15	0.45	0.81
	Electricity available per 1000 population	110.8	186.5	184.8	195.7	195.7	156.5	161.1
	Toilet facilities available to population per 1000	950.6	945.8	961.3	970.4	949.2	924.7	910.3

Source: Census of India, 2001
CB cantonment boards, *CMC* city municipal councils, *CT* census towns, *MCorp* municipal corporation, *NAC* notified area committee, *TMC* town municipal corporations, *TP* town panchayat

Table 2 Summary: physical levels of services

Size class	Below 25,000		25,000–50,000		Above 50,000		All	
	Average	CV	Average	CV	Average	CV	Average	CV
Water supply								
Per capita supply (LPCD)	102	1.3	74.6	0.7	96	0.6	90	1.1
Norms coverage (%)	76	1.2	56	0.6	72	0.6	69	1.1
Days of supply in a week	3	0.5	3	0.5	3	0.5	3	0.5
Hours of supply in a day	1	0.8	1	1.2	1	1.4	1	1.1
Solid waste management								
Collection efficiency	75	0.2	88	0.04	100	0.1	85	0.2
Transportation efficiency	71.4	0.2	88	0.06	100	0.8	83	0.5
Urban roads								
Road density (km per km^2 area)	5	1.13	6.3	1.1	9	2.2	6	2.5
Norms coverage (%)	71.6	1.1	90	1.1	84	2.6	82	2.6

the largest city size class. If compared with 24 × 7 water supply norm, the indicators are not too encouraging.

For solid waste management, both the collection and the transportation efficiencies increase with size class of cities, the medians being recorded at 85 and 83 % for the entire state, respectively. The variation in each size class is minimal as far as these indicators are concerned. The norm being 100 %, we can infer that the solid waste management indicators are closer to the norm than those of water supply.

As far as road density per square kilometer area of a ULB as a norm is concerned, the bigger cities are closer to the norms, but higher variations in bigger size classes are also noticed. On an average for the state, 82 % of the norms are being covered for this indicator.

If we compare the services in a particular size class of city, we find that in the smallest size class, it is water supply which has the minimum shortfall from norms, in the medium-size cities, it is road density which is closest to the norms, and in the largest city size class, it is the solid waste management which performs the best with zero shortfall from norms. One plausible explanation could be that performance of water supply and roads are guided by grants and financed projects which are targeted to small- and medium-size classes of cities rather than bigger cities. For solid waste management, it is the community participation and role of NGOs which could be instrumental, which are more prominent in the biggest size class of cities. However, statistical validation of these explanations cannot be given due to non-availability of data.

Table 3 above summarizes the operations and maintenance (ONM) expenditures and their shortages from financial norms on all of the basic urban services in the ULBs of Karnataka. We find that in water supply, the ONM expenditures actually incurred cannot cover the norms prescribed for the same in all the size classes. On an average, there is a shortage of 47 % for cities in the state as a whole, the highest per capita expenditure being incurred in the biggest size class with the highest shortfall from norms at 54 %. The variation within a size class is high in the biggest size class of cities. For solid waste management, only 9.3 % of the norms prescribed for ONM expenditures are being covered with a very high variation across cities. For urban roads, 82 % of the expenditure norms on ONM are being covered with a high variation across cities.[5] On an average taking all the services together, there is a shortage of 57 % of the ONM expenditure norms, the shortage being the highest (64 %) in the biggest size class of cities.

[5] The case for street lighting is different as we find that the expenditures incurred are 1051 % more than that prescribed by norms. This can be attributed to the fact that the state is changing over to the low-energy-intensive bulbs for street lighting. As the ONM includes the cost of bulbs, we get such unusually high figures for expenditures in this transition period as the low-energy bulbs cost on an average 20 times more than the usual ones and the norms do not include additional costs of changing over from high-energy-consuming bulbs to low-energy-consuming bulbs.

Table 3 Summary: expenditures on services

Services	Indicators	Below 25,000		25,000–50,000		Above 50,000		All	
		Average	CV	Average	CV	Average	CV	Average	CV
Water supply	ONM expenditure per capita (INR)	168	1.3	213	0.6	228	2	203	1.5
	Coverage of norms (%)	55	1.2	58	0.6	46	2	53	1.3
Solid waste management	ONM expenditure per capita (INR)	8.5	2.7	14.2	1.5	14.5	1.5	11	3.5
	Coverage of norms (%)	7.5	2.7	13	1.5	12	1.4	9.3	3.2
Urban roads	ONM expenditure per capita (INR)	35.60	1.7	36.10	1.6	20	1.5	33	1.7
	Coverage of norms (%)	71.6	1.1	90	1.1	84	2.6	82	2.6
Street lighting	ONM expenditure per capita (INR)	43.4	1	37	1.5	39	0.8	42	1.2
	Coverage of norms (%)	1447	1	1238	1.5	211	1.5	1151	1.4
All services	ONM expenditure per capita (INR)	364	1	390	1	352	1.4	372	1
	Coverage of norms (%)	45	1	46	1	36	1.2	43	1

3 Financial indicators and performance of urban local bodies

After analyzing the issues related to service delivery, we look at the financial indicators of performance of the ULBs in Karnataka. We touch upon the main expenditure heads and major sources of revenues in the ULBs of Karnataka. The major tax sources comprise of the property tax, advertisement tax, toll on vehicles, additional stamp duty, water tax; non-tax collections are mainly from user charges on services, rental income from municipal properties, fees and fines, developmental charges, License fee (building, trade, hotel), building betterment fee, birth and death registration fee, food and adulteration fee, slaughter house fee, compounding fee, etc.

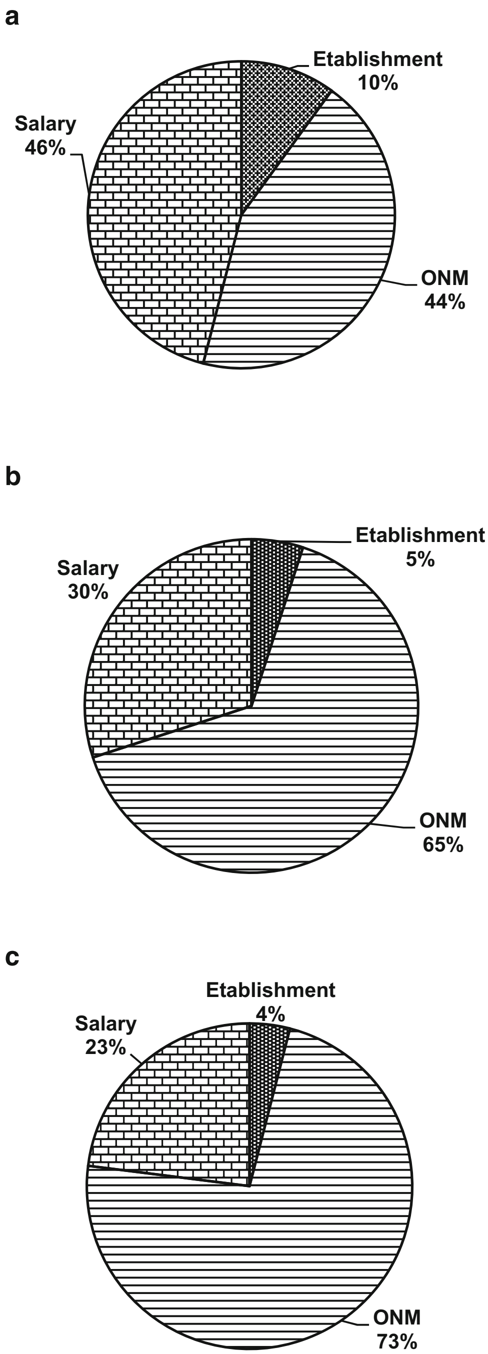
It is to be noted that we confine our analysis to the own revenue heads and revenue expenditures. The main focus would be to judge the self-reliance of the ULBs for which one of the indicators which is important is the coverage of revenue expenditures from the own revenue sources. It has been the mandate of various urban reform agendas in India to enable the ULBs to cover the revenue expenditures from their own source revenues. We analyze the facts with the help of two sets of charts below where we have recorded the average value of each component in the composition of revenue expenditures and own revenues in percentages.

Figure 1a–c below show the composition of revenue expenditures in various size classes of cities and for the state of Karnataka as a whole. The major components of revenue expenditures are operations and maintenance expenditures for service provision, the salaries of different categories of regular employees including the contractual payments and establishment which is the running cost of maintaining the establishment of the ULB. A productive and useful way of allocating the resources would be to have a greater share of operations and maintenance than any other component.

We find that the ONM component is higher than the other two components of all the size classes except the smallest size class (below 25,000) and in the state as a whole, followed by the salary and the establishment components. If we compare across size classes, we find that bigger cities have on an average higher proportions of ONM expenditures, while both salary and establishment components show higher proportions in smaller cities. This is indicative to the fact that bigger cities are incurring more productive expenses than the smaller ones. One intuitive explanation could be the demand side pressure which dominates. The population in bigger cities consists of proportionately higher number of educated, professional people who constitute the service class. Their demand for quality services can make the local government incur more productive expenses.

Figure 2a–c above give an idea about the composition of own revenues. We find that for the cities of Karnataka, as a whole tax and non-tax components are on an average more or less equal (non-tax with a slightly higher proportion). Property taxes show the highest proportion in the smallest size class and the lowest in the biggest size class. It is the lesser number of alternatives of revenue collection, in the non-tax and other tax components, in the smaller cities other than property taxes which makes this proportion higher. For instance, cable operator tax, mobile tower charges, etc., are yet to be implemented in many of the smaller cities. For non-tax and other tax components, it is difficult to find a well-defined pattern across size classes of cities.

Fig. 1 Composition of revenue expenditure. **a** Below 25,000 size class, **b** 25,000–50,000 size class, **c** above 50,000 size class



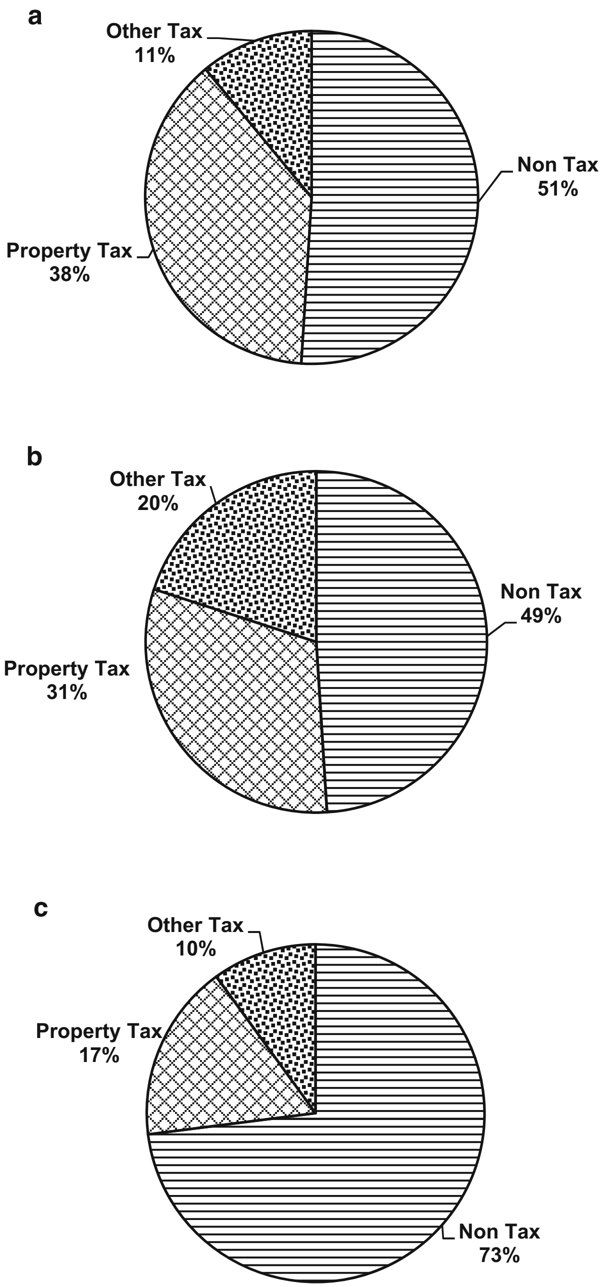


Fig. 2 Composition of own revenue. **a** Below 25,000 size class, **b** 25,000–50,000 size class, **c** above 50,000 size class

We also attempt a quick evaluation of the performance of the ULBs of Karnataka on the basis of some simple indicators. One way to assess is to see whether the own revenues can cover the revenue expenditures, if not, what is the percentage of shortfall?

Then, we can see whether the own revenues are sufficient to cover the ONM costs of basic services provided by the ULBs. Table 4 below summarizes the findings.

We find that on an average only 26 % of the revenue expenditures can be covered by own revenues in the ULBs of Karnataka with a high degree of variation (CV = 5.3). Only the own revenues of the biggest size class can cover fully the revenue expenditures and has a surplus of 12 %, but with a high variation in the size class. The smaller two size classes can cover a small proportion with hardly any variation within the size class (Row 1, Table 4).

As far as the ONM cost coverage is concerned, we find that on an average, the ULBs in Karnataka can finance 50 % of the ONM costs on basic services through their own revenues with a very high variation in the proportions across cites. Only the biggest size class of cities has a surplus over the ONM costs (Row 2, Table 4).

We also attempt to see whether water charges collection can cover the ONM expenditures on water. We find that only 13 % of the ONM expenditures on water can be covered by water charges, which is more or less uniform across size classes with very little variation in each size class and also across size classes. (Row 3, Table 4).

We have also analyzed the performances of the ULBs in Karnataka from the collection efficiency ratios of property taxes which can be an important indicator of performance evaluation of the units. Collection efficiency ratio is defined as the ratio of the amount of tax actually collected to the amount demanded. The tax demanded and collected can be for the current and arrears which are recorded separately. Here, we consider the total of current and arrears for the collection efficiency ratios calculations. We find that the overall average collection efficiency is only 62 % which is the lowest in the smallest size class and the highest in the medium size class with little variation across cities (Row 4, Table 4).

We have also attempted an estimation of own revenue capacities. In the absence of data on incomes of the cities, we have taken the collection efficiency ratios as the reference for the estimations. We take 100 % collection efficiency in arrears collection and 90 % collection efficiency in current collections of property taxes which has been the basis for many reforms agenda on Indian cities. We find that on an average, own revenues can increase by 16 % if the arrears collection is fully appropriated and current collection is at least 90 % of the current demand for property taxes, the non-tax and other taxes being the same as before. The highest increase of 41 % is recorded in the biggest size class (Row 5, Table 4).

Having estimated the own revenue potentials, we would like to know how much of the expenditure requirements on ONM can be covered once this potential is realized. Expenditure requirements on ONM for five major services are estimated from HPEC (2011) financial norms. These are benchmarks corresponding to the physical norms, so can be used to estimate the expenditure requirements.[6] We find that only 27.5 % of the ONM expenditure requirements can be fulfilled by the own revenues once the potential for the latter is fully realized. This proportion is higher in bigger cities with moderately high variation across cities (Row 6, Table 4).

[6] Estimating expenditure functions and expenditure needs has many data-related and methodological problems. So we have to rely on expert judgment approach which has been used for many US and Australian cities for specific services (Reschovsky 2007).

Table 4 Some financial performance indicators

Indicators	Below 25,000		25,000–50,000		Above 50,000		All	
	Average	CV	Average	CV	Average	CV	Average	CV
1. Own revenue to revenue expenditure ratio (%)	13	0.5	31	0.21	112	3	26	5.3
2. Own revenue to ONM expenditure ratio (%)	24	1.4	52	0.65	200	2.5	50	4.4
3. Water charges to ONM expenditure on water (%)	15	0.8	11	0.7	12	0.9	13	0.8
4. Collection efficiency of property taxes (%)	53	0.6	65	0.4	58	0.6	62	0.5
5. Own revenue capacity to actual own revenue (index)	116	2.6	116	0.2	141	2.6	116	3
6. Own revenue capacity to ONM requirements	23.5	2	27.5	2	27.5	2.2	27.5	2.2

4 Performance evaluation of urban local bodies: a nonparametric approach

In this section, we would like to develop a model in a benchmarking framework based on the principles of mathematical programming. Our effort would be to attempt an in-depth analysis of performance taking the ULBs as the decision making unit (DMU) by bringing in the expenditures on various accounts as *inputs* and provision of services as *outputs*. This analysis attempts to bring together the financial parameters and the service delivery of the ULBs in the spirits of Eeckaut et al. (1993), De Borger et al. (1994), Grossman et al. (1999) which analyses the efficiencies of municipalities in different countries or explains the factors affecting these efficiencies. The main objective of our analysis is to assess the performance of the ULBs in service delivery and resource utilization in an integrated manner. We also move a step further and pinpoint the possible sources of cost savings by identifying the sources for mis-utilization of resources and estimating the quantum of resources mis-utilized.

The benchmarking exercise is based on the theory of production. Production is an act of transforming inputs into outputs. Outputs are in general desirable outcomes. Hence, more output is better. At the same time, inputs are valuable resources with alternative uses. The objective of a DMU is either to produce as much output as possible from a specific quantity of inputs or to produce specific quantity of output using as little input as possible. An input–output combination is a feasible production plan if, given the state of technological knowledge, the output quantity can be produced from the associated input quantity or vice versa.

The performance of any DMU can be evaluated in terms of relative efficiency of the unit concerned. Efficiency by its simplest definition of the output version refers to the ability of a DMU to produce the maximum levels of outputs with a set of inputs. The change in prices of inputs or a shift in technology or otherwise can result in a change in the input mix used by the DMU which in turn affects efficiency. When we refer to the DMU's ability to produce as much as it can without taking any possible impact of input prices, it is called productive or technical efficiency (TE).

We would derive the technical efficiency scores of the ULBs as a measure of performance. The main advantage of this tool is that it can be applied to any economic activity in any sector even with constraints in availability of data on market prices. The application of efficiency analysis in public service delivery is particularly useful because of this advantage.

Technical efficiency is an index which is expressed as the ratio of actual production and the potential productive capacity of a DMU using the same amount of resources. There are various ways to measure the technical efficiency. Once the decision making unit in a sector performs an economic activity transforming a set of inputs to a set of outputs and a frontier of production can be conceived of considering all the decision making units in the sector, we can apply the concept of technical efficiency to assess the performance of the units. While the basic principle of measurement of technical efficiency is the distance of the point of operation of a decision making unit from that projected on the frontier, two factors, viz. the way the frontier is constructed and the way the distance is measured, make one method of estimation different from the other.

The parametric approach requires the imposition of a specific functional form for a production frontier and some assumptions like independently and identically normally distributed errors which have to be uncorrelated with the independent variables. In contrast, the nonparametric approach does not require any functional form. It is based on a set of behavioral assumptions regarding production. Taking information from data on inputs and outputs, the data envelopment analysis (DEA) method generates a discrete piecewise frontier by optimizing on *each* individual observation given the set of pareto-efficient DMUs or the peers. The technical efficiency scores are derived as the ratio of the actual output to the ideal output specified by the generated frontier.

For each family of parametric or nonparametric specifications, the estimation can be done through mathematical programming or econometric techniques. The distance between the point on which a decision making unit *actually* operates and the point on the frontier on which it *should have* operated can be measured as a radial or a non-radial characterization. In this discussion, we would consider radial measures. We would consider the nonparametric method of DEA which uses a linear programming principle for estimating technical efficiency and is deterministic in nature.

The theoretical foundation of efficiency analysis dates back to Koopmans (1951) who defined a point in the commodity space as efficient whenever an increase in the net output of one good resulted in a decrease in that of another. Due to its obvious similarity with the notion of pareto optimality, this definition is known as the Pareto–Koopmans condition for TE. Debreu (1951) introduced the concept of coefficient of resource utilization as a measure of TE for the economy as a whole (from the point of view of cost of resources) and interpreted any deviation of this measure from unity as a deadweight loss for the society on account of inefficient utilization of resources. The measures of efficiency subsequently developed by Farrell (1957) expressed a close link with the notion (in axiomatic production theory) of radial contraction of inputs/expansion of outputs from an observed point to the frontier, i.e., the efficiency of a firm reflect the ability to use the inputs in optimal proportion, given their respective prices or to achieve the maximum level of output attainable by the state of technology. Farrell assumed constant returns to scale (CRS) technology in production. Hoffman (1957) pointed out that the dual simplex method, an algorithm to solve a linear programming (LP) problem, could be applied to obtain Farrell's measure of efficiency. This was used in Farrell and Fieldhouse (1962) where the case of increasing returns to scale was also incorporated. Later, the DEA literature was developed by Charnes et al. (1978) with a conversion of the fractional program into a linear program by selecting suitable weights (which are nothing but the virtual prices of inputs and outputs). A more generalized variable returns to scale (VRS) model was developed by Banker et al. (1984).

4.1 Nonparametric optimization approach: data envelopment analysis (DEA)

The justification for using nonparametric DEA is that it requires only behavioral assumptions on the production technology which are very basic. Also, DEA performs well even with moderate-sized data. The formulation of standard DEA problem is discussed in detail in CCR (1978), BCC (1984), and in the present context in Bandyopadhyay (2012).

Both CCR (1978) and BCC (1984) models calculate only radial (in) efficiency. For radial and slack calculation together, one has to use an extended formulation based on BCC (1984). Radial measures are preferred as they can be used to measure radial efficiency and can also estimate off-radial slacks in an integrated multi-stage methodology. The input version of the efficiency models is particularly useful here because the main purpose of this analysis is to focus on the expenditure management of ULBs.

Model 1 is the input version of the efficiency with slacks given as:

$$
\begin{aligned}
\text{Min:} \quad & \tilde{\theta} = \theta - \varepsilon\left(\sum_{j=1}^{m} S_j^+ + \sum_{i=1}^{m} S_i^-\right) \\
\text{Subject to:} \quad & \sum_{t=1}^{N} \lambda_t y_{jt} - S_j^+ = y_{jt}; \quad \forall j = 1, 2, \ldots, m \\
& \sum_{t=1}^{N} \lambda_t x_{it} + S_i^- = \theta x_{it}; \quad \forall i = 1, 2, \ldots, n \\
& \sum_{t=1}^{N} \lambda_t = 1 \\
& \lambda_t, s_j^+, s_i^- \geq 0; \quad \forall t = 1, 2, \ldots, N; \forall j = 1, 2, \ldots, m; \forall i = 1, 2, \ldots, n.
\end{aligned}
\qquad \text{(Model-1)}
$$

where θ is free.

s_j^+, s_i^-, indicates the output and input slack and ε is any pre-assigned positive number, however small. Positive sign means output should be increased and negative sign means input should be decreased.

It is the treatment of slacks that motivates the extension of the basic model to different stages. A single-stage DEA can solve a linear program in model 1 and calculate slacks residually.

Model 1 can be executed as a two-stage model. In a two-stage DEA, first, the input efficiency scores are derived and then a stage follows where corresponding to these efficiency scores the optimal slacks are estimated for each ULB. This is done by estimating $\tilde{\theta}$ in Eq. 1.1 in the first stage. In the second stage, the non-radial movement on the efficient frontier is achieved by optimizing the slack variables in Eq. 1.2.

However, the presence or absence of weakly efficient DMUs makes the procedure a little different.

A DMU is efficient iff

$$\tilde{\theta} = 1 \text{ and } s_i^{-\star} = 0; \text{ and (or) } s_j^{+\star} = 0 \quad \text{for all } i \text{ and } j;$$

A DMU is weakly efficient iff

$$\tilde{\theta} = 1 \text{ and } s_i^{-\star} = s_j^{+\star} = 0 \quad \text{for some } i \text{ and } j;$$

We do not know before the calculations whether weakly efficient DMUs are present. In the absence of weakly efficient DMUs, we can estimate the optimal slacks using Eq. 1.3 in the second stage.

$$\begin{aligned}
&\text{Min:} && \theta = \tilde{\theta} \\
&\text{Subject to:} && \sum_{t=1}^{N} \lambda_t y_{jt} \geq y_{jt}; \quad \forall j = 1, 2, \ldots, m \\
& && \sum_{t=1}^{N} \lambda_t x_{it} \leq \theta x_{it}; \quad \forall i = 1, 2, \ldots, n \\
& && \sum_{t=1}^{N} \lambda_t = 1 \\
& && \lambda_t, \geq 0; \quad \forall t = 1, 2, \ldots, N; \quad \forall j = 1, 2, \ldots, m; \quad \forall i = 1, 2, \ldots, n.
\end{aligned} \tag{1.1}$$

where θ is free.

$$\begin{aligned}
&\text{Max:} && \left(\sum_{j=1}^{m} s_j^+ + \sum_{i=1}^{n} s_i^- \right) \\
&\text{Subject to:} && \sum_{t=1}^{N} \lambda_t y_{jt} - s_j^+ = y_{jt}; \quad \forall j = 1, 2, \ldots, m \\
& && \sum_{t=1}^{N} \lambda_t x_{it} - s_i^- = \tilde{\theta} x_{it}; \quad \forall i = 1, 2, \ldots, n \\
& && \sum_{t=1}^{N} \lambda_t = 1 \\
& && \lambda_t, \geq 0; \quad \forall t = 1, 2, \ldots, N; \quad \forall j = 1, 2, \ldots, m; \quad \forall i = 1, 2, \ldots, n.
\end{aligned} \tag{1.2}$$

where θ is free.

$$\begin{aligned}
s_j^+ &= \sum_{t=1}^{N} \lambda_t y_{jt} - y_{jt}; \quad \forall j = 1, 2, \ldots, m \\
s_i^- &= \tilde{\theta} x_{it} - \sum_{t=1}^{N} \lambda_t x_{it}; \quad \forall i = 1, 2, \ldots, n
\end{aligned} \tag{1.3}$$

A two-stage procedure can suffer from two shortcomings depending upon the dataset and the nature of the problem to solve. Optimization of slacks in the second stage can lead to maximization instead of minimization of slacks in this procedure. Also, the solutions are sensitive to the units in which the data are expressed. However, whether we need to go beyond the two-stage procedure could be a matter of choice or an empirical question, which depends on the structure of the dataset and the problem to be addressed. The slacks have to be interpreted with caution. However, we can interpret them in the context of our model which gives us meaningful insights.

4.2 Productive efficiency of ULBs in Karnataka: results

We fit a six output five input model with outputs as:

twaters: Total annual water supplied in a ULB,
troadlength: Total roadlength in a ULB,
tstreetlights: Total no. of streetlights in a ULB,
tswtransported: Total daily solid waste transported after collection,
parkarea: Total area developed and maintained as parks in a ULB,
lroadscleaned: Total length of roads cleaned daily in the ULB.

The input vector is given by:

onm: Total onm expenditures on basic services,
laborcost: Total cost on wages, salaries and contractual payments on labor
perempl: Total no. of permanent employees in the ULB,
establishment: Total expenditure of running the establishment of the ULB,
tcapacityvehicles: Total capacity of vehicles for solid waste collection of a ULB.

Table 5 below gives the summary statistics of the input and output variables used to generate the input efficiency scores for the ULBs in Karnataka. We use the latest data collected for 2009–2010 for all the variables.

It is to be noted that inputs chosen cover the running operations and maintenance costs, laborcost, human capital stock as number of permanent employees, size or capacity of vehicles to perform a service like solid waste management, and the establishment cost. With severe data constraints, these can be included in the model as inputs which go into the provision of important services spelt out in the output vector.

Figure 3 above gives the distribution of efficiency scores of ULBs. Efficiency scores can vary between 0 and 1. We find that more than 50 % of the ULBs have efficiency higher than 0.73 and the remaining 50 % of the ULBs are distributed in the lower range between 0.27 and 0.73. The efficiency scores of all the ULBs are tabulated in Table 9 in the Appendix.

Table 6 above summarizes some useful statistics. We have grouped the efficiency scores for each size class to generate these statistics from the optimization model results which is applied to all the cities together. We find that there is not much difference in the average and the median and the variation across cities and within a city size class is also minimal. On an average, the ULBs in Karnataka can save up to 27 % of the inputs to achieve the maximum efficiency in the prescribed model (Table 6). That is to say the cities can provide the same levels of services by utilizing resources lesser by 27 % of what they currently use. Though we do not get any uniform pattern for the average efficiency scores across size classes, we find that the highest efficiency score is recorded for the biggest size class of cities and the lowest score in the medium-size class. The medium-size class also records the highest percentage of inefficient ULBs in the group.

We also attempt an analysis of additional resource saving through slacks in inputs or outputs after attaining the maximum efficiency. The inputs for which slacks are positive for a particular ULB would imply that the usage of these inputs can be reduced (by the amount of slack recorded) keeping the efficiency scores the same. These slacks determine the sources and quantum of input savings additional to what has been

Table 5 Summary statistics of variables: input-oriented efficiency model

	Median	Average	SD	Max	Min	CV
Outputs						
twaters (l)	2, 950, 000	8, 460, 819	21, 627, 106	200, 000, 000	12, 370	2.6
troadlength (km)	55	113	202	1, 773	4	1.8
tstreetlights (no.)	1, 650	3, 524	7, 469	61, 523	210	2.1
tswtransported (tons)	10	24	73	900	1	3.0
parkarea (m^2)	13, 646	115, 930	523, 453	5, 632, 000	2	4.5
lroadscleaned (km)	16	65	284	3, 600	0	4.4
Inputs						
onm (INR)	13, 346, 500	38, 650, 055	130, 438, 933	1, 569, 443, 000	867, 000	3.4
laborcost (INR)	7, 313, 000	540, 232, 266	7, 401, 955, 836	108, 000, 000, 000	197, 000	13.7
perempl (no.)	44	98	210	1, 961	7	2.1
establishment (INR)	672, 000	10, 967, 211	101, 032, 896	1, 400, 000, 000	20, 000	9.2
tcapacityvehicles (tons)	15	221	1, 505	16, 240	1	6.8

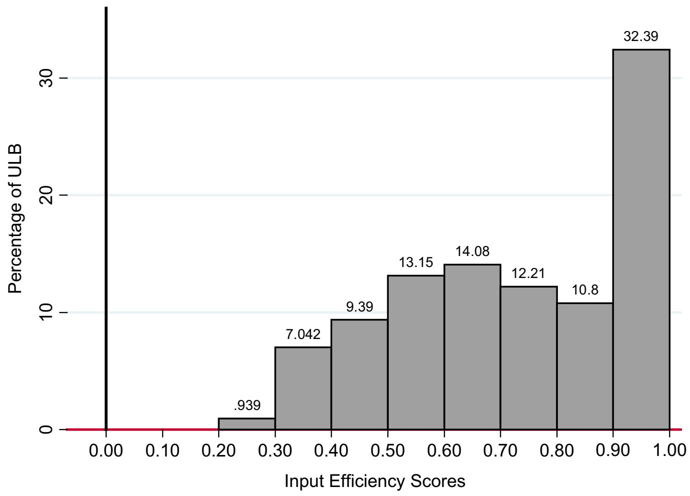


Fig. 3 Distribution of efficiency scores ULBs

Table 6 Summary: input-oriented efficiency model for Karnataka cities

	Below 25,000	25,000–50,000	Above 50,000	All
No. of ULBs	88	75	50	213
Inefficient ULBs (no.)	64	58	31	153
Inefficient ULBs (%)	72.7	77.3	62	71.8
Average	0.76	0.67	0.77	0.73
SD	0.2	0.24	0.22	0.22
Max	1	1	1	1
Min	0.3	0.27	0.34	0.27
CV	0.27	0.35	0.28	0.3

recorded in the radial efficiency scores. Table 7 below summarizes the variables in which slacks are recorded. For each size class, the number and percentage of ULBs having slacks in input and output variables in the model are recorded. It is interesting to note that in our model, slacks are recorded for inefficient ULBs. We find that among the input variables, the highest proportion of ULBs record slacks in establishment expenditure and the lowest proportion of ULBs record slacks in ONM expenditure. This is true for all the size classes of cities. As far as the output slacks are concerned, on the whole the highest proportion of ULBs record slacks on the length of roads cleaned.

From the above analysis, it is clear that many of the ULBs can further save resources/increase outputs after reducing the inputs to have a radial contraction of 27 % on an average to attain 100 % efficiency. We can quantify these slacks by taking the values of the slacks in the respective variables as a percentage of the values of the variables used in the model.

Table 8 below presents the summary statistics on the quantum of slacks in inputs and outputs in our model. We find that after a radial contraction of all inputs by 27 %

Table 7 ULBs with slacks in input-used/output-produced among inefficient ULBs

	Below 25,000		25,000–50,000		Above 50,000		All	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Outputs								
twaters	32	50	25	43	11	35	68	44
troadlength	43	67	24	41	10	32	77	50
tstreetlights	28	44	26	45	16	52	70	46
tswtransported	43	67	22	38	8	26	73	48
lroadscleaned	33	52	39	67	22	71	94	61
Inputs								
onm	9	14	10	17	3	10	22	14
laborcost	31	48	10	17	5	16	46	30
perempl	15	23	12	21	5	16	32	21
establishment	33	52	27.5	47.5	15	48	75	49
tcapacityvehicles	13	20	28	48	20	65	59	39

on an average in the ULBs in Karnataka, the quantum of slacks is the highest for establishment expenditures (13 %) and lowest for ONM expenditures (2.3 %), and this is true for all size classes of cities. For outputs, the quantum of expansion potential is the highest for water supply (188 %) and the lowest for street lighting (17 %), but this does not hold for all the size classes of cities.[7] In most of the resources and services, the quantum of slack is higher in smaller cities indicating to the fact that mis-utilization of resources and under-provision of services are more pronounced in the smaller cities.

5 Concluding remarks

In the literature on public finance in general, the issues of efficiency in revenue generation, expenditure management, and service delivery are dealt separately. We often come across cases where the output delivered by a particular level of government is below the level prescribed or targeted. Lower expenditures incurred to deliver the output than the requirements generally lead to these shortfalls. A common argument in explaining these shortfalls point toward the low revenue generation due to narrow base, lower rates, and administrative inefficiency reflected in low collection efficiency of revenues. But addressing the issue of mis-utilization of resources imbedded in the resources actually spent in the form of leakage of various kinds is also relevant in explaining the failure to attain the levels of outputs desired. The first step in analyzing this is to estimate the extent of mis-utilization . This is particularly difficult in the

[7] It is to be noted that the input slack in percentages cannot exceed 100 as the optimization exercise in production involves minimization of inputs and the potential reduction in inputs cannot exceed the amounts of inputs used in the model, whereas output slacks can exceed 100 as output expansions are determined from the model and the potential expansion can exceed the amount of outputs produced.

Table 8 Quantum of slacks in input-used/output-produced among inefficient ULBs (%)

	Below 25,000		25,000–50,000		Above 50,000		All	
	Average	CV	Average	CV	Average	CV	Average	CV
Outputs								
twaters	47	2.5	445	6	51	4	188	8
total roadlength	47	2	28	3	11	3	32	3
streetlights	22	5	14	2	14	2	17	4
swtransported	49	2.8	19	2.8	6	3	28	3
length of roads cleaned	109	5.8	83	2	62	2	89	5
Inputs								
onm	2	3.7	3	3	2	5	2.3	4
laborcost	13	1.7	4	3.5	2.2	4	7	2
perempl	4	3	4	2.9	3	4	4	3
establishment	17	1.5	11	1.6	10	1.7	13	1.6
tcapacityvehicles	5	3	11	1.6	11	1.5	10	2

context of developing countries due to non-availability of disaggregated data. This is more or less true for all levels of governments. The present paper is oriented to address these issues for urban local governments in India.

Indian cities are characterized with poor service delivery, both in qualitative and quantitative terms. The paper analyzes separately the shortfalls in services provision and expenditure requirements and also attempts to estimate the revenue capacities of the sample of cities in the state of Karnataka. It also brings in different categories of expenditures incurred by the cities as inputs and the levels of services as outputs to estimate the performance scores of the urban local governments. It also identifies the categories of expenditures where mis-utilizations have been recorded and gives an estimation of the quantum of this mis-utilization.

As far as the physical levels of services are concerned, there have been shortfalls from norms for all the services in all size classes of cities. We find that own revenues can finance only 27 % of the revenue expenditures actually incurred and 50 % of the ONM expenditures actually incurred on major services. We also find that own revenues collected can cover less than 50 % of the ONM expenditure norms prescribed for Indian cities on the major services in the cities of Karnataka. We estimate the expenditure requirements on major services and the own revenue potentials of the ULBs and find that there can be a possible increase of 16 % in the own revenues which can cover 27.5 % of ONM expenditure requirements on major services.

After a detailed analysis of the expenditures, revenues, and service delivery, we attempt to fit a DEA model to derive the technical efficiency scores of the ULBs. We find that the ULBs on an average can reduce 27 % of their expenditures to provide the same levels of services provided currently by them.

In the process, we also attempt an estimation of the possible overspending or under-provision of services by the ULBs in a benchmarking framework with a detailed analysis of the slacks involved in the model. We also find that there can be additional savings particularly on establishment and labor expenditures to operate at the maximum efficiency levels. We find that the extent of problem of unproductive spending and under-provision of services is more pronounced in smaller cities.

The paper also draws some conclusions on the efficiencies in different size classes of cities. It has been found that the performances of the smaller cities are more discouraging than the bigger ones. Though in India, there has been specific reform agendas targeted for small and medium towns, there is a tendency of neglecting these cities. It is to be noted that the performance of the smaller cities are crucial for that of the bigger cities.

In India, urban agglomerations often spread first around the big central city and then around the smaller cities as well. Mostly, due to land scarcity and exorbitant housing prices in the bigger central cities, people have to reside in adjacent smaller cities. As a result, the unbalanced growth in the basic infrastructure and urban services in the smaller cities can deter the growth and development of the bigger cities as the people who come for employment in the bigger cities stay in the smaller neighboring cities and their unmet demand for these basic services can cause them to relocate to a new destination for work. This interdependence has always been ignored in policies in India.

The mis-utilization of resources in establishment and laborcost is an important empirical finding for Indian cities. On an average, across all city size classes, 13 %

of the establishment costs can be saved to deliver the same levels of services with the same efficiency levels. Similarly, laborcost can be saved by 7 % on an average across all city size classes. It is in the establishment expenditures and contractual payments in the laborcost component where we find more leakages as the monitoring of these expenditures are difficult. Administrative inefficiency could possibly contribute to inefficient usage of spending. Over-employment in the city governments is also indicated from our model.

Appendix

Table 9.

Table 9 Efficiency scores of the ULBs in Karnataka

Sl. no.	ULB	Input efficiency scores
1	Afzalpur	1
2	Aland	0.600485282
3	Alnavara	0.372469076
4	Alur	0.692001473
5	Anekal	0.391944057
6	Ankola	0.34854772
7	Annigeri	0.396670809
8	Arakalgud	0.463033612
9	Arasikere	0.425046846
10	Athani	0.469462295
11	Aurad	1
12	Badami	0.267654689
13	Bagalkote	0.610659762
14	Bagepalli	1
15	Bailahongal	1
16	Bangarpet	0.67974928
17	Bankapura	1
18	Bannur	0.663859143
19	Bantwal	1
20	Basavakalyana	0.584984124
21	Basavanabagewadi	0.515723808
22	Beelagi	0.875304534
23	Belgaum	1
24	Bellary	1
25	Belthangadi	1
26	Belur	0.821359487
27	Bhadravathi	1
28	Bhalki	0.393483913
29	Bhatkal	1

Table 9 continued

Sl. no.	ULB	Input efficiency scores
30	Bidar	1
31	Bijapur	0.877046519
32	Birur	0.617137823
33	Byadgi	1
34	Challakere	0.387033212
35	Chamarajanagar	0.592901
36	Channagiri	0.617379176
37	Channapatna	0.531787969
38	Channarayapatna	0.661097558
39	Chikkaballapur	1
40	Chikkanayakanahalli	0.666857991
41	Chikkodi	0.913105557
42	Chikmagalur	0.471594631
43	Chincholi	1
44	Chintamani	0.339075552
45	Chitradurga	0.512030525
46	Chittaguppa	1
47	Chittapur	0.466822296
48	Dandeli	0.581750689
49	Davangere	1
50	Devadurga	1
51	Devanahalli	0.753726144
52	Doddaballapur	0.603940119
53	Gadag Betegeri	0.888378722
54	Gajendragad	0.851757122
55	Gangavathi	0.693351082
56	Gokak	0.791622627
57	Gowribidanur	0.461725794
58	Gubbi	0.725705106
59	Gudibande	1
60	Gulbarga	1
61	Guledgudda	0.327032065
62	Gundlupet	0.418173539
63	Gurumitkal	1
64	Haliyal	0.973973086
65	Hanagal	0.662912254
66	Hanur	0.850671528
67	Harappanahalli	0.684869388
68	Harihara	0.719963047
69	Hassan	0.707509606
70	Haveri	1
71	Heggadadevanakote	0.809991218

Table 9 continued

Sl. no.	ULB	Input efficiency scores
72	Hirekerur	0.829358105
73	Hiriyur	0.470877128
74	Holalkere	0.507967606
75	Holenarsipura	0.300608662
76	Honnali	0.892688886
77	Honnavar	0.576278878
78	Hoovinahadagali	1
79	Hosadurga	0.727447908
80	Hosakote	0.294540384
81	Hosanagara	0.723127062
82	Hospet	1
83	Hubli Dharwad	1
84	Hukkeri	1
85	Humnabad	0.817517188
86	Hunagund	0.87148942
87	Hunsur	0.817596961
88	Ilkal	0.450680815
89	Indi	0.744151872
90	Jagalur	0.561785776
91	Jamakhandi	0.441093502
92	Jewargi	0.338496002
93	Jog Kargal	1
94	K.R.Nagar	0.567094543
95	K.R.Pet	1
96	Kadur	0.824872796
97	Kalagatgi	0.465246435
98	Kamalapur	1
99	Kampli	0.580769045
100	Kanakapura	0.578597458
101	Karkala	1
102	Karwar	0.8735714
103	Kerur	0.653439475
104	Khanapur	0.650212304
105	Kolar	0.942043148
106	Kollegal	0.747127458
107	Konnur	0.643856116
108	Koppa	0.736632418
109	Koppal	0.540031382
110	Koratagere	1
111	Kottur	0.820212088
112	Kudachi	0.678726023
113	Kudligi	0.42530363

Table 9 continued

Sl. no.	ULB	Input efficiency scores
114	Kumta	0.53999589
115	Kundagol	0.298041466
116	Kundapur	0.620280104
117	Kunigal	0.667145045
118	Kushalanagara	0.72343212
119	Kushtagi	0.929059586
120	Lakshmishwara	0.382373584
121	Lingasugur	1
122	Maddur	0.798192975
123	Madhugiri	1
124	Madikeri	0.538407015
125	Magadi	1
126	Mahalingapur	1
127	Malavalli	0.551566293
128	Malur	1
129	Mandya	1
130	Mangalore	1
131	Manvi	1
132	Molakalmur	1
133	Moodabidri	0.616161695
134	Mudagal	0.768371325
135	Mudalagi	0.728651278
136	Muddebihal	0.690034253
137	Mudhol	0.738386468
138	Mudigere	0.493871345
139	Mulbagal	0.451427224
140	Mulgund	0.782288787
141	Mulki	0.572023715
142	Mundagod	0.508034006
143	Mundargi	0.708025651
144	Mysore	1
145	Nagamangala	0.564371793
146	Nanjanagud	0.488642792
147	Naragund	0.46562626
148	Narasimharajapura	0.656931406
149	Naregal	1
150	Navalgund	0.37781851
151	Nelamangala	0.935512348
152	Nippani	1
153	Pandavapura	0.563832453
154	Pavagada	0.974227661
155	Periyapatna	0.758718667

Table 9 continued

Sl. no.	ULB	Input efficiency scores
156	Puttur	1
157	Rabkavi Banhatti	0.647527044
158	Raichur	0.888157094
159	Ramadurg	0.853467281
160	Ramanagaram	0.55287467
161	Ranebennur	0.573565772
162	Rayabagh	1
163	Robertsonpet	1
164	Ron	0.348973828
165	Sadalaga	0.769409712
166	Sagar	0.518933808
167	Sakleshpura	0.680600629
168	Saligrama	1
169	Sandur	1
170	Sankeshwar	1
171	Saragur	0.51260523
172	Saundatti	0.801861788
173	Savanur	0.439343397
174	Sedam	0.897733821
175	Shahabad(CMC)	1
176	Shahapur	0.463381403
177	Shidlaghatta	1
178	Shiggaon	1
179	Shikaripura	0.673051396
180	Shimoga	1
181	Shiraguppa	0.8330567
182	Shirahatti	1
183	Shiralakoppa	0.655718452
184	Shringeri	0.672077641
185	Shrirangapatna	0.927500185
186	Siddapur	0.707773715
187	Sindagi	0.675323588
188	Sindhanoor	0.718244339
189	Sira	1
190	Sirsi	0.558658163
191	Somwarpet	0.49591436
192	Soraba	1
193	Srinivasapur	0.416883088
194	Sullya	0.880430742
195	Surpur	1
196	T.Narsipur	0.914094635
197	Talikote	0.598099575

Table 9 continued

Sl. no.	ULB	Input efficiency scores
198	Tarikere	0.367690064
199	Tekkalakote	0.746076709
200	Teradal	0.789954094
201	Thirthahalli	0.768935418
202	Tiptur	0.347141991
203	Tumkur	0.692431944
204	Turuvekere	0.722542801
205	Udupi	1
206	Ullal	1
207	Vijayapura	0.970651338
208	Virajpet	0.842466396
209	Wadi	0.553134217
210	Yadgir	0.71026863
211	Yelandur	1
212	Yelburga	0.74838059
213	Yellapur	0.581849336

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