# Performance Appraisal of Iranian Municipalities by DEA Method

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## Abstract

Efficiency is one of economic concepts, which its enhancement has always been at the focus of politics and economy practitioners in order to improve standard of living, prosperity, peace, and human security; so that all economic schools and communities relatively emphasize this notion and suggest proper political advices to increase efficiency of various factors. Nowadays, regarding the qualitative and quantitative development of cities, the role of municipalities in urban management increasingly highlighted; thus, measuring the efficiency of municipalities is necessary for planning and better performance of municipalities. The present research tried to measure the performance of municipalities exceeding one hundred people through using DEA method and constant return to output-based scale (CCR-O) and variable return to output-based scale (BCC-O) in 2010; regarding municipalities' relatively stable revenues, permanent revenues, semi-stable and totally unstable revenues as two inputs; and costs of urban and administrative services, as well as urban construction (including 1. Improved urban traffic; 2. Improved urban environment; and 3. Establishing entertainment and income-generating facilities) as five outputs. Obtained results indicate that 16 of 44 understudy municipalities i.e. 36.36% and 17 municipalities (38.64%) are efficient in CCR and BCC methods, respectively. The mean efficiency of the first method is 86.97% and 27.87% for the second method. Moreover, once municipalities totally ranked and an efficient virtual model introduced for inefficient municipalities, the main cause of inefficiency assigned to their extreme deviation from sufficient municipalities in costs of building cultural and sport places, which requires the highest attention at change average of 240%.

**Keywords:** Performance evaluation, efficiency, municipality, data envelopment analysis (DEA), urban costs, urban revenues.

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## Introduction

Any organization requires evaluation system to determine desirability level and quality of activities particularly in dynamic and complex contexts. Lack of control and evaluation system means deficiency in communication inside and outside organization, which its outcome for organization is aging and finally death (Baba Akbari, 2005; 3). Existence or non-existence of an effective and efficient performance evaluation system directly relates with an organization's life and death that its deficiency viewed as organizational disease. What cannot be assessed cannot be properly dealt with. Organizations need to utilize scientific models in performance evaluation for proper management so that enable to measure their effort amount and results.

In recent years, assessing organizational performance caused extending frameworks and methodologies including balanced scoring, organizational excellence models, activity-based costing, etc. each providing extensive advantages. One of the most effective methods in dealing with large data and estimating efficiency is "data envelopment analysis" (DEA) that is a powerful, standard, and transparent methodology, though some constraints, allowing management to simultaneously analyze relatively large numbers of inputs and outputs through different scales. DEA is a new, innovative technique establishes mathematical planning in management quantity models.

On the other hand, municipality is a public, non-governmental organization founded at urban level to meet citizens' local developmental, entertainment, and servicing needs and to handle urban facilities' affairs. The first municipalities formally founded in Iran following the approval of Baladiye in 1907. Municipalities possess abundant powers and duties; further, they have extended relations with other organizations. Of municipalities' responsibilities include transportation (taxi and bus systems), green space, city sanitary, issuing building permit, trade and craft affairs, fruit and vegetable markets, etc. (Taheri, 1998).

These semi-profit departments undergo some costs to perform tasks and deliver city services; as they are almost non-governmental organizations, most costs supplied through income and taxes and less than 10% of the total budget of municipalities comes from government assist. However, small municipalities get more shares from department of the interior (Urban studies and planning center, 2002).

Municipalities, regarding their inherent duties, including 1. Urban services; 2. Architecture and urban planning; 3. Traffic and transportation; 4. Social and cultural; 5. Technical and construction; and 6. Financial and income, is one of the most influential institutes in citizens' daily life. Therefore, evaluating the performance of municipalities is critically important requiring a method to simultaneously analyze all these factors and offer a coherent framework for determining efficient municipalities considering the complexity of activities, large inputs, and outputs.

Moreover, it is clear that once municipalities' performance evaluated, the next step is comparing the two. Comparison must rely on a real comparison in order to objectively compare the performance of municipalities considering real and observable data

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disregarding subjective standards; this is what the present research did. The main characteristics of this method are as follows:

1. This method introduced some of DMUs as efficient and by which created efficient border; then, assigned this border as evaluation criterion of other units. Thus, evaluation criterion is DMUs operative in similar conditions.

2. The second important characteristic of this analysis is "combined evaluation of a set of factors"; thus, it jointly evaluates all inputs and outputs.

3. Other feature is "compensation" characteristic. Simply, this characteristic allows any DMU to compensate its deficiency in each input and output by the help of other inputs or outputs.

4. Considering that data envelopment analysis models solved through linear planning and linear planning method is not sensitive to measurement unit; thus, inputs and outputs can use different measurement units.

5. Data envelopment analysis method is a management approach relatively measuring DMU's efficiency and offering management strategies. To do this, the decision-maker unit determines benchmark. This unit introduces the benchmark and reference for inefficient units in order to enhance its efficiency through benchmarking by inefficient units and achieve efficiency limit (Fazli and Azar, 2002; 122).

Today, after three decades of revolution obtaining increasingly growth in various domains, urban management domain is still the most neglected management areas in spite of all achievements in service deliveries. Lack of a proper activity model led to a chain trial and error movement by urban management; thus, finding the proper combination of inputs and outputs based on accurate indicators makes achievement road clear for mayors as a roadmap to continue activity. Moreover, in public organizations such as municipalities, designing and establishing performance evaluation system can lead to proper directing of management to achieve goals, efficiency, and efficacy of activities, and desired responsibility to citizens.

Thus, according to the prominent role of municipalities as a dynamic institute in urban servicing, this research tries to evaluate the performance of municipalities with over one hundred thousand population. To do this, the best indicators, inputs, and outputs selected to evaluate municipality's performance; next, efficient, and inefficient municipalities identified and ranked; then, a benchmark is offered to obtain efficiency border of inefficient municipalities from efficient municipalities.

## Research background

Considering the long history of founding municipalities in Iran exceeding one hundred years, and great experiences, few studies conducted on the role of municipalities studying their performance in cities the results of which can be used here. Some of the scientific sources, papers, and thesis about this issue are as follows:

Basiri Parsa (1993) studied the efficiency of municipalities in Hamadan province through using DEA method. The results show that less than 50% of municipalities were completely efficient within the study period; while, many municipalities never attained full performance.

Akbari, Bidarom, and Nasr Isfahani (1993) measured technical efficiency of developmental activities of Isfahan municipality in urban areas using DEA. Assuming CCR-O, four areas; and by assuming BCC-O, areas two, four, five, and six were identified as efficient.

Vanden Ikat et al (1993) measured cost efficiency of 235 municipalities in Belgium through using DEA and FDH methods. Researchers concluded using CCR-O only 7% of municipalities are totally efficient and 20% are efficient by BCC-O method.

Michaleuv et al (1996) evaluated efficiency of 24 cities in Bulgaria using DEA method. According to CCR-O, 62% of all municipalities were inefficient.

Vartingthon et al (2001) measured technical and scale efficiency of 103 local states in Australia through using DEA method. The results demonstrate that 42 units of 103 municipalities had net technical efficiency and 37 units had scale efficiency.

Sempiadsouza and Stousik (2003) estimated technical efficiency of 4796 municipalities by using DEA method in Brazil. Obtained results reveal that there is a direct relation between municipality size and efficiency levels. Furthermore, inefficiency in most municipalities can be outcome of uncontrollable exogenous factors such as natural and climate factors as well as political outcomes.

## Materials and methods

The present paper evaluates municipalities' performances using DEA method in a case study of municipalities with the population exceeding 100'000 people. The statistical population of the present research were 80 municipalities over 100'000 population. In order to better evaluate municipalities' performances, data of all research participants were gathered; and finally, data of 55% of understudied municipalities were collected through municipality organization, general governor office urban management office and understudied municipalities. Data were analyzed using GAMS software.

Complementary data were collected through other approaches including documentary and field approaches so that exited and available data, document, and resources were applied for some statistical analyses.

Of the most important components of such studies is making decision about defining indicators and determining efficiency measurement type. Studies showed that many studies conducted both at university and government levels in order to study and formulate the best indicators of performance evaluation of municipalities in country, the most significant of which is "formulating and measuring performance indicators in Isfahan municipality" conducted by Isfahan municipality in 2005-2006 with over 600 pages in three volumes.

On the other hand, according to urban economy perspective municipalities are considered as one type of local governments, and indeed one of the major means of central government in efficiently fulfilling its duties. In economic theories, municipalities take the responsibility of redistribution of local revenues, resource allocation, and producing public product (Moezzi Moghaddam, 2003).

In other word, local government created to play the role of redistributing local revenues, allocating resources, and producing public products in a more efficient way. Since local government, comparing central government can better respond to different preferences of people in different regions, resource allocation by local governments can be more efficient (Moezzi Moghaddam, 2003).

On the other hand, as reliable and precise information of municipality's costs and revenues somehow reflect policy making and planning of urban management for redistributing of local revenues and resource allocation; and finally, according to urban experts' attitudes, municipality's collected revenues within one year and its costs in various domains during the period will be regarded as inputs and outputs, respectively.

This research utilizes two inputs and five outputs as follows:

- Inputs

Municipality's revenues in annual financial reports always categorized in seven main headings including (Adapted from municipality's comprehensive financial system provided by national municipalities' organization):

1. Revenues from public duties: the most and major income source of municipalities attributed to revenues of public duties. The most important taxes include duties on building permission, excess density, separation of lands and building. Now, a significant portion of municipal revenues supplied through this source. In addition, such revenue sources strongly related to fluctuations of urban construction market so that any repression or prosperity of construction immediately manifest in municipal collected revenues. Undoubtedly, relying on such incomes will be the origin of municipality future financial crisis because construction market repression disables municipalities in even delivering regular services (Hashemi and Taherkhani, 2008).

2. Revenues from specialized duties: it mainly contains duties of renovation and parking removing that are municipality's major building incomes; however, it is unstable. Others instances are fire insurance duties and plants' 1% charges.

3. Service costs and incomes of municipality's profit institutes: it includes the fees paid for street asphalt, expert, selling plans, income of waste selling and collecting, etc. that if enabled, will be a proper financial source for structural and harmonious development of cities leading to urban sustained development in various environmental, structural, and social domains.

4. Revenues from municipality's properties and funds: leasehold, machinery rent, entrance fees paid for municipal' facilities, parking and park meters, daily and

weekly markets, etc. classified as these revenues. High income of this source indicates optimal using of funds and facilities as well as proper maintaining of municipality's facilities. It viewed as sustainable source.

5. Government and governmental organizations' grants: government developmental grants as well as credits of national budget for buying bus have always been one of the important municipality's revenue sources. In return, no clear legal terms exist for government grants to municipalities and no certain policy adopts. Further, it considered as unstable revenue.

6. Donations, gifts, and assets: citizens' self-assistance, donations of public institutes, penalties of violating urban constructions shows income sources in which the most important one is the fine commission of article 100. It is also considered as municipality's unstable revenues.

7. Other sources of funding: it includes profit of selling municipality's property and or 80% of duties and income collected within urban protected areas that are normally unstable.

Therefore, municipalities must find strategies to attain sustained revenues through which timely initiate their projects and services, get the results, have non-hazardous urban development, and preserve and improve urban environment.

- Sustained income

According to second article of the comprehensive plan of Tehran municipality's sustained incomes, those municipal revenues possessing following characteristics considered as sustained income:

1. Sustainability: it is stable, at least does not extremely fluctuate in short term.

2. Desirability: its earning causes enhanced justice-oriented approach without damaging city's environmental, structural, social, and economic constructs.

3. Flexibility: income basis enlarges over time and extends along with expenditures in order to avoid financial hardship (Tehran Islamic Council, 2007).

Therefore, in order to better analyze municipalities' performance, all income headings of understudied municipalities divided into two major classes and used as two inputs including:

1. Relatively stable and permanent revenues: entailing three income headings of 1. Revenues of public duties, 2. Costs and incomes of municipal profit institutes, and 3. Revenues earned from municipality's funding and properties.

2. Semi stable and totally unstable revenues: embracing four income headings of 1. Revenues attained by specialized duties, 2. Government and organizational government grants, 3. Donations, gifts, and assets, and 4. Other sources of funding.

However, this classification is clearly recognized among municipalities and many scientific research works have been conducted.

- Outputs

Total municipal expenditures divided into two public and related institutes and organizations' expenditures. Public costs itself divide into three administrative services task, urban services task, and urban developmental task. The two administrative and urban services tasks are supplied by current credits and urban developmental task by developmental credits (Urban studies and planning center, 2002).

In this research, all administrative task expenditures including employees' compensation costs, costs of goods and services, etc. referred as "expenditures of administrative services".

All costs of urban servicing including urban cleaning costs, waste collecting and disposing, etc. entitled "expenditures of urban services".

Urban developmental task shows municipality's programs in implementing developmental and constructional projects that are diverse projects leading to city development and citizens' welfare. Urban developmental programs each consisting of some plans and any plan embraces some projects are as follows: (adapted from comprehensive financial system of national municipalities by municipal organizations)

1. Urban planning and development: it contains preparing and approval of comprehensive, guided, and detailed plans, land acquisition plan required for urban development, acquisition plan and property obligations, etc.

2. Directing and disposal of urban surface water: it includes building of surface water disposal channels, improving urban watercourses, rivers coverage and repairing, and digging well in urban passages.

3. Transportation program and improved urban traffic: it entails infrastructure plans and passages paving with asphalt, sidewalk programs of urban passages, constructing bridges around city, building public parking lots, establishing public transportation system (subway, tramcar, etc.)

4. Cities' protective facilities plan: it merely includes breakwater, embankment, and coast wall.

5. Improving urban environment program: it contains programs like constructing parks, squares, landscapes, providing water sources and digging wells, cultivation, as well as preserving green environment, etc.

6. Founding entertainment, cultural, and tourist centers plan: it includes building amusement park, sport clubs, libraries, etc.

7. Building other urban facilities plan: building and repairing of public restrooms and finishing plans of workshop industries complex

8. Income generating facilities plan: it merely includes the plan of building and developing urban income generating facilities.

Since the most significant urban expenditures are developmental costs that a large amount of credits are dedicated to it, the eight programs of this task summarized into three groups in term of subject matter and studied as three separate outputs in order to analyze municipalities' decision-making for resource allocation in more details:

- "Improved urban traffic": transportation and improved urban traffic and planning urban development including facilities' network, grade separation, and public transportation such as taxi, bus, and subway

- "Improved urban environment": directing and disposing surface water in city, building protective facilities for cities, improving urban environment and creating other urban facilities including beautification, making parks and landscapes, and utilizing urban facilities and equipment

- Constructing entertainment and income generating places: building sport, cultural, and tourist centers and creating income generating facilities

Therefore, in general, this research outputs are as follows:

1. Administrative costs

2. Urban costs

3. Urban developmental costs (improving urban traffic)

4. Urban developmental costs (improving urban environment)

5. Urban developmental costs (constructing sport, cultural, and income generating centers)

Thus, research conceptual mode illustrated in Figure 1.

## Performance evaluation

There are several definitions for performance evaluation. In its literary meaning it defined as the activity of finding the value of something, the result, the level of working and product result (Daryani, 2005). In fact, performance evaluation is the process of measuring organizations' performances in terms o efficiency, efficacy, empowerment, accountability based on management basics and notions to realize organizational objectives and tasks (Moein, 2004).

Though, Farl (1957) introduced efficiency measuring method based on economic theories and practically estimated agricultural efficiency of the United States, it is not so functional due to Farl's limitations and practical problems in measurement. It remained inactive for many years up to 1977 that practical measuring of efficiency based on Farl definition through econometrics method (SFA) and to 1978 through DEA method by the

help of linear planning were made possible. Nowadays, efficiency measurement methods can be classified as Figure 2.
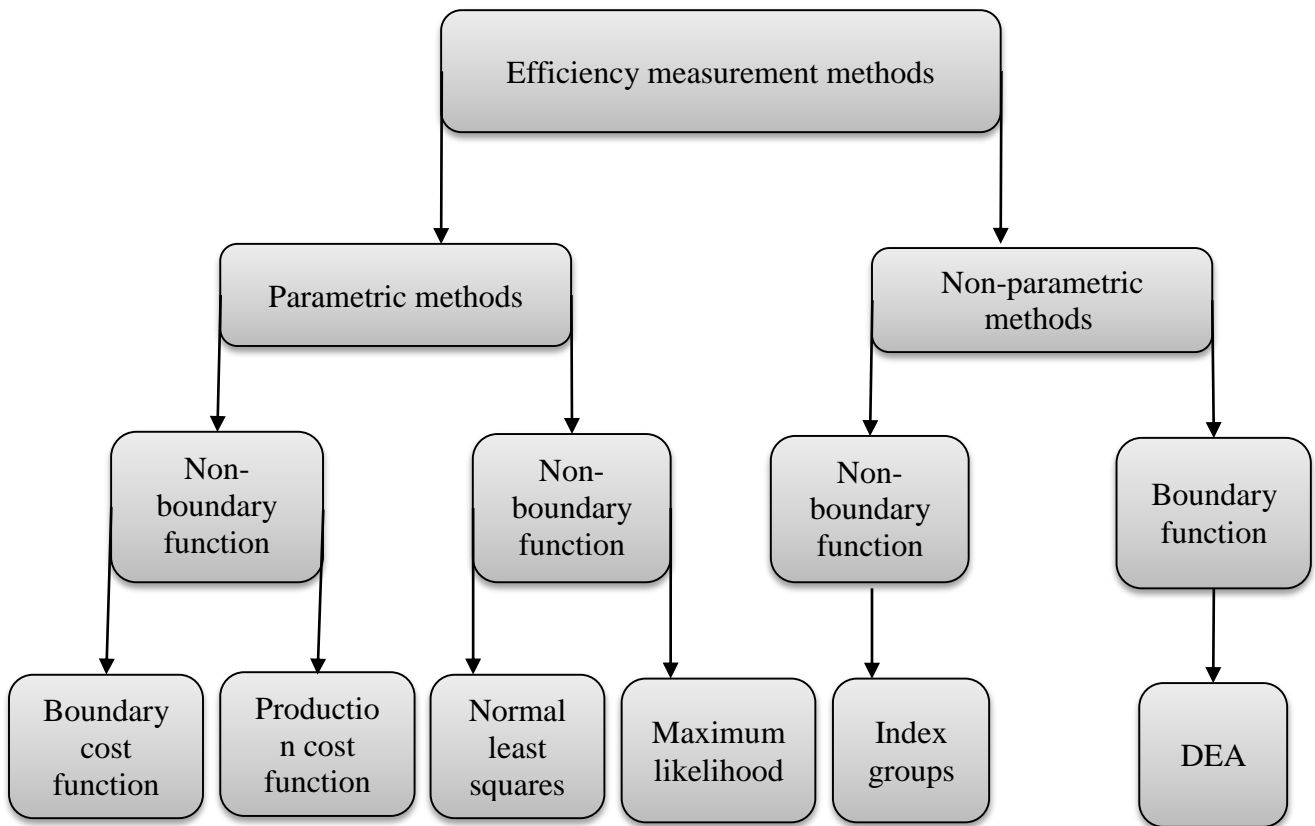


Figure 2: Measurement methods

Source: Souri et al (2007)

DEA method refers to PhD thesis by Rhodes that evaluated the performance of public schools in the United States. This study led to publishing public introduction of DEA in 1978. In this year, data envelopment analysis method by CCR group added to economic literature through universalizing Farl method so that embraces production process feature with several production factors or some products. This method is mainly known as efficiency measurement method around the world. DEA method that applies linear planning technique is of non-parametric methods of estimating identical production process (Imami, 2000; 35).

Efficiency of an organization unit (DMU) is the result of output to the input of that unit. If an organizational unit can produce more outputs with constant inputs, or constant outputs by less inputs and or more outputs by less inputs, that unit has higher efficiency (Mehrez and Yossi, 2000; 109-124). If organizational units only have one input and output, efficiency is the result of output to input; but, if an organizational unit has several inputs and outputs, finding common weight for different outputs and inputs will be

difficult and even impossible. Thus, it is necessary to use DEA technique (Azar, 2000; 129-146).

Consider the following system that is a collection of different organizational units (different DMUs):
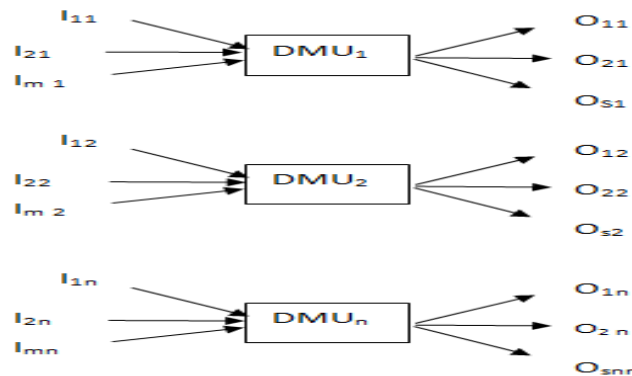


Figure 3 A system with different DMUs

According to the above picture, any organization entails n decision-making unit (DMU$_j$) with m inputs (I$_{ij}$) and S outputs (O$_{rj}$). Therefore,

The number of decision-making unit j=1, 2, 3, . . . , n

Number of input i=1,2,3,. . . ,m

Number of output r =1,2,3,. . . ,s

Thus,

$$\frac{\sum_{r=1}^{S} W_r O_{rj}}{\sum_{i=1}^{m} Vi I_{ij}}$$

$$\text{J unit efficiency} = \frac{\text{Sum of weighted outputs}}{\text{Sum of weighted inputs}} = \frac{W1O1j + W2O2j + \ldots + WSOSj}{V1I1j + V2I2j + \ldots + VmImj}$$

Where, W$_r$ is the weight of r$^{th}$ output and V$_i$ is the weight of i$^{th}$ input. Applying DEA technique and evaluating decision-making units requires making a linear planning model and comparing reactive efficiency of DMUs. Therefore, linear planning models must be formulated as much as the numbers of decision-making units determining the relative efficiency of each unit (E$_j$) (Azar, 2000; 129-146).

*CCR model*

This model introduced by Charnes, Cooper, and Rhodes for the first time in 1978 and it is acronym for initials of the three. Let decision-making units or DMU equal n meaning

that DMU$_n$ . . ., DMU$_2$ , DMU$_1$ in which DMUs use m inputs to attain S outputs. Thus, DMU$_j$ inputs and outputs include (I$_{1j}$, I$_{2j}$, . . . , I$_{mj}$) and (O$_{1j}$, O$_{2j}$, . . . ,O$_{sj}$), respectively. Therefore, input and output matrices illustrated by I and O, respectively, as follows:

$$I = \begin{bmatrix} I_{11}I_{12}...I_{1n} \\ I_{21}I_{22}...I_{2n} \\ I_{m1}I_{m2}...I_{mn} \end{bmatrix} \quad O = \begin{bmatrix} O_{11}O_{12}...O_{1n} \\ O_{21}O_{22}...O_{2n} \\ O_{s1}O_{s2}....O_{Sn} \end{bmatrix}$$

Considering these data and outputs, CCR initial model for zero unit (understudy unit) can be written as follows: (Charnes and Etcetra, 1984; 91-107).

$$MaxE_0 = \frac{\sum_{r=1}^{s} W_r O_{r0}}{\sum_{i=1}^{m} V_i I_{i0}}$$

St:

$$\sum_{r=1}^{s} W_r O_{rj} - \sum_{i=1}^{m} V_i I_{ij} \leq 0$$

wr $\geq 0$

vi $\geq 0$

## Discussion and results

Once research inputs and outputs operationally determined using non-parametric linear planning method (DEA), technical efficiency of 44 understudy municipalities calculated through two methods of CCR and BCC in output-oriented way by the help of GAMS software. Output-oriented hypothesis selected as municipalities lack high control over their incomes (inputs); on the contrary, municipalities costing dealt with urban managers in different headings. They, for instance, reduce administrative costs and in turn, increase developmental costs that are urban progress indication by handling costs within headings.

Results indicate that 16 of 44 studied municipalities (36.36%) in CCR method including large municipalities like Mashhad, Tabriz, Zahedan, as well as small municipalities like Doroud, Behbahan, and Masjed Soleiman are efficient; and 28 other municipalities are in the range of 0.597164 to 1'000'000 in term of efficiency. In BCC method, by a negligible difference, 17 municipalities of total 44 (38.64%) were efficient. The significant difference was efficiency of Sabzevar municipality in BCC method; while, it was inefficient in CCR method at 0.985469. Furthermore, efficiency mean of desired municipalities in CCR and BCC was 86.97% and 87.27%, respectively.

*Anderson-Peterson method (AP)*

Anderson and Peterson (AP) proposed efficient unit ranking method in1993 that made determining the most efficient unit possible. Scores of efficient units exceed one through this technique; thus, efficient units ranked similar to inefficient units. Research results of municipalities' performance evaluation and ranking by AP method in CCR method results are illustrated in Table 4.

Table 4: Results of Anderson and Peterson method

| DMU number | Name of Municipality | Objective value | AP | Municipality ranking |
|---|---|---|---|---|
| 41 | Mashhad municipality | 1.000000 | 3.8081 | 1 |
| 2 | Zahedan municipality | 1.000000 | 2.8841 | 2 |
| 6 | Abadan municipality | 1.000000 | 2.1692 | 3 |
| 31 | Semnan municipality | 1.000000 | 2.0106 | 4 |
| 15 | Behbahan municipality | 1.000000 | 1.5551 | 5 |
| 42 | Masjed Soliyman municipality | 1.000000 | 1.549 | 6 |
| 14 | Birjand municipality | 1.000000 | 1.4994 | 7 |
| 29 | Shahr e Kurd municipality | 1.000000 | 1.3437 | 8 |
| 20 | Rafsanjan municipality | 1.000000 | 1.2727 | 9 |
| 23 | Tabriz municipality | 1.000000 | 1.239 | 10 |
| 22 | Doroud municipality | 1.000000 | 1.1615 | 11 |
| 11 | Boroujerd municipality | 1.000000 | 1.1484 | 12 |
| 38 | Kermanshah municipality | 1.000000 | 1.1097 | 13 |
| 17 | Khoramshahr municipality | 1.000000 | 1.0821 | 14 |
| 1 | Zabol municipality | 1.000000 | 1.0611 | 15 |
| 35 | Marvdasht municipality | 1.000000 | 1.0429 | 16 |
| 10 | Mahshahr municipality | 0.986763 | 0.9868 | 17 |
| 26 | Sabzevar municipality | 0.985469 | 0.9855 | 18 |
| 12 | Jahrom municipality | 0.951139 | 0.9511 | 19 |
| 25 | Marand municipality | 0.925701 | 0.9257 | 20 |
| 32 | Kerman municipality | 0.904262 | 0.9043 | 21 |
| 4 | Ahvaz municipality | 0.903144 | 0.9031 | 22 |
| 44 | Iranshahr municipality | 0.897336 | 0.8973 | 23 |
| 43 | Qazvin municipality | 0.882463 | 0.8825 | 24 |
| 40 | Neyshabour municipality | 0.879240 | 0.8792 | 25 |
| 18 | Khoram Abad municipality | 0.869081 | 0.8691 | 26 |
| 16 | Dezfoul municipality | 0.855762 | 0.8558 | 27 |
| 5 | Ize municipality | 0.846377 | 0.8464 | 28 |
| 24 | Maraghe municipality | 0.832883 | 0.8329 | 29 |
| 36 | Gonbad e Kavous municipality | 0.829808 | 0.8298 | 30 |
| 33 | Quchan municipality | 0.826150 | 0.8262 | 31 |
| 39 | Yasouj municipality | 0.775253 | 0.7753 | 32 |
| 8 | Babol municipality | 0.756846 | 0.7568 | 33 |
| 37 | Gorgan municipality | 0.745165 | 0.7452 | 34 |
| 19 | Jiroft municipality | 0.744782 | 0.7448 | 35 |

| DMU number | Name of Municipality | Objective value | AP | Municipality ranking |
|---|---|---|---|---|
| 13 | Torbat e Heidariye municipality | 0.734767 | 0.7348 | 36 |
| 34 | Shiraz municipality | 0.703234 | 0.7032 | 37 |
| 7 | Amol municipality | 0.659142 | 0.6591 | 38 |
| 30 | Shahroud municipality | 0.654243 | 0.6542 | 39 |
| 28 | Zanjan municipality | 0.645306 | 0.6453 | 40 |
| 9 | Bojnourd municipality | 0.636599 | 0.6366 | 41 |
| 27 | Sari municipality | 0.635429 | 0.6354 | 42 |
| 21 | Rasht municipality | 0.622048 | 0.622 | 43 |
| 3 | Andimeshk municipality | 0.597164 | 0.5972 | 44 |

*Determining reference or virtual benchmark for inefficient units*

Inefficient units are the units with efficiency smaller than one. To make these units efficient, it is necessary to apply adjustments in inputs and outputs amounts. In other words, we must determine how much increase in inputs' values and decrease in outputs makes municipalities efficient. In fact, a type of virtual benchmark defined for inefficient municipality. Table 5 represents inefficient municipalities of CCR model, their inputs and outputs, as well as the desired level of these inputs and outputs for efficiency of municipalities. The first raw "current status" of inefficient municipality indicates the current amount of inputs and outputs of this municipality; the second raw "desired status" shows that amount of inputs and outputs by which municipalities attain efficiency boundary; the third raw "change percent" also shows changing of municipalities' present inputs and outputs in percent for efficiency.

Table 5: Benchmarking of inefficient municipalities in CCR method

| DMU number | Name of Municipality | Raw type | Inputs | | Outputs | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Relatively stable and permanent revenues | Semi-stable and totally unstable revenues | Administrative costs | Urban costs | (Developmental costs Improved urban terrific) | (Developmental costs Improved urban environment) | Developmental costs(creating sport, cultural entertainment and income generating centers) |
| 3 | Andikeshk Municipality | Current status | 58392 | 31261 | 18065 | 21207 | 7178 | 10505 | 3714 |
| | | Desired status | 58392 | 31261 | 30251 | 35513 | 25138 | 17591 | 6219 |
| | | Cahnge percent | 0.00% | 0.00% | 67.46% | 67.46% | 250.21% | 67.46% | 67.46% |
| 4 | Ahvaz Municipality | current status | 1325625 | 1171118 | 456662 | 978651 | 951514 | 149665 | 2536 |

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| DMU number | Name of Municipality | Raw type | Inputs | | Outputs | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Relatively stable and permanent revenues | Semi-stable and totally unstable revenues | Administrative costs | Urban costs | (Developmental costs Improved urban terrific) | (Developmental costs Improved urban environment) | Developmental costs(creating sport, cultural entertainment and income generating centers) |
| | | Desired status | 1325625 | 1171118 | 505636 | 1083604 | 1053557 | 342746 | 81234 |
| | | Change percent | 0.00% | 0.00% | 10.72% | 10.72% | 10.72% | 129.01% | 3103.24% |
| 5 | Izeh Municipality | current status | 29898 | 28410 | 8312 | 18023 | 7026 | 9876 | 7393 |
| | | Desired status | 29898 | 28410 | 9821 | 21294 | 23113 | 11669 | 8735 |
| | | Change percent | 0.00% | 0.00% | 18.15% | 18.15% | 228.97% | 18.15% | 18.15% |
| 7 | Amol Municipality | current status | 151355 | 131160 | 23797 | 73293 | 120994 | 22099 | 10117 |
| | | Desired status | 151355 | 131160 | 36103 | 111195 | 183563 | 40726 | 15349 |
| | | Change percent | 0.00% | 0.00% | 51.71% | 51.71% | 51.71% | 84.29% | 51.71% |
| 8 | Babol Municipality | current status | 108285 | 70619 | 40625 | 23046 | 77070 | 43465 | 1222 |
| | | Desired status | 108285 | 70619 | 53677 | 59047 | 101831 | 57429 | 5119 |
| | | Change percent | 0.00% | 0.00% | 32.13% | 156.21% | 32.13% | 32.13% | 318.92% |
| 9 | Bojnourd Municipality | current status | 233875 | 180998 | 34574 | 125040 | 114337 | 39155 | 5020 |
| | | Desired status | 233875 | 180998 | 54310 | 196419 | 179606 | 61506 | 14163 |
| | | Change percent | 0.00% | 0.00% | 57.08% | 57.08% | 57.08% | 57.08% | 182.13% |
| 10 | Mahshahr Municipality | current status | 240481 | 31545 | 18850 | 116197 | 30817 | 45157 | 1709 |
| | | Desired status | 240481 | 31545 | 30806 | 117756 | 37247 | 45763 | 1732 |
| | | Change percent | 0.00% | 0.00% | 63.43% | 1.34% | 20.87% | 1.34% | 1.34% |

| DMU number | Name of Municipality | Raw type | Inputs | | Outputs | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Relatively stable and permanent revenues | Semi-stable and totally unstable revenues | Administrative costs | Urban costs | (Developmental costs Improved urban terrific) | (Developmental costs Improved urban environment) | Developmental costs(creating sport, cultural entertainment and income generating centers) |
| 12 | Jahrom Municipality | current status | 53399 | 33131 | 10926 | 16646 | 24668 | 21264 | 13026 |
| | | Desired status | 53399 | 33131 | 13695 | 17501 | 25935 | 22356 | 13695 |
| | | Change percent | 0.00% | 0.00% | 25.34% | 5.14% | 5.14% | 5.14% | 5.14% |
| 13 | Torbat e Heidariye Municipality | current status | 58979 | 62625 | 18539 | 33439 | 31873 | 27318 | 4440 |
| | | Desired status | 58979 | 62625 | 25231 | 45510 | 43378 | 37179 | 6043 |
| | | Change percent | 0.00% | 0.00% | 36.10% | 36.10% | 36.10% | 36.10% | 36.10% |
| 16 | Dezfoul Municipality | current status | 136235 | 69042 | 38166 | 90862 | 32584 | 22754 | 4133 |
| | | Desired status | 136235 | 69042 | 44599 | 106177 | 59767 | 26589 | 4830 |
| | | Change percent | 0.00% | 0.00% | 16.85% | 16.85% | 83.42% | 16.85% | 16.85% |
| 18 | Khoram abad Municipality | current status | 121409 | 166384 | 75787 | 63189 | 72398 | 20711 | 6915 |
| | | Desired status | 121409 | 137869 | 87204 | 72708 | 83304 | 23831 | 7957 |
| | | Change percent | 0.00% | -17.14% | 15.06% | 15.06% | 15.06% | 15.06% | 15.06% |
| 19 | Jiroft Municipality | current status | 30301 | 44923 | 10140 | 19375 | 17692 | 9864 | 3133 |
| | | Desired status | 30301 | 44923 | 13615 | 26014 | 23755 | 13244 | 4207 |
| | | Change percent | 0.00% | 0.00% | 34.27% | 34.27% | 34.27% | 34.27% | 34.27% |
| 21 | Rasht Municipality | current status | 614398 | 416250 | 65862 | 310738 | 296009 | 112947 | 1847 |
| | | Desired status | 614398 | 416250 | 105879 | 499540 | 475862 | 181573 | 35593 |

| DMU number | Name of Municipality | Raw type | Inputs | | Outputs | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Relatively stable and permanent revenues | Semi-stable and totally unstable revenues | Administrative costs | Urban costs | (Developmental costs Improved urban terrific) | (Developmental costs Improved urban environment) | Developmental costs(creating sport, cultural entertainment and income generating centers) |
| | | Change percent | 0.00% | 0.00% | 60.76% | 60.76% | 60.76% | 60.76% | 1827.06% |
| 24 | Maraghe Municipality | current status | 125489.5 | 61763.08 | 23633.66 | 73405.44 | 45384.2 | 29726.07 | 10750 |
| | | Desired status | 125490 | 61763 | 28376 | 88134 | 58882 | 35690 | 12907 |
| | | Change percent | 0.00% | 0.00% | 20.06% | 20.06% | 29.74% | 20.06% | 20.06% |
| 25 | Marand Municipality | current status | 135364 | 108683 | 86372 | 41630 | 55600 | 38810 | 19135 |
| | | Desired status | 135364 | 108683 | 93304 | 74819 | 66730 | 41924 | 20671 |
| | | Change percent | 0.00% | 0.00% | 8.03% | 79.72% | 20.02% | 8.03% | 8.03% |
| 26 | Sabzevar Municipality | current status | 73651 | 171771 | 37740 | 48442 | 77868 | 44558 | 10915 |
| | | Desired status | 73651 | 146954 | 38296 | 49156 | 79016 | 45215 | 11076 |
| | | Change percent | 0.00% | -14.45% | 1.47% | 1.47% | 1.47% | 1.47% | 1.47% |
| 27 | Sari Municipality | current status | 290966 | 168101 | 79395 | 67472 | 177741 | 111647 | 10692 |
| | | Desired status | 290966 | 168101 | 124947 | 135591 | 279718 | 175703 | 16826 |
| | | Change percent | 0.00% | 0.00% | 57.37% | 100.96% | 57.37% | 57.37% | 57.37% |
| 28 | Zanjan Municipality | current status | 317117 | 268676 | 74716 | 143370 | 221830 | 44370 | 14720 |
| | | Desired status | 317117 | 268676 | 115784 | 222174 | 343759 | 82473 | 22811 |
| | | Change percent | 0.00% | 0.00% | 54.97% | 54.97% | 54.97% | 85.87% | 54.97% |
| 30 | Shahroud Municipality | current status | 116808 | 96395 | 40868 | 20124 | 45760 | 50417 | 18105 |

| DMU number | Name of Municipality | Raw type | Inputs | | Outputs | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Relatively stable and permanent revenues | Semi-stable and totally unstable revenues | Administrative costs | Urban costs | (Developmental costs Improved urban terrific) | (Developmental costs Improved urban environment) | Developmental costs(creating sport, cultural entertainment and income generating centers) |
| | | Desired status | 116808 | 96395 | 62466 | 56110 | 75834 | 77062 | 27673 |
| | | Change percent | 0.00% | 0.00% | 52.85% | 178.82% | 65.72% | 52.85% | 52.85% |
| 32 | Kerman Municipality | current status | 480622 | 502513 | 314141 | 161414 | 275295 | 154616 | 4701 |
| | | Desired status | 480622 | 443698 | 347400 | 273260 | 304442 | 170986 | 13846 |
| | | Change percent | 0.00% | -11.70% | 10.59% | 69.29% | 10.59% | 10.59% | 194.54% |
| 33 | Quchan Municipality | current status | 40520 | 40797 | 10914 | 29253 | 25037 | 11849 | 3448 |
| | | Desired status | 40520 | 40797 | 13211 | 35409 | 30306 | 14342 | 4174 |
| | | Change percent | 0.00% | 0.00% | 21.04% | 21.04% | 21.04% | 21.04% | 21.04% |
| 34 | Shiraz Municipality | current status | 1803140 | 2378527 | 218058 | 741530 | 2065362 | 306312 | 20089 |
| | | Desired status | 1803140 | 1276139 | 310079 | 1054458 | 2936951 | 435577 | 123348 |
| | | Change percent | 0.00% | -46.35% | 42.20% | 42.20% | 42.20% | 42.20% | 514.01% |
| 36 | Gonbad e Kavous Municipality | current status | 45867 | 40502 | 9761 | 33009 | 27209 | 9270 | 5559 |
| | | Desired status | 45867 | 40502 | 11763 | 39779 | 32790 | 11171 | 6699 |
| | | Change percent | 0.00% | 0.00% | 20.51% | 20.51% | 20.51% | 20.51% | 20.51% |
| 37 | Gorgan Municipality | current status | 297612 | 147841 | 44043 | 135729 | 148300 | 73810 | 26416 |
| | | Desired status | 297612 | 147841 | 59105 | 182146 | 199016 | 99052 | 35450 |
| | | Change percent | 0.00% | 0.00% | 34.20% | 34.20% | 34.20% | 34.20% | 34.20% |

| DMU number | Name of Municipality | Raw type | Inputs | | Outputs | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Relatively stable and permanent revenues | Semi-stable and totally unstable revenues | Administrative costs | Urban costs | (Developmental costs Improved urban terrific) | (Developmental costs Improved urban environment) | Developmental costs(creating sport, cultural entertainment and income generating centers) |
| 39 | Yasouj Municipality | current status | 182184 | 96442 | 35753 | 25859 | 128603 | 81275 | 10036 |
| | | Desired status | 182184 | 96442 | 75868 | 76375 | 165885 | 104837 | 12945 |
| | | Change percent | 0.00% | 0.00% | 112.20% | 195.35% | 28.99% | 28.99% | 28.99% |
| 40 | Neyshabour Municipality | current status | 85287 | 136185 | 31705 | 61624 | 31646 | 56647 | 8245 |
| | | Desired status | 85287 | 120551 | 36060 | 70088 | 56487 | 64427 | 9377 |
| | | Change percent | 0.00% | -11.48% | 13.73% | 13.73% | 78.50% | 13.73% | 13.73% |
| 43 | Qazvin Municipality | current status | 373267 | 673245 | 83331 | 234599 | 419657 | 132712 | 66283 |
| | | Desired status | 373267 | 549999 | 113756 | 265846 | 475552 | 150388 | 75111 |
| | | Change percent | 0.00% | -18.31% | 36.51% | 13.32% | 13.32% | 13.32% | 13.32% |
| 44 | Iranshahr Municipality | current status | 27964 | 51770 | 13470 | 7005 | 18600 | 17750 | 10448 |
| | | Desired status | 27964 | 51770 | 15011 | 11475 | 24858 | 19781 | 11643 |
| | | Change percent | 0.00% | 0.00% | 11.44% | 63.81% | 33.65% | 11.44% | 11.44% |

Once municipalities' performances evaluated, efficient and inefficient municipalities introduced, and efficient municipalities benchmarked, the results demonstrate that the main cause of inefficiency is ignoring the fifth output i.e. developmental costing for building entertainment, cultural and sport, and income generating centers as average costing of inefficient municipalities must be 2.4 times to approach efficiency boundary. Lack of urban costs with the mean of 51.44% ranked second, and developmental costs for improved urban traffic with the average 49.95% ranked as the third factor of inefficient municipalities (see Table 6).

Table 6: Studying main factors of inefficiency of municipalities in CCR

|  | Administrative costs | Urban costs | Developmental costs (improved urban traffic) | Developmental costs (improved urban environment) | Developmental costs (creating entertainment, sport and cultural as well as income generating centers) |
|---|---|---|---|---|---|
| Sum of change percentages | 986.25% | 1440.34% | 1398.73% | 979.33% | 6723.96% |
| Change mean | 35.22% | 51.44% | 49.95% | 34.98% | 240.14% |

Finally, according to the obtained results, the following recommendations are suggested to increase and enhance efficiency level of inefficient municipalities:

1. Increasing developmental costs and optimizing production factors, if possible (reducing excessive production factors).

2. Creating motivational and incentive system like rewarding efficient municipalities by authorities institutes such as municipal organization to efficient municipalities and those with efficient growth in order to more enhance efficiency and encourage other inefficient municipalities for harder effort.

3. Municipalities' authorities institutes like department of the interior and general governor office design and implement a system for permanent studying of municipalities' efficiency and performance by selecting the best indicators.

Moreover, researchers may concern following issues for further research:

1. One limitation of such methods is disregarding environmental potentials. Therefore, it is suggested to offer a model regarding environmental potentials in addition to municipal costs and revenues, and other indicators.

2. Data envelopment analysis studies the relation between inputs and outputs; thus, it is recommended to study the logical relation between inputs and outputs corresponding to the inputs.

3. Some of inputs and outputs differ with peers. For instance, in outputs, high outputs does not necessarily mean better performance such as administrative costs that is non-productive and even it may be stated that its lower level shows higher efficiency; also, in inputs, however, high unstable revenues are good source of supplying the activity for that year, in long-term it totally harms municipality. Further, it may be possible that income fluctuations led to irreparable damages to urban activities; thus further studies recommended.

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