

Performance appraisal of Agricultural Market Committees in India–Data Envelopment Analysis Approach

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Abstract- Efficient performance of Agricultural Market Committees(AMCs) is considered to be the sine quo non for the economic development of an agrarian country like India. Though the number of AMCs have been steadily increasing in India, still the farmers are being exploited by one form or another in transacting the agricultural commodities. In view of this, several apprehensions and concerns were raised fearing about the performance of AMCs in discharging the regulatory provisions for efficient transaction of agricultural commodities. Various enactments have been formulated by Government from time to time to revamp the agricultural marketing system in the country and presently, Model act 2005 (The State Agricultural Produce Marketing (Development and Regulation) Act, 2005) has been under implementation. In this context of exploring the agricultural marketing system with a farmers ended approach, the present paper aims at analyzing the performance appraisal of AMCs in Telangana region of AP in India through Data Envelopment Analysis(DEA) approach. The analytical findings revealed that 59% of selected DMUs are being operated at Scale Efficiency <1. The remaining 41% DMUs are being operated at constant return to scale(CRS) and this directs the Government to continue the existing support even in the future.

Index terms- Agricultural Market Committees, Data Envelopment Analysis, Efficiency, Return to Scale

I. INTRODUCTION

Efficient performance of agricultural markets is considered as the *sine qua non* of economic development of any country. This is not an exception with reference to India. It is a known fact that, regulated agricultural markets have been established in India with the prime objective of transacting agricultural produce efficiently and thereby, to safeguard the interests of the farming community. Since 1966 and upto the current year, there have been a steady progress in the establishment of regulated agricultural markets in the country. In India, the organized marketing of agricultural commodities has been promoted through a network of regulated markets. Most State Governments and Union Territory(UT) administrations have enacted legislations (Agricultural Produce Marketing (Regulation) Act (APMC Act)) to provide for the regulation of agricultural produce markets. While by the end of 1950, there were 286 regulated markets in the country, their number as on 31st, March 2011 stood at 7566 consists of 2433 principal markets and 5133 sub-yards. Some wholesale markets are outside the purview of the regulation under APMC Acts. Similar trends were noticed in the state of Andhra Pradesh in general and Telangana region of Andhra Pradesh in particular. In Andhra Pradesh, with 23 districts, there are 905 regulated markets which consists of 329 principal markets and 576 sub-yards and in Telangana region comprising of 10 districts, 131 principal markets and 347 sub-yards are reported as on 31st, March 2011.

So far, so forth, these regulated markets in Telangana region of Andhra Pradesh are serving the farming community in view of the laid out promises at the time of their establishment. The contributions of these regulated markets are clearly manifested through various outcomes in the forms of viz, regulating the marketing practices, systematizing the marketing costs, settlement of disputes between farmers and traders, prompt payment of sales proceeds, checking the malpractices of marketing middlemen etc., with a view to safeguard the interests of the farmers in transacting their produce and return, to realize significant producer's share in consumer's rupee. To keep up these promises, the Government from time to time revised the marketing regulations and presently Model Act, 2005 (The State Agricultural Produce Marketing (Development and Regulation) Act, 2005) has been enacted to make the farmers more dynamic and competitive in the context of liberalized trade regime. However, coming to the reality, there exists a wide gap between the promises made and actual performance shown by these regulated markets. The earlier mentioned regulatory provisions offered by these regulated markets are being exploited in one form or other against the interests of the farming community. Thus, it became evident that, these regulated markets in the Telangana region of Andhra Pradesh in India are not efficient enough in discharging the regulatory provisions and hence, the farmers could not enjoy the true benefits of market regulation. It is in this context, the researchers made an attempt to analyse the technical efficiency in the functioning of regulated markets in Telangana region of Andhra Pradesh in India. It has seen that not many attempts were found in India in general and Telangana region in particular to analyse the efficiency of functions of regulated markets. In this background, this study is certainly a contribution in the analysis of efficiency of regulated markets. Thus this study explores the use of Data Envelopment Analysis(DEA) which is a powerful Operations Research tool appropriate for the context. This study is conducted with the following specific objectives:

- 1). To study whether the regulatory provisions contribute to the technical efficiency of the functioning of regulated markets and if they contribute, how they influence the efficiency.
- 2). To analyse the trends in the efficiency in the functioning of regulated markets.

II. METHODOLOGY

For analyzing the efficiency of regulated markets in India, Telangana region of Andhra Pradesh state has been purposefully selected, as the investigators hail from this state. (DEA) model was used to assess the technical efficiency of regulated markets in Telangana region of Andhra Pradesh in India. DEA is one of the most popular approaches used in the literature to appraise the performance of Decision Making Units (DMUs). It permits the selection of efficient markets with in the Telangana region. DEA was used in prior studies on the efficiency of financial institutions to examine the impact of some specific changes such as financial reforms, the impact of financial practices and the impact of different ownership groups. DEA assesses the efficiency frontier on the basis of all input and output information from the region. (Rogers, 1998). Thus, the relative efficiency of markets operating in the same region can be estimated (Fried et al. 2002). Hence, identification of performance indicators in regulated markets is useful for identifying a benchmark for the whole region. Moreover, the DEA methodology has the capacity to analyse multi-inputs and multi-outputs to assess the efficiency of institutions (Coelli, Rao & Battese 1998).

DEA model

Several DEA models have been presented in the literature. The basic DEA model evaluates efficiency based on the productivity ratio which is the ratio of outputs to inputs. This study applied Charnes, Cooper and Rhode's (CCR) (1978) model and Banker, Charnes and Cooper (BCC) (1984) model. The production frontier has constant returns to scale in CCR model. The basic CCR model formulation (dual problem/ envelopment form) is given by :

The basic CCR model formulation (dual problem/ envelopment form)

$$\text{Min}\theta - \varepsilon \left(\sum_{i=1}^m s_i^- + \sum_{r=1}^s s_r^+ \right)$$

Subject to :

$$\sum_{j=1}^n \lambda_j x_{ij} + s_i^- = \theta x_{i0} \quad (i=1, \dots, m)$$

$$\sum_{j=1}^n \lambda_j y_{rj} - s_r^+ = y_{r0} \quad (r=1, \dots, s)$$

$$\lambda_j \geq 0 \quad (j=1, \dots, n)$$

Source :Zhu (2003, p.13)

where, θ denotes the efficiency of DMU j , while y_{rj} is the amount of r^{th} output produced by DMU j using x_{ij} amount of i^{th} input. Both y_{rj} and x_{ij} are exogenous variables and λ_j represents the benchmarks for a specific DMU under evaluation (Zhu 2003). Slack variables are represented by s_i^- and s_r^+ . According to Cooper, Seiford and Tone (2004) the constraints of this model are :

- i. the combination of the input of firm j is less than or equal to the linear combination of inputs for the firm on the frontier;
- ii. the output of firm j is less than or equal to the linear combination of outputs for the firm on the frontier; and
- iii. the main decision variable θ_j lies between one and zero.

Further, the model assumes that all DMUs are operating at an optimal scale. However, imperfect competition and constraints to finance may cause DMUs to operate at some level different to the optimal scale (Coelli, Rao & Battese 1998). Hence, the Banker, Charnes and Cooper (1984) BCC model is developed with a production frontier that has variable returns to scale. The BCC model forms a convex combination of DMUs (Coelli, Rao & Battese 1998). Then the constant returns to scale linear programming problem can be modified to one with variable returns to scale by adding the convexity constraint $\sum \lambda_j = 1$. The model given below illustrates the basic BCC formulation (dual problem/envelopment form) :

The basic BCC model formulation (dual problem/envelopment form)

$$\text{Min}\theta - \varepsilon \left(\sum_{i=1}^m s_i^- + \sum_{r=1}^s s_r^+ \right)$$

Subject to :

$$\sum_{j=1}^n \lambda_j x_{ij} + s_i^- = \theta x_{i0} \quad (i=1, \dots, m)$$

$$\sum_{j=1}^n \lambda_j y_{rj} - s_r^+ = y_{r0} \quad (r=1, \dots, s)$$

$$\lambda_j \geq 0 \quad (j=1, \dots, n)$$

$$\sum_{j=1}^n \lambda_j = 1$$

Source :Zhu (2003, p.13)

This approach forms a convex hull of intersecting planes (Coelli, Rao & Battese 1998). These planes envelop the data points more tightly than the constant returns to scale (CRS) conical hull. As a result, the variable returns to scale (VRS) approach provides technical efficiency (TE) scores that are greater than or equal to scores obtained from the CRS approach (Coelli, Rao & Battese 1998). Moreover, VRS specifications will permit the calculation of TE decomposed into two components: scale efficiency (SE) and pure technical efficiency (PTE). Hence, this study first uses the CCR model to assess TE then applies the BCC model to identify PTE and SE for each DMU. The relationship of these concepts is given below :

Relationship between TE, PTE and SE

$$TE_{CRS} = PTE_{VRS} * SE$$

where TE_{CRS} = Technical efficiency of constant return to scale
 PTE_{VRS} = Technical efficiency of variable return to scale
 SE = Scale efficiency

Source : Coelli, et al., (1998).

The above relationship, which is unique, depicts the sources of inefficiency, i.e., whether it is caused by inefficient operation (PTE) or by disadvantageous conditions displayed by the scale efficiency (SE) or by both. If the scale efficiency is less than 1, the DMU will be operating either at decreasing return to scale (DRS) if a proportional increase of all input levels produces a less-than-proportional increase in output levels or increasing return to scale (IRS) at the converse case. This implies that resources may be transferred from DMUs operating at DRS to those operating at IRS to increase average productivity at both sets of DMUs (Boussofiane et al.,1992).

III. DATA AND VARIABLES FOR THE STUDY

Efficiency of a AMC depends on the facilities available with the AMC such as drying platforms, storage units, market functionaries etc., which leads to good amount of arrivals and in turn AMC earns countable market fees creating employment. DEA assumes that, the inputs and outputs have been correctly identified. Usually as the number of inputs and outputs increase, more DMUs tend to get an efficiency rating of 1 as they become too specialized to be evaluated with respect to other units. On the other hand, if there are too few inputs and outputs, more DMUs tend to be comparable. In any study, it is important to focus on correctly specifying inputs and outputs. DEA is commonly used to evaluate the efficiency of a number of AMCs and it is a multi-factor productivity analysis model for measuring the relative efficiency of a homogeneous set of regulated markets (DMUs). For every inefficient AMC, DEA identifies a set of corresponding efficient AMC that can be utilized as benchmarks for improvement of performance and productivity. DEA is developed based on two scale of assumptions viz., Constant Return to Scale (CRS) model and Variable Return to Scale (VRS) model. CRS means that the producers are able to linearly scale the inputs and outputs without increasing or decreasing efficiency. This is a significant assumption. The assumption of CRS may be valid over limited ranges but its use must be justified. As an aside, CRS tends to lower the efficiency scores while VRS tends to raise efficiency scores.

For enabling the study of evaluation of AMC's we have the following resources(inputs) and productivity indicators or outputs :

- Inputs :** X_1 - Arrivals(in Qtls), X_2 - Amenities & facilities(in MTs.)
 X_3 - Market functionaries(in Nos.), (X_4) - Notified market area(in Kms)
Outputs : Y_1 - Valuation(Rs. in Lakhs), Y_2 - Market fees(Rs. in Lakhs)
 Y_3 - Staff position(in Nos.)

The study involves the application of DEA to assess the efficiency of 128 AMCs in Telangana region(nine districts, excluding Hyderabad district since it is a urban district and having only 3 AMCs) of Andhra Pradesh State in India during the years 2005-06, 2006-07, 2007-08 and 2008-09. The data used for assessment was obtained from the Annual Reports published by Directorate of Marketing and Inspection(vide ref : www.agmarknet.nic.in) and from the Annul Administrative Reports of the selected AMCs. DEA is applied separately for each year using input-orientation with radial distances to the efficient frontier. By running these programmes with the same data under CRS and VRS assumptions, measures of overall technical efficiency (TE) and 'pure' technical efficiency(PTE) are obtained, along with scale efficiencies. The details were shown in Tables (1) to (3).

IV. RESULTS AND DISCUSSION

The main theme of the present study is to assess the performance of AMCs in nine districts viz., Adilabad, Karimnagar, Khammam, Mahabubnagar, Medak, Nalgonda, Nizamabad, Rangareddy, Warangal which are located in Telangana region of Andhra Pradesh state in India. The study intends to assess the efficiency of facilities in AMCs and thereby improving infrastructure of AMCs to provide suitable marketing avenues for farming community.

PERFORMANCE OF AMCs AT REGIONAL LEVEL: The findings of DEA portrayed through Table 1 revealed the following salient information :

- Nearly 41 percent i.e. 52 out of 128 total AMCs in Telalngana region are operated at Constant Return to Scale(CRS) in the entire period of study, that is 2005-06 to 2008-09. This reveals that these 52 AMCs in Telangana region are operating with stability, balancing the inputs(resources contained in these) to satisfy the outputs i.e. the purpose of AMCs. These are :

S.No.	Name of AMC	Return to Scale			
		2005-06	2006-07	2007-08	2008-09
1	ADILABAD	crs	crs	crs	crs
2	ASIFABAD	crs	crs	crs	crs

3	ECHODA	crs	crs	crs	crs
4	KAGAZNAGAR	crs	crs	crs	crs
5	GANGADHARA	crs	crs	crs	crs
6	JAGITIAL	crs	crs	crs	crs
7	JAMMIKUNTA	crs	crs	crs	crs
8	KARIMNAGAR	crs	crs	crs	crs
9	KATARAM	crs	crs	crs	crs
10	PEDDAPALLI	crs	crs	crs	crs
11	POTHUGAL	crs	crs	crs	crs
12	SULTANABAD	crs	crs	crs	crs
13	VEMULAWADA	crs	crs	crs	crs
14	BURGAMPAHAD	crs	crs	crs	crs
15	DHAMMAPETA	crs	crs	crs	crs
16	ENKOOR	crs	crs	crs	crs
17	KALLUR	crs	crs	crs	crs
18	KHAMMAM	crs	crs	crs	crs
19	SATHUPALLI	crs	crs	crs	crs
20	WYRA	crs	crs	crs	crs
21	ALAMPUR	crs	crs	crs	crs
22	BADEPALLY	crs	crs	crs	crs
23	GADWAL	crs	crs	crs	crs
24	KALWAKURTHY	crs	crs	crs	crs
25	KOLLAPUR	crs	crs	crs	crs
26	KOSGI	crs	crs	crs	crs
27	MAHABUBNAGAR	crs	crs	crs	crs
28	SHADNAGAR	crs	crs	crs	crs
29	NARAYANKHED	crs	crs	crs	crs
30	NARSAPUR	crs	crs	crs	crs
31	SADASHIVPET	crs	crs	crs	crs
32	SIDDIPET	crs	crs	crs	crs
33	ALAIR	crs	crs	crs	crs
34	HUZURNAGAR	crs	crs	crs	crs
35	KODAD	crs	crs	crs	crs
36	NIDMANOOR	crs	crs	crs	crs
37	VALIGONDA	crs	crs	crs	crs
38	ARMOOR	crs	crs	crs	crs
39	BANSWADA	crs	crs	crs	crs
40	BODHAN	crs	crs	crs	crs
41	GANDHARI	crs	crs	crs	crs
42	KAMAREDDY	crs	crs	crs	crs
43	NIZAMABAD	crs	crs	crs	crs
44	MARPALLY	crs	crs	crs	crs
45	NARSINGI	crs	crs	crs	crs
46	TANDUR	crs	crs	crs	crs
47	KESAMUDRAM	crs	crs	crs	crs
48	KODAKANDLA	crs	crs	crs	crs
49	MULUG	crs	crs	crs	crs
50	NARSAMPET	crs	crs	crs	crs
51	PARKAL	crs	crs	crs	crs
52	WARANGAL	crs	crs	crs	crs

- About 16 percent i.e. 20 out of 128 total AMC's in Telangana region are operating with Increasing Return to Scale(IRS) through out the study period which reveal that these are showing encouraging trial to promote the purpose subject to additional inputs or resources are support. Infact these AMC's do need encouragement to promote the goal or purpose of AMC's. These are :

S.No.	Name of AMC	Return to Scale			
		2005-06	2006-07	2007-08	2008-09
1	BOATH	irs	irs	irs	irs
2	CHENNUR	irs	irs	irs	irs
3	JAINATH	irs	irs	irs	irs
4	JAINOOR	irs	irs	irs	irs
5	KHANAPUR	irs	irs	irs	irs
6	SARANGAPOOR	irs	irs	irs	irs
7	GOLLAPALLY	irs	irs	irs	irs
8	HUSNABAD	irs	irs	irs	irs
9	HUZURABAD	irs	irs	irs	irs
10	KORUTLA	irs	irs	irs	irs
11	MANTHANI	irs	irs	irs	irs
12	METPALLY	irs	irs	irs	irs
13	AMANGAL	irs	irs	irs	irs
14	ATHMAKUR	irs	irs	irs	irs
15	DUBBAK	irs	irs	irs	irs
16	JOGIPET	irs	irs	irs	irs
17	RAMAYAMPET	irs	irs	irs	irs
18	THOGUTA	irs	irs	irs	irs
19	PARIGI	irs	irs	irs	irs
20	GHANPUR(STN)	irs	irs	irs	irs

- However it is regrettable to note that some of the other AMCs shown below are operating with Decreasing Return to Scale(DRS) through out the study period which implies that the resources are not utilized properly and wasted. Those AMCs are :

S.No.	Name of AMC	Return to Scale			
		2005-06	2006-07	2007-08	2008-09
1	CHANDUR	DRS	DRS	DRS	DRS
2	CHOUTUPPAL	DRS	DRS	DRS	DRS

Further it is observed that AMCs like Dharmaram, Nelakondapalli, Achampet, W.P.Town, Chityal and Halia are exhibiting dismal performance regarding operational efficiency of the resources, i.e., they are operated with DRS for three years of reference period of study which indicates that the resources of these AMCs have to be transferred to AMCs operated with IRS. It is also noticed that some of the AMCs have shown a shift in the return to scale pattern i.e either from IRS to CRS or vice-versa implying that, there is increased resource use efficiency i.e., with reference to the exploitation of resources usage . Hence, these AMCs have shown an increased pace of return to scale(RTS) in the recent year 2008-09 compared to the earlier periods. However it is disheartening to say that, the selected AMCs like Bhainsa, Madhira, Nagarkurnool, Nakrekal, Miryalguda and Suryapet are showing dismal performance regarding the operational efficiency of the resources, as the RTS had shown a shift either from IRS to DRS or from CRS to DRS.

PERFORMANCE OF AMCs AT DISTRICT LEVEL: Mean technical efficiency of AMCs in Telangana region district-wise was obtained and shown in table-2 and 3. Interestingly some of the following observations are established.

- In Telangana region more number of efficient AMCs are identified compared to inefficient AMCs which reveal that the purpose of AMCs are significant in this part of Andhra Pradesh.
- Further it is interesting and encouraging to note that number of efficient AMCs increased from the financial year 2005-06 to 2008-09 which is a positive growth and trend for the promotion of AMCs actively as per the intention of Government scheme in the Telangana region of Andhra Pradesh.

Among selected districts, Warangal district had exhibited highest scale efficiency for two years i.e., 2005-06 and 2008-09 and Nizamabad district is having highest scale efficiency for two years i.e., 2006-07 and 2007-08. The districts with least scale efficiencies are Medak, Rangareddy, Warangal and Adilabad in the years 2005-06, 2006-07, 2007-08 and 2008-09 respectively. Regarding mean technical efficiency, no district is constant in its position throughout the reference period of study.

The informal discussions held with AMC Officials revealed the following interesting points for this heartening performance:

- Farmers are showing positive attitude for transacting their produce in the AMCs compared to local markets on account of the competitive price being realized in the AMCs.
- Strengthening of infrastructure in the market yards like grading, processing, marketing information network, storage facilities etc.
- More encouragement by the Government in the form of implementing pledge loan scheme, Rythu Bandhu Padhakam etc.
- Regulation of marketing practices and marketing costs.

V. CONCLUSIONS

The analyses reveal that nearly 67 percent of the overall 128 AMC in Telangana region seen to be performing optimally (efficiently fulfilling the purpose) balancing the resources. However still 33 percent of the overall 128 AMCs, the efficiency is behind optimal level. Among this, 29 percent of AMCs are not achieving the best performance due to lack of availability of adequate resources while improvement can be established with augmenting adequate resources (inputs). However, other 4 percent of AMCs do not perform efficiently due to lack of motivation since the resources are under utilized and does not exhibit the fulfillment of optimal performance inspite of adequate resources. Therefore the study identifies that the resources which are unutilized in some of the AMCs can be distributed to those which are lagging behind due to scarcity of resources to promote and strengthen the overall activity of AMC performance in this region. This will promote 90 percent of AMCs to achieve optimal performance within the region and to participate in the wellbeing of farming community as per the intention of the Government support.

REFERENCES

- [1] Banker, R.D., Charnes, A. & Cooper, W.W. (1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management Science*, 30, 1078-1092.
- [2] Boussofiane, A., Dyson, R.G. & Thanassoulis, E. (1992). Applied data envelopment analysis. *European Journal of Operations Research*, 52, 1-15.
- [3] Charnes, A., Cooper, W.W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European Journal of Operations Research*, 2, 429-444.
- [4] Coelli, T., Rao, D. & Battese, G. (1998). *An introduction to efficiency and productivity analysis*. Kluwer Academic Publisher group, London.
- [5] Cooper, W.W., Seiford, L.M. & Tone, K. (2004). *Data Envelopment Analysis, a comprehensive text with models*. Kluwer Academic Publisher group, London.
- [6] Fried, H., Lovell, C., Schmidt, S. & Yaisawarng, S. (2002). Accounting for environmental effects and statistical noise in data envelopment analysis. *Journal of Productivity Analysis*, 17, 157-174.
- [7] Rogers, M. (1998). The definition and measurement of productivity. The university of Melbourne, Australia; Melbourne institute of applied economics and social research.
- [8] Zhu, J. (2003). *Quantitative models for performance evaluation and benchmarking*, Kluwer Academic Publishers group, London.
- [9] www.agmarketnet.nic.in - Website.

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Table 1 : CRS, VRS, Scale efficiency and RTS of selected AMCs

S.No.	Name of AMC	2005-06				2006-07				2007-08				2008-09			
		CRS	VRS	Scale	RTS	CRS	VRS	Scale	RTS	CRS	VRS	Scale	RTS	CRS	VRS	Scale	RTS
1	ADILABAD	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
2	ASIFABAD	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
3	BHAINSA	1	1	1	crs	1	1	1	crs	0.978	1	0.978	DRS	0.7941	1	0.7941	DRS
4	BOATH	0.8829	0.9585	0.9211	irs	0.8024	0.9895	0.8109	irs	0.9488	1	0.9488	irs	0.8479	0.9503	0.8923	irs
5	CHENNUR	0.6816	1	0.6816	irs	0.6816	1	0.6816	irs	0.8953	1	0.8953	irs	0.7476	1	0.7476	irs
6	ECHODA	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
7	INDERVELLY	1	1	1	crs	1	1	1	crs	1	1	1	crs	0.7876	1	0.7876	irs
8	JAINATH	0.7008	1	0.7008	irs	0.7126	1	0.7126	irs	0.8836	1	0.8836	irs	0.7008	1	0.7008	irs
9	JAINOOR	0.8303	1	0.8303	irs	0.7338	0.9902	0.7411	irs	0.7925	1	0.7925	irs	0.5261	1	0.5261	irs
10	KAGAZNAGAR	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
11	KHANAPUR	0.7449	0.9928	0.7503	irs	0.7449	0.9928	0.7503	irs	0.7449	0.9928	0.7503	irs	0.7488	0.9928	0.7542	irs
12	KUBEER	1	1	1	crs	1	1	1	crs	1	1	1	crs	0.3248	0.9201	0.3531	irs
13	LUXETTIPET	1	1	1	crs	1	1	1	crs	0.9246	1	0.9246	DRS	1	1	1	crs
14	MANCHERIAL	1	1	1	crs	1	1	1	crs	1	1	1	crs	0.7873	0.9507	0.8281	irs
15	NIRMAL	0.8419	0.9021	0.9333	DRS	0.9234	0.941	0.9813	DRS	0.8453	0.8599	0.983	irs	0.7358	0.7667	0.9597	irs
16	SARANGAPOOR	0.9022	1	0.9022	irs	0.7025	1	0.7025	irs	0.7671	1	0.7671	irs	0.5909	1	0.5909	irs
17	CHOPPADANDI	0.9357	1	0.9357	irs	0.9587	1	0.9587	irs	0.8869	1	0.8869	irs	1	1	1	crs
18	DHARMAPURI	0.8007	0.9422	0.8498	irs	0.8884	0.9785	0.908	irs	0.8207	0.9422	0.8711	irs	1	1	1	crs
19	DHARMARAM	0.9491	0.9885	0.9601	DRS	1	1	1	crs	0.9054	0.9561	0.9469	DRS	0.8997	0.916	0.9822	DRS
20	GANGADHARA	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
21	GOLLAPALLY	0.6605	0.9024	0.7319	irs	0.671	0.9117	0.7359	irs	0.7574	0.9026	0.8392	irs	0.63	0.9093	0.6929	irs
22	HUSNABAD	0.7677	0.881	0.8714	irs	0.7423	0.8941	0.8302	irs	0.6756	0.8028	0.8415	irs	0.5452	0.8187	0.6659	irs
23	HUZURABAD	0.4367	0.8047	0.5427	irs	0.4586	0.7984	0.5744	irs	0.4411	0.7984	0.5524	irs	0.6274	0.8096	0.775	irs
24	JAGITIAL	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
25	JAMMIKUNTA	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
26	KARIMNAGAR	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
27	KATARAM	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
28	KORUTLA	0.6251	0.9429	0.663	irs	0.5526	0.9336	0.5919	irs	0.6193	0.9345	0.6628	irs	0.7307	0.9459	0.7724	irs
29	MALLIAL	1	1	1	crs	0.6	1	0.6	irs	0.7562	1	0.7562	irs	0.5675	1	0.5675	irs
30	MANTHANI	0.4237	0.8126	0.5214	irs	0.5529	0.9776	0.5655	irs	0.4329	0.9782	0.4425	irs	0.2879	0.8781	0.3279	irs
31	METPALLY	0.7714	0.8013	0.9627	irs	0.7754	0.8343	0.9295	irs	0.5658	0.7509	0.7535	irs	0.6583	0.8095	0.8132	irs
32	PEDDAPALLI	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs

33	POTHUGAL	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
34	SIRICILLA	1	1	1	crs	0.9825	1	0.9825	irs	0.9054	1	0.9054	irs	1	1	1	crs

Table 1 (Cont'd) : CRS, VRS, Scale efficiency and RTS of selected AMCs

35	SULTANABAD	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
36	VEMULAWADA	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
37	BADHRACHALAM	1	1	1	crs	1	1	1	crs	0.9609	1	0.9609	irs	1	1	1	crs
38	BURGAMPAHAD	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
39	DHAMMAPETA	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
40	ENKOOR	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
41	KALLUR	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
42	KHAMMAM	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
43	KOTHAGUDEM	1	1	1	crs	1	1	1	crs	0.8154	0.8812	0.9253	irs	1	1	1	crs
44	MADHIRA	1	1	1	crs	1	1	1	crs	1	1	1	crs	0.8974	1	0.8974	DRS
45	NELAKONDAPALLI	0.9145	0.9836	0.9298	DRS	0.9449	1	0.9449	DRS	1	1	1	crs	0.8776	0.9158	0.9583	DRS
46	Nugurucherla (HQ)	0.8199	0.8938	0.9174	DRS	1	1	1	crs	1	1	1	crs	0.9271	0.9935	0.9332	DRS
47	SATHUPALLI	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
48	WYRA	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
49	YELLANDU	0.7305	1	0.7305	DRS	0.9302	1	0.9302	DRS	1	1	1	crs	1	1	1	crs
50	ACHAMPET	0.6494	0.6658	0.9754	irs	0.6587	0.6634	0.9929	DRS	0.8115	0.9265	0.8759	DRS	0.5872	0.6211	0.9454	DRS
51	ALAMPUR	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
52	AMANGAL	0.7121	0.9177	0.7759	irs	0.7435	0.9177	0.8102	irs	0.9384	0.9612	0.9763	irs	0.9454	0.964	0.9807	irs
53	ATHMAKUR	0.4413	0.8914	0.4951	irs	0.4303	0.8666	0.4966	irs	0.5577	0.9492	0.5876	irs	0.6743	1	0.6743	irs
54	BADEPALLY	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
55	DEVARAKADRA	0.6106	0.9255	0.6598	irs	0.7043	0.9223	0.7636	irs	0.887	0.9538	0.93	irs	1	1	1	crs
56	GADWAL	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
57	KALWAKURTHY	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
58	KOLLAPUR	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
59	KOSGI	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
60	MAHABUBNAGAR	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
61	MAKTHAL	1	1	1	crs	0.7987	0.8114	0.9844	irs	0.7873	0.7926	0.9933	irs	0.742	0.7425	0.9993	irs
62	NAGARKURNOOL	1	1	1	crs	1	1	1	crs	1	1	1	crs	0.8651	0.9249	0.9353	DRS
63	NARAYANPET	0.7986	0.9122	0.8755	irs	0.8987	0.9568	0.9393	irs	1	1	1	crs	1	1	1	crs
64	SHADNAGAR	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
65	W.P.ROAD	1	1	1	crs	1	1	1	crs	1	1	1	crs	0.9576	1	0.9576	irs

66	W.P.TOWN	0.5616	0.5723	0.9814	irs	0.4784	0.4915	0.9733	DRS	0.4925	0.5123	0.9612	DRS	0.6892	0.7155	0.9633	DRS
67	DUBBAK	0.3653	1	0.3653	irs	0.3776	1	0.3776	irs	0.5081	1	0.5081	irs	0.3025	1	0.3025	irs
68	GAJWEL	1	1	1	crs	0.8335	0.8844	0.9425	DRS	1	1	1	crs	0.7045	0.7362	0.9569	irs
69	JOGIPET	0.5742	0.973	0.5901	irs	0.5916	0.9005	0.6569	irs	0.6523	0.8776	0.7433	irs	0.5494	0.826	0.6651	irs
70	MEDAK	1	1	1	crs	1	1	1	crs	0.9122	1	0.9122	DRS	1	1	1	crs

Table 1 (Cont'd) : CRS, VRS, Scale efficiency and RTS of selected AMCs

71	NARAYANKHED	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
72	NARSAPUR	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
73	RAMAYAMPET	0.9869	1	0.9869	irs	0.9379	1	0.9379	irs	0.9709	1	0.9709	irs	0.9228	1	0.9228	irs
74	SADASHIVPET	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
75	SIDDIPET	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
76	THOGUTA	0.4624	0.8048	0.5746	irs	0.382	0.8519	0.4484	irs	0.654	1	0.654	irs	0.1587	0.5222	0.3039	irs
77	ZAHEERABAD	1	1	1	crs	1	1	1	crs	1	1	1	crs	0.7888	0.8988	0.8776	irs
78	ALAIR	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
79	BHONGIR	0.4445	1	0.4445	irs	0.461	1	0.461	irs	0.4752	1	0.4752	irs	1	1	1	crs
80	CHANDUR	0.805	0.8806	0.9142	DRS	0.8886	0.8972	0.9903	DRS	0.8074	0.8264	0.9769	DRS	0.6115	0.62	0.9863	DRS
81	CHITYAL	0.8526	0.8669	0.9834	DRS	0.6894	0.7045	0.9786	irs	0.8572	0.8696	0.9858	DRS	0.6798	0.6802	0.9994	DRS
82	CHOUTUPPAL	0.8138	0.8284	0.9824	DRS	0.7331	0.7344	0.9982	DRS	0.7926	0.8036	0.9863	DRS	0.7683	0.8939	0.8596	DRS
83	DEVARAKONDA	0.8139	1	0.8139	irs	1	1	1	crs	0.8004	1	0.8004	irs	1	1	1	crs
84	HALIA	0.8895	0.9318	0.9546	DRS	1	1	1	crs	0.8139	0.8452	0.9629	DRS	0.9077	0.9736	0.9323	DRS
85	HUZURLAGAR	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
86	THIRUMALAGIRI	0.4491	0.4957	0.9061	irs	1	1	1	crs	1	1	1	crs	1	1	1	crs
87	KODAD	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
88	MIRYALAGUDA	1	1	1	crs	0.6107	0.7516	0.8125	irs	0.4869	0.704	0.6916	irs	0.5019	0.5953	0.843	DRS
89	MOTHKUR	0.482	0.8434	0.5715	irs	0.8023	0.8366	0.9589	DRS	0.6181	0.6225	0.9928	irs	1	1	1	crs
90	NAKREKAL	0.7157	0.7564	0.9462	DRS	1	1	1	crs	1	1	1	crs	0.9519	1	0.9519	DRS
91	NALGONDA	0.9082	1	0.9082	DRS	0.7527	0.8371	0.8992	irs	0.7582	0.8317	0.9117	irs	0.8001	0.8462	0.9455	irs
92	NEREDUCHERLA	0.7428	0.8206	0.9052	irs	1	1	1	crs	1	1	1	crs	1	1	1	crs
93	NIDMANOOR	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
94	SURYAPET	1	1	1	crs	0.6648	0.7615	0.873	irs	0.3906	0.4863	0.8033	irs	0.7366	0.7694	0.9574	DRS
95	VALIGONDA	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
96	Venkateswara Nagar	1	1	1	crs	1	1	1	crs	1	1	1	crs	0.9751	0.9838	0.9912	irs
97	ARMOOR	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
98	BANSWADA	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs

99	BODHAN	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
100	GANDHARI	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
101	KAMAREDDY	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
102	MADNOOR	0.8378	0.8742	0.9583	irs	1	1	1	crs	1	1	1	crs	0.9349	1	0.9349	irs
103	NIZAMABAD	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
104	PITLAM	0.9922	1	0.9922	irs	0.9426	1	0.9426	irs	0.9677	1	0.9677	irs	1	1	1	crs
105	VARNI	1	1	1	crs	1	1	1	crs	1	1	1	crs	0.7042	0.8244	0.8541	irs
106	YELLAREDDY	0.8627	1	0.8627	irs	1	1	1	crs	1	1	1	crs	1	1	1	crs

Table 1 (Cont'd) : CRS, VRS, Scale efficiency and RTS of selected AMCs

107	CHEVELLA	1	1	1	crs	0.4624	1	0.4624	irs	1	1	1	crs	1	1	1	crs
108	IBRAHIMPATNAM	0.9786	0.9787	0.9999	DRS	1	1	1	crs	0.9627	0.9628	0.9998	DRS	0.9463	0.9602	0.9855	irs
109	MARPALLY	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
110	MEDCHAL	0.7567	0.9691	0.7809	irs	0.9726	1	0.9726	irs	1	1	1	crs	1	1	1	crs
111	NARSINGI	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
112	PARIGI	0.9096	1	0.9096	irs	0.7733	1	0.7733	irs	0.8218	1	0.8218	irs	0.7328	1	0.7328	irs
113	SARDARNAGAR	1	1	1	crs	0.5	0.7363	0.6791	irs	1	1	1	crs	0.7873	1	0.7873	irs
114	SHANKERPALLY	1	1	1	crs	0.5613	0.9621	0.5834	irs	1	1	1	crs	1	1	1	crs
115	TANDUR	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
116	VIKARABAD	1	1	1	crs	0.9623	1	0.9623	irs	1	1	1	crs	1	1	1	crs
117	CHERIAL	1	1	1	crs	1	1	1	crs	0.4713	0.6456	0.73	irs	1	1	1	crs
118	GHANPUR(STN)	0.8811	0.9501	0.9274	irs	0.5669	0.8395	0.6753	irs	0.3589	0.7458	0.4813	irs	0.9079	0.9288	0.9775	irs
119	JANGAON	0.9881	0.9891	0.9989	irs	0.8283	0.9064	0.9139	irs	0.6039	0.7727	0.7816	irs	1	1	1	crs
120	KESAMUDRAM	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
121	KODAKANDLA	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
122	MAHABUBABAD	1	1	1	crs	1	1	1	crs	0.4886	0.6503	0.7513	irs	1	1	1	crs
123	MULUGU	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
124	NARSAMPET	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
125	PARKAL	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
126	THORRUR	0.9745	0.9924	0.9819	DRS	1	1	1	crs	0.4543	0.6451	0.7042	irs	0.9415	0.9446	0.9967	irs
127	WARANGAL	1	1	1	crs	1	1	1	crs	1	1	1	crs	1	1	1	crs
128	WARDHANNAPET	0.9009	1	0.9009	irs	0.514	1	0.514	irs	0.3806	1	0.3806	irs	1	1	1	crs
	MEAN	0.903	0.966	0.9317		0.8897	0.9647	0.9196		0.8891	0.9546	0.9265		0.8907	0.9574	0.9261	
	S.D.	0.1634	0.0813	0.1348		0.1765	0.0826	0.1517		0.1795	0.1035	0.1371		0.1789	0.0954	0.1505	

Table 2: District-wise and Year-wise Mean Technical Efficiencies

District	2005-06			2006-07			2007-08			2008-09		
	CRS	VRS	SCALE	CRS	VRS	SCALE	CRS	VRS	SCALE	CRS	VRS	SCALE
ADB	0.9115	0.9908	0.9200	0.8938	0.9945	0.8987	0.9238	0.9907	0.9327	0.7870	0.9737	0.8084
KRMR	0.8685	0.9538	0.9019	0.8591	0.9664	0.8838	0.8383	0.9533	0.8729	0.8473	0.9544	0.8799
KMM	0.9588	0.9906	0.9675	0.9904	0.9999	0.9905	0.9828	0.9909	0.9912	0.9771	0.9930	0.9838
MBNR	0.8690	0.9344	0.9272	0.8654	0.9194	0.9388	0.9103	0.9468	0.9603	0.9095	0.9393	0.968
MDK	0.8535	0.9798	0.8652	0.8293	0.9670	0.8512	0.8816	0.9889	0.8899	0.7661	0.9076	0.8208
NGD	0.8377	0.917	0.9121	0.8738	0.9223	0.9459	0.8316	0.8942	0.9256	0.8912	0.9138	0.9719
NZB	0.9693	0.9874	0.9813	0.9943	0.9999	0.9944	0.9968	0.9999	0.9969	0.9639	0.9824	0.9789
RGR	0.9645	0.9948	0.9690	0.8232	0.9698	0.8433	0.9070	0.9202	0.9099	0.8864	0.9229	0.8871
WRL	0.9787	0.9943	0.9841	0.9091	0.9788	0.9253	0.7298	0.8716	0.8191	0.9875	0.9895	0.9979

Note : ADB=Adilabad, KRMR=Karimnagar, KMM=Khammam, MBNR=Mahabubnagar, MDK=Medak, NGD=Nalgonda, NZB=Nizamabad, RGR=Rangareddy, WRL=Warangal.

Table 3: Descriptive statistics of selected AMCs

Description	2005-06			2006-07			2007-08			2008-09		
	CRS	VRS	SCALE	CRS	VRS	SCALE	CRS	VRS	SCALE	CRS	VRS	SCALE
No. of AMCs evaluated	128	128	128	128	128	128	128	128	128	128	128	128
No. of efficient AMCs	78	93	78	79	94	79	76	95	76	77	93	77
No. of Inefficient AMCs	50	35	50	49	34	49	52	33	52	51	35	51
Mean Score	0.9030	0.9660	0.9317	0.8897	0.9647	0.9196	0.8891	0.9546	0.9265	0.8907	0.9574	0.9261
Standard Deviation	0.1634	0.0813	0.1348	0.1765	0.0826	0.1517	0.1795	0.1035	0.1371	0.1789	0.0954	0.1505
Maximum Score	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Minimum Score	0.3653	0.4957	0.3653	0.3776	0.4915	0.3776	0.3589	0.4863	0.3806	0.1587	0.5222	0.3025