Measuring and analyzing the efficiency of the performance of the municipalities of the Mayoralty of Baghdad using the data envelope analysis methodology

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ABSTRACT

Measuring the efficiency of the performance of the municipalities of the Mayoralty of Baghdad is one of the tools used in determining how to use the resources available to these municipalities, and to achieve the well-being of the population of the municipalities of the research sample, and to achieve sustainable development and some of its indicators. The aim of the research is to assess the efficiency and specific factors in the municipalities of the Mayoralty of Baghdad during the period (2021-2019) using the data envelope analysis (DEA) methodology by panel data. And using the inputs and outputs of these municipalities to determine the efficient and inefficient municipalities. and reference municipalities with full technical proficiency, DEAP 2.1 program has been implemented. The research concluded that there were four municipalities that were not technically efficient in using their resources, which are: Al-Kadhimiya Municipality, Al-Dora Municipality, Al-Rasheed Municipality, and Al-Sadr Municipality out of a total of (13) municipalities, which indicates that they are working at the lowest level of production. Its relative efficiency is less than (100%). In addition, Al-Sadr Municipality has shown increased returns, enabling it to expand its activity and achieve the optimum efficiency scale. There are also three municipalities that showed Diminishing Returns (Al-Kadhimiya municipality, Al-Dora municipality, and Al-Rasheed municipality), which means that they did not reach the optimal combination of their resources. It did not reach the optimum level of output, and it is unable to expand its activity and reach optimal efficiency, and despite large allocations for capital and operational expenditures in some municipalities, it did not fulfill its role in satisfying the needs of the population in those municipalities of clean water and getting rid of pollution. environment, and was unable to achieve the requirements of sustainable development. The researchers recommend that inefficient municipalities should resort to the reference municipalities that have achieved 100% efficiency, to see their working methods and planning methods, as well as to increase the inputs of inefficient municipalities in order to address the imbalance in efficient municipalities.

Keywords:	Performance Efficiency, Municipalities, DEA Technique

Introduction

The concept of performance measurement has received increasing attention from researchers in the field of economics, because performance represents the main motive for the existence of any institution or not, and is considered the

most contributing factor to achieving its main goal, which is survival and continuity. Therefore, it is necessary to rationally and rationally exploit the available resources and capabilities, which is expressed by the term "efficiency." In sectors and institutions that do not aim for profit, such as service institutions.

The services provided by the municipalities of the Mayoralty of Baghdad, in general, have great importance in the lives of the residents of the city of Baghdad, and the service sector is the basis for the activities of urban centers in the world. If the cities have commercial, industrial, agricultural, cultural, and religious functions, these jobs depend mainly on The service sector, and the city is considered successful and advanced based on the services it provides to its residents and non-residents.

The research will focus on presenting the reality of the activity of municipal services in the city of Baghdad through the activity of the Mayoralty of Baghdad, especially since this activity was characterized by weakness for different periods of time and still is, as a result of the lack of financial allocations and the lack of investment plans necessary to raise the efficiency of the performance of this sector and work to exploit the resources allocated to it and reduce of the wastage of it.

The DEA model analysis is a DATA-oriented approach to evaluating the performance of a group of units called (DMUs' Decision-Making Units). Which converts multiple inputs into multiple outputs, and it has been observed in the past years the application of the (DEA) model to evaluate the performance of many units operating in different fields and different countries as in governments, hospitals, states, business establishments, and others, because this analysis requires very few assumptions as It opens the horizons for the complex cases of the relationship between inputs and outputs in decision-making units.

Research Importance: Evaluate the efficiency of the performance of services provided by municipalities using the data envelope analysis method to show the extent of success or failure of service units in achieving their service plans. The (DEA) model is one of the modern and very

appropriate methods for measuring this efficiency, as well as the lack or absence of research in this vital field, which reflects the sophistication of society due to the services it receives that are most needed in human life and sustainable development.

Research problem: Despite the large expenditure on the units (municipalities) of the Mayoralty of Baghdad to provide services to the community, these units did not perform their tasks as required, so we focused on them in this research, in order to identify the causes that limit the ability of these units to achieve their goals efficiently using the (DEA) model. Therefore, the research problem revolves around the following questions:

1. Were the municipalities of the Baghdad Municipality able to achieve efficiency in their performance?

2. Does evaluate the municipalities on the basis of efficiency and productivity standards, and determining the reference municipalities, contribute to the formulation of a service policy?

Research Hypothesis: "The decision-making units in the municipalities of the Mayoralty of Baghdad did not achieve high-performance efficiency."

Research Aims:

1- Applying the DEA model to measure the efficiency of the performance of the municipalities of the Mayoralty of Baghdad and to identify the efficient municipalities by using their available resources to reach the targeted outputs.

2- Identifying the municipalities that have not achieved complete relative efficiency and knowing the reasons behind this.

Research Methodology: The research relied on the (non-parametric) mathematical method using the (DEA) model, to measure the efficiency of the performance of the municipalities of the Mayoralty of Baghdad.

The research sample: Municipalities of the Mayoralty of Baghdad within the borders of the Baghdad governorate, which includes 13 municipalities during the period (2021-2019).

Search Borders:

Spatial border: Municipalities of the Mayoralty of Baghdad within the boundaries of the city of Baghdad.

Temporal border: The research included the period (2021-2019).

Literature Review

First: Arabic Studies

1-Karim Najm Khalaf Al-Asadi Study (2010)

"Evaluating the performance of the municipal services sector activity in the province of Baghdad (Al-Karada municipality - a case study)"

The study aimed at the extent of the contribution of the Karrada municipality unit in implementing the service plans specified for it for the years (2009-2010) and identifying deviations, their causes, and methods of treatment. The study concluded that the Karrada municipality suffers from many problems that are reflected in the performance of its work, the most important of which is the weak financial allocations, which hinder it in the implementation of its service activities, as well as the lack of mechanisms and the weakness of human cadres responsible for managing municipal services and their need for training and rehabilitation.

2- Study of Safaa Taleb Saleh and Hanadi Sakr (2019)

"Evaluation of the efficiency of the Ramadi municipality directorate using the DEA model / an applied study"

The research aims to measure and evaluate the efficiency of the Ramadi Municipal Directorate using the DEA model, and the research community was represented by (8) municipal departments, and the monthly data was adopted. The research concluded that there is a discrepancy in the efficiency values of the municipal departments of the research sample, and the research recommends the necessity of adopting the municipal departments with full efficiency as a reference for the inefficient departments.

3- Aqil Dakhil Karim Study (2018)

"Auditing the performance of the municipalities' problem and its role in improving the services provided (applied research in the Muthanna Municipality Directorate)".

The aim of the research was to seek to identify the objectives of the unified accounting system for municipalities, propose other indicators that help in auditing the performance of municipal institutions, and ascertain the role played by the control bodies in achieving the efficiency, effectiveness, and economical aspects of the environmental aspects of the services provided, using indicators of the activity of municipal institutions. The research also aims to prepare and implement a program to audit the performance of these institutions. The research concluded that there is a process of auditing the performance of important information that reflects the extent of the economic unit's ability to achieve its goals and invest its financial and human resources. the study recommends the need for municipal institutions to rely on self-resources through the implementation of laws and instructions related to their activities to reduce the burden on the budget.

Second: Foreign Studies

1- Tomasz Skica, et al. study (2019)

Measuring the Efficiency of Polish Municipalities –DEA Approach"

This research focused on building the ranking of municipalities based on their efficiency from a development point of view, and the research used the DEA methodology, and the research included 2044 municipalities in the year 2016, and the municipalities were ranked based on the results of the DEA model, and the research showed that inefficient municipalities must follow methods and procedures Reference units to reach the efficient level.

2- Corrado IO Storto Study (2013)

"Evaluating Technical Efficiency of es: A Data Italian Major Municipality DEA Model"

This paper presents an exploratory study aimed at evaluating the spending efficiency of (103) major municipalities in Italy. This study resorted to using DEA to calculate the degree of efficiency and verification among economies of scale. One of the municipalities needs deeper research.

3- Dillber Caglar Onbaslgluo Study

"The Turkish Cypriot Municipalities Productivity & Performance: An Application of DEA & the DEA Model"

The research aim is to measure the efficiency, technical efficiency, productivity, and determining factors for the implementation of the sustainable development policy for the five major municipalities in Northern Cyprus during the quarterly period (2004-2018). Independent revenue sources (grants) and per capita expenditures of the municipalities of Northern Cyprus have a negative impact on the efficiency and employment rate of the municipalities.

The DEA analysis showed that the population has a positive impact that may increase technical efficiency, and finally the results of this research showed that the implementation of appropriate environmental programs not only improves the efficiency of the local government but also help in environmental sustainability and the geographical location of regional changes and barriers to sustainable initiatives using appropriate waste mechanisms Clean water technology and solar lighting.

4- Ronaldo Seroa da Motta and Ajax Moreira Study (2009)

This study focuses on analyzing the impact of political and institutional factors on the performance of municipalities in improving social welfare in Brazil during the period (1990-2000). This study has adopted the random production limits model, conditional on the variables related to the costs of providing services and those that can affect the efficiency of the municipality. The results indicated that we cannot reject: 1) economies of scale. 2) the effect of the voting margin in the municipality and the type (first or second) of the mandate of the elected governor, suggesting a form of nepotism; 3) The local politics and the presence of sectoral councils did not affect the level of efficiency of municipal spending, which indicates the inconsistency of information between politics and voters.

5- Nara F Monkam Study (2014)

Local municipality productive efficiency and its determinants in South Africa

The research aim is twofold: the first is to analyze the productive or technical efficiency of providing municipal services in (South Africa), that is, to identify the most efficient local municipalities in the country, in terms of providing the best possible services to the public at the lowest possible cost, and to investigate the empirical determinants of the efficiency of local spending. In order to draw policy conclusions about the efficiency and effectiveness of local service delivery in South Africa. While allocation efficiency ensures the closest possible match between public services and local needs and preferences, productive or technical efficiency, on the other hand, ensures that the best or maximum local public services (outputs) are provided at the lowest possible cost (inputs).

Theoretical Framework: Dea Models
1-Methodology and Dea Models

The methods adopted for estimating efficiency are usually divided into parametric methods (S.F.A. random bound analysis), and nonparametric methods (D.E.A. boundary). Here we have resorted to estimating the functional form of best practice (Best Practice), based on the nonparametric methods of D.E.A. (Batal et al., 2017: 22).

Efficiency measurement was initiated by Farrell in 1957, to define a simple measure of the efficiency of a facility using multiple inputs. Data envelope analysis is widely used and used by researchers because of its power, and because it is well recognized as a valuable decision support tool for management control, organization diagnosis, and benchmarking studies (Farrell, 1957: 253).

Data envelope analysis measures the competency of different units, called "decision-making units" (DMUs). The DEA is a non-parametric method for estimating the relative efficiency of homogeneous decision-making units. It makes simple assumptions in the estimation of the empirical production function that transforms inputs into outputs, assuming a convex production limit, and a high disposition to inputs and outputs (Charnes. Cooper & Rhodes, 1978: 429-444).

The production limit is generated (formation) by solving sequential linear programming problems, each of which is for a municipality, while the technical efficiency (which is the unit's

ability to produce a specific set of outputs with less consumption than the corresponding inputs), independently of any input prices The municipality, measured by the distance between the real observation and the limit obtained from all the studied municipalities, and accordingly, the results of the efficient municipality are achieved if the technical efficiency TE = 1, but the municipality is inefficient, or technically incompetent if the technical efficiency is TE 1 >, DEA calculates the efficiency of the decision-making unit by dividing the weighted sum of its outputs by the weighted sum of the inputs, and that the weights of the inputs and outputs are not determined in advance, but are determined as part of the solution to the maximization problem. In a very simple case, each decision-making unit is allowed to freely weigh its inputs and outputs to maximize its relative efficiency, (Mikulas, 2012: 150).

DEA models can be input-oriented (determining the minimum inputs to achieve a given level of output). Or with an external orientation (maximizing outputs with specific levels of inputs), and in any case, the current research adopted an internal orientation, because municipal administrations have greater control over inputs than over outputs, and the production function is built by searching for the maximum possible percentage in reducing the inputs used, while output levels are constant. As long as the research sample includes different sizes of municipalities, the degree of efficiency is calculated by adopting two concepts:

The first concept is the one introduced by Charnes et. al., 1978: 429-444 in which CRS is assumed to be constant.

The second concept: Is presented by (Banker, Charnes & C, 1984: 1078-1092) and it follows the BCC model and assumes the change of returns to volume VRS, and in particular, the internal trend model under VRS defines as follows:

Orientation - inward - with constant returns to scale:

$$\text{Min} \quad \theta, \lambda, \theta$$
$$Y\lambda \geq yi$$
$$\text{S.t.} \quad X\lambda \leq \theta \, Xi$$
$$Y \geq 0$$

Orientation - Direction - in light of the change in returns to scale:

$$\text{Min} \quad \theta, \lambda, \theta$$
$$Y\lambda \geq yi$$
$$\text{S.T.} \quad X\lambda \leq \theta \, Xi$$
$$N1'\lambda = 1$$
$$\lambda \geq 0$$

where:

λ = is the vector of relative weights, (N * 1) given per unit.

N = number of units.

Assuming data on:

I = input.

O = output.

X = represents the input matrix (I * N).

Y = represents the output matrix (O * N).

For the (ith) unit, these are represented by the column vectors (Xi) for the inputs and (Yi) for the outputs. This refers to the CRS model, and under this model, the unit operates at its maximum capacity, and the increase in the quantities of inputs leads to an increase in production. The assumption of constant returns to scale is avoided in the VRS model, which means that the unit operates at a lower level of maximum power, that is, the amount of input used does not increase production in the same proportion by introducing an additional constraint on λ, and allowing returns to volume, i.e. N1'λ = 1, Since N1' is a vector of one of them. This constraint imposes the convexity of the boundary. Finally, the degree of efficiency (θ) is a numerical quantity, and the technical efficiency is estimated by assuming values between 0 and 1, and when the value is equal to one, it indicates a point on the limit and therefore the technical efficiency is equal to one. In our research, we computed both constant and variable returns to scale efficiencies. We interpreted the ratio of fixed returns to volume to variable returns to volume as the volumetric efficiency, which refers to the ability of each decision-making unit to work at the ideal size operations. In order to find whether the municipality has volumetric efficiency, and determine the type of volume returns, the DEA model under the condition that volume returns do not increase can be applied by substituting N1'λ=1 with the constraint N1'$\lambda \leq 1$, and setting the volumetric efficiency as follows:

$$SE = \frac{TECRS}{TENIRS}$$

Where:

TECRS = Efficiency under constant returns to scale

TENIRS = Efficiency with no increasing returns to scale

If SE = 1, the municipality has volumetric efficiency, under both (CRS and VRS), but if SE = 1, the municipality operates under increasing returns to scale, but if SE > 1, the municipality operates under decreasing returns to scale.

Data and its sources

The municipalities of the Baghdad Municipality provide basic and different types of services. In the framework of this research, we used two inputs, and seven outputs for each of the municipalities.

A. Input

1. Current operating expenses. measured in billions.
2. Operating capital. measured in billions.

B. Output

1. The number of floors equipped with water.
2. Sewer lines / m2.
3. Patching areas / m2.
4. The number of seedlings planted.
5. Removal of rubble / m3.
6. Waste removal/tons.
7. The total population of each municipality.

The data source for these variables was obtained from:

1-Baghdad Municipality, Administrative Department, Human Resources Department.

2-Baghdad Municipality, Administrative, and Financial Department, Budget Division.

3-Baghdad Municipality, Planning and Follow-up Department, Statistics Division.

4-Baghdad Municipality, Baghdad Water Department, Operation and Maintenance Department, Calculator Division.

These variables were used, in order to analyze and measure the efficiency, and productivity change of the studied municipalities. For data analysis, we used DEAP V.2.1.

Metadata

Table (1) indicates the descriptive statistics of the inputs and outputs (means, standard deviations, maximum and minimum value). These statistics show that the mean trend (X4, X2) is decreasing, and (Y2, Y1, X7, X6, X1) is increasing, while (X5, X3) was fluctuating between increase and decrease. Table (7) shows the statistics of inputs and outputs of the municipalities of the Mayoralty of Baghdad for the period (2019-2021).

Where:

X1 = the number of floors equipped with water.

X2 = sewer lines.

X3 = patching areas.

X4 = the number of seedlings planted.

X5 Remove debris.

X6 = Waste removal.

X7 = the total population of each municipality.

Y1 = Current operating expenses.   Y2 = Working capital.

Table (1) Input and output statistics of the municipalities of the Mayoralty of Baghdad for the years 2019, 2020, 2021

					2020				
Mean	50468.23	2695.8	12543.7	416805.4	35646.9	234055.2	697983	16031.5	7844.4
Maximum	121774	17065	66316	1500600	116950	527984	1228090	30140	22393
Minimum	26082	11	1966	21118	2620	86282	201872	6673	1349
Std. Dev	29889.4	5495.7	17078	413110.3	32688	113409	379517.3	7130	5398.5

				2019					
	output							Input	
Variables Statistics	X1	X2	X3	X4	X5	X6	X7	Y1	Y2
Mean	50068.62	574.692	24373.08	818984.1	64855	68694.1	674948.8	15813.1	6889.61
Maximum	121465	2360.0	92175.00	6907400	167682	523608	1187563	29834	14803
Minimum	25599	20.0	7746.000	21650	380	138803	19521	643	1723
Std. Dev	29864.5	672.4	22535	1835467	60671.6	108264.8	366993.3	6449.6	3278.9

				2021					
Mean	81642.7	445.7	22284.5	310927.2	55880.2	243158.8	723197.8	20694	9880.5
Maximum	440088	1476	47208	1100945	145776	519785	1270000	18868	9261
Minimum	26565	31	9414	39914	3004	101765	208761	39702	27910
Std. Dev	111730.8	404.4	11782.9	273805.9	45130.4	108901	391768.6	9776	3001

Source: From the work of researchers based on the data of the Baghdad Municipality for the period (2019-2021) and using the Eviews12 program

Measuring efficiency and total worker productivity in the municipalities of the Mayoralty of Baghdad during the period (2019-2021).

1- Measuring the relative efficiency and productivity change

The results of the analysis for each of the municipalities are shown in the statistical appendix. The average performance values for the period (2021 - 2019), it is shown in Table (2). It should be noted that the researcher adopted the output guidance model, which is based on maximizing output levels while using the same level of current inputs. Efficiency scores were presented and then the results were analyzed and the reference municipalities identified and the improvements required in the inefficient municipalities. Table (2) shows the indicators of output efficiency.

Table (2): Output efficiency index

	Decision making units (municipalities)	Relative efficiency under constant return	Technical efficiency under the change of return	Volumetric efficiency	return
1	Mansour	1	1	1	_
2	the people	1	1	1	_
3	Karrada	1	1	1	_
4	Kadhimiya	0.704	1	0.704	diminishing
5	session	0.706	0.968	0.729	diminishing
6	Rashid	0.772	1	0.772	diminishing
7	the flame	1	1	1	_
8	Karkh	1	1	1	_
9	Adhamiya	1	1	1	_
10	Ghadir	1	1	1	_
11	Chest 1+2	0.949	0.976	0.972	increasing
12	Rusafa	1	1	1	_
13	New Baghdad	1	1	1	_
average		0.933	0.996	0.937	

Source: From the work of researchers based on the data in Table (1) and the data of the program (DEAP V.2.1).

It is clear from the above table that there are nine municipalities (DMU), which are: (Al-Mansour, Al-Shaab, Karada, Al-Shula, Al-Karkh, Al-Adhamiya, Al-Ghadir, Al-Rusafa, and New Baghdad), which have achieved complete relative efficiency with direct direction out of (13) municipalities, and from Then it reached an efficiency of 100%. It also fulfilled the condition of stagnant values equal to zero. Hence, these municipalities are the ones that constitute the efficient boundaries for the research sample, while the other municipalities have achieved lower levels of efficiency, or below the efficient boundaries according to the degree of each municipality. These municipalities are represented in (Al-Kadhimiya, Al-Dora, Al-Rasheed, Al-Sadr I, and II). The average full relative efficiency for all municipalities was (0.933), which is a high percentage that confirms the high utilization of the level of outputs of the studied municipalities. The results indicate that the municipality of Al-Kadhimiya obtained the lowest relative efficiency index, which is (0.704), but Al-Dora

municipality had an index (0.706), and Al-Rasheed Municipality ranked third (0.772), while Al-Sadr Municipality (first and second) was (0.949). These results indicate that the four municipalities that suffer from a decrease in their relative efficiency should increase their outputs by (29.6%, 29.4%, 22.8%, and 5.1%), respectively.

The results of Table (2) indicate that the average technical efficiency of all sample municipalities was (0.996), which confirms that the decision-making units in these municipalities have the ability to achieve maximizing outputs with the least available inputs (resources). Al-Dora municipality came with the lowest technical efficiency (0.968), but Al-Sadr Municipality (first and second) with technical efficiency reached (0.976). The average volumetric efficiency of the studied municipalities was (0.937), and this efficiency reflects the ability of the municipalities to expand based on the size of their operations. The municipality of Al-Kadhimiya came with the lowest volumetric efficiency (0.704), but Al-Dora municipality (0.729), Al-Rasheed municipality ranked third (0.772), and Al-Sadr municipality ranked fourth (0.972). This means that the mentioned municipalities have not reached a complete efficiency of the size (capacity) of the municipality, that is, there is a difference between the technical efficiency under the change return and the constant of the return, that is, the border production is different from the optimal production, and the optimal amount of used inputs differs from the number of actual inputs under the return Fixed.

It is noted that in the municipalities of (Al-Kadhimiya, Al-Dawra, and Al-Rasheed), their relative efficiency was (0.704, 0.706, 0.772), respectively. This confirms that the output efficiency must increase by (30%, 29.4%, and 22.8%), respectively while maintaining the level of inputs, and technical efficiency (1,000, 0.968, 1.000), respectively, assuming that a constant level of output is maintained. Efficiency High efficiency, and volumetric efficiency (0.704, 0.729, 0.772) respectively, and this indicates that the benefit resulting from the excess spending will give a lower return. In addition, the returns to scale are decreasing return to scales, which means that the percentage increase in inputs is greater than the percentage increase in outputs (services).

Reference units (the clues)

Table (3) indicates the reference units and the required improvements in the inefficient municipalities, and the efficient reference units are determined for the inefficient municipalities, based on their proximity or distance from the efficient municipalities. An efficient municipality is considered a reference municipality by weight (1). As for the inefficient municipality, the sum of its weights is close to or equal to one.

The reference municipalities of the municipality of Dora are (Al Shaab Municipality, Al-Mansour, New Baghdad, Al-Rasheed, and Al-Kadhimiya), and this municipality must go to these municipalities to achieve a higher level of efficiency, and benefit from their service patterns. As for the reference municipalities of the Al-Sadr Municipality (the first and the second), they are (Al-Rusafa, Al-Shula, and Al-Adhamiya), and this municipality must look and benefit from the production and service patterns that these municipalities follow because these municipalities use the same amount of resources, that is, they must refer to their counterparts, i.e. compare Same with more efficient one's units. While four municipalities were inefficient and did not make good use of their resources (inputs).

Note: The municipalities of Al-Rasheed and Al-Kadhimiya have no clues because they are closer to efficiency than to inefficiency, so they do not need clues, so they can rely on their resources and administrative procedures taken in them.

From the foregoing, we can conclude the following:

From the foregoing, we can conclude the following:

- There are (9) efficient municipalities out of a total of (13) municipalities that were able to reduce the level of inputs to a minimum possible with a fixed level of outputs, and thus were able to reach an efficiency level of 100%, and thus provided more beneficial services to the residents of the working municipalities in which.

- The average relative efficiency, as the results indicate, has reached (0.933). These results reflect that there are (9) municipalities out of a total of (13) efficient municipalities that were able to maximize their outputs for the benefit of society.

Table (3): Reference Municipalities of Inefficient Municipalities

	municipalities	Reference municipalities
1	Al-Mansour Municipality	Al-Mansour Municipality
2	People's Municipality	People's Municipality
3	Karrada Municipality	Karrada Municipality
4	Kadhimiya Municipality	Al-Mansour Municipality, Karkh Municipality, Karrada Municipality, Al-Shaab Municipality
5	Dora Municipality	Karrada Municipality, New Baghdad, Shaab
6	Rashid Municipality	Al-Akradah Municipality, Al-Shula Municipality, New Baghdad Municipality, Al-Shaab Municipality
7	Al-Shula Municipality	Al-Shula Municipality
8	Karkh Municipality	Karkh Municipality
9	Adhamiya	Adhamiya Municipality
10	Al Ghadeer Municipality	Al Ghadeer Municipality
11	Al-Sadr Municipality	Al-Rusafa Municipality, Al-Shula Municipality, Karrada Municipality
12	Rusafa Municipality	Rusafa Municipality
13	New Baghdad Municipality	New Baghdad Municipality

Source: From the work of researchers based on the data of the DEAPV2.1. program.

Conclusions

(1) The data envelope analysis method is one of the mathematical methods that give accurate results that the decision-making units (the municipalities of the Baghdad Municipality) can rely on in allocating their resources to avoid the waste that occurs in the use of the resources available to them.

(2) The results of the assessment showed that there were four municipalities that were not technically efficient in using their resources: Al-Kadhimiya Municipality, Al-Dora Municipality, Al-Rasheed Municipality and Al-Sadr Municipality out of a total of thirteen municipalities, which indicates that these municipalities operate below the production limit, as the relative efficiency in them has reached (0.704, 0.706, 0.772, 0.972) respectively and indicates that it suffers from a decrease in its relative efficiency, which
It should increase its output by (29.6%, 29.4%, 22.8%, 5.1%) respectively.

(3) Some municipalities of the Baghdad Municipality have shown an increasing yield (Al-Sadr Municipality), which enables them to expand their activities and achieve the optimum level of efficiency. There are also three municipalities that showed decreasing volume yields (Al-Kadhimiya Municipality, Al-Dora Municipality, Al-Rasheed Municipality) with values (0.704, 0.729, 0.772), respectively. Which means that it has not reached the optimal combination of its resources, and it has not reached the optimal level of output, and it is unable to expand its activity and reach full efficiency.

(4) The study sample municipalities, despite the large capital and operational expenditures in them, but they did not fulfill their role in satisfying the population's need for clean water, getting rid of environmental pollution, creating a state of green economy and keeping pace with the requirements of sustainable development. This is due to the state of administrative and financial corruption.

Recommendations

(1) The inefficient municipalities have to resort to the reference units (municipalities) that have achieved technical efficiency (100%) according to their proximity to the reference units. The municipality of Kadhimiya has to see the plans, procedures and measures carried out by the municipalities (Al-Mansur, Al-Karkh, Al-

Karrada, Al-Shaab), and the Dora municipality should refer to the evidence of the municipalities (Al-Karada, New Baghdad, Al-Shaab). As for the Al-Rasheed municipality, it must take advantage of the evidence (the municipality of Karrada, the municipality of Al-Shula, the new Baghdad municipality, and the municipality of the people).

(2) The necessity of directing the Baghdad Municipality towards the less efficient municipalities and providing them with sufficient inputs in order to keep pace with the efficient units. Some municipalities with higher inputs did not achieve higher efficiency than those with lower inputs.

(3) The necessity of conducting research and studies on the efficiency of the performance of the municipalities of the Mayoralty of Baghdad by adopting two methods, the first for teachers (DEA Model) and the second for teachers (standard) by adopting the Tobit, s Model.

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