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Efficiency measurements on service centers using data envelopment analysis model: A case study of counties in West Azerbaijan Province

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A B S T R A C T

Establishing service centers in counties is among the main elements in improving social welfare. Nowadays, the majority of counties not only face a shortage in service centers but also an unbalanced distribution of services. In turn, efficiency measurement of counties regarding establishing service centers is in great importance. Hence, it is essential to improve the efficiency of urban services, while distributing services in a way by which all counties are provided with balanced services. This study aims to evaluate the efficient counties in terms of having service centers. Descriptive-analytic method was applied to achieve the mentioned aim. Data was also collected using documentary and library methods. Data Envelopment Analysis (DEA) model is one of the effective ways to measure efficiency. The present study investigates the performance and efficiency of 17 counties in West Azerbaijan province in terms of having service centers using CCR and BCC models in data envelopment analysis method. The results indicate only 6 counties on CCR model and 7 counties on BCC model are relatively efficient and the remaining ones are inefficient. Finally, inefficient counties are modeled and the improvements needed for them to meet the efficiency boundary are explained.

K e y w o r d s: *Service centers, efficiency evaluation, data envelopment analysis model, West Azerbaijan Province.*

Introduction

In recent decades, urbanization has been preferred on municipal engineering so urban growth is faced serious problems and challenges (Ebrahimzadeh and Rafiee, 2009: 123). It is for the first time in history that more than a half of the world's population lives in urban areas. It is predicted that urban population will be duplicated in developing countries by 2030. This rapid population development brings difficulties and major challenges for counties (Chen, 2014). One of the challenges faced by urban and regional planners is the uneven and unbalanced growth of counties and regions. By looking at the spatial distribution of services in counties and urban areas it can be argued that services have been distributed in an unbalanced manner (Taqvaii & Akbari, 2009: 97). Urban development can be sustained if it provides specific strategies and

approaches to optimally meet residents' service needs. Due to their attitudes, structural weaknesses in urban management and the lack of public participation, service providers have not been able to efficiently distribute spatial balanced service. However, the focus of service centers on a single space not only results in high and low bipolar areas but also inflames the consumer population flow into these counties, which in turn leads to environmental pressure, traffic, pollution including sound and air etc. It is worth mentioning that this phenomenon attracts complementary and parallel applications, and exacerbates the polarization of spatial counties (Khakpour & Bavanoori, 2009: 187). The inequality and spatial imbalance in counties is not a new phenomenon in the world, although in developing countries, due to the significant socioeconomic and economic disparities and the imbalance in the distribution of services, the spatial differences of counties have been intensified and is more pronounced (Abdi Daneshpour, 1999: 37). In Iran, like other countries, the inappropriate distribution of urban services in different counties is highly concerned, and has become a transnational problem. The main concern of urban authorities has been the provision of urban services and less attention has been paid to its proper distribution (Kamran et al., 2010: 148). The purpose of this study is to scale counties in West Azerbaijan regarding providing service centers and identifying the level of their efficiency in services. Data envelopment analysis model has been applied since DEA model is a nonparametric approach. It also provides possibility to rank populations and analyze the contribution of each indicator (Charnes et al., 1977: 430). This model is based on a linear programming approach and its main purpose is to compare and evaluate a number of decision makers having different inputs and outputs (Afshar Kazemi et al., 2006: 42). This study applies two basic models of data envelopment analysis including CCR model and BCC model. Counties of the study province are ranked according to the service centers indicators.

Theory and Methodology

The present study is an applied one with mathematical modeling approach. The mathematical model used in this study is data envelopment analysis including BCC and CCR with an output-based approach. The variables used in the study are extracted and defined according to the data collected on 2014 of counties in West Azerbaijan province. The data were analyzed using DEA model in Frontier Analyst software and the results were extracted. Then, using efficiency scores, counties were ranked. Finally, counties are modeled by introducing a model county to the inefficient counties. Level of improvement in outputs needed for inefficient counties to reach the efficiency threshold is explained as well.

Research technique

This method, which is globally known as efficiency measurement method provides a breakdown for outputs while measuring the efficiency of return to the scale in production. Currently, DEA is one of highly researched areas in measuring performance which has been widely addressed by researchers around the world. This method is applied to assess the performance of public and nonprofit organizations whose pricing information is usually unavailable or unreliable. This method is generally uses the term Decision Maker Unit (DMU) instead of the term producer in order to be committed to generalization. DEA uses a linear programming technique and is among nonparametric methods for estimating isoquant functions (Imami Meybodi, 2000). Input- or output-based models: Given that the inputs of business organizations are centrally determined at a certain level, the output-based model (output maximization derived from the specified input) is used in this study.

CCR model

This model, which is a planning pattern, seeks to maximize the relative efficiency of the unit p by

choosing a set of weights for all inputs and outputs, while the rating of each unit should be less than or equal to 1.

Equation 1

$$
\begin{aligned}
&CCR_D - I\\
&MAX \quad wp=\textstyle\sum_{r=1}^{S} u_r\, y_{rp}\\
&St:\\
&\sum_{i=1}^{s} v_i\, x_{ip} = 1\\
&\sum_{r=1}^{s} u_r\, y_{rp} - \sum_{i=1}^{s} v_i\, x_{ip} \le 0\\
&\qquad\qquad j = 1, \ldots, n\\
&ur \ge 0 \qquad\qquad r = 1, \ldots, s\\
&vj \ge 0 \qquad\qquad i = 1, \ldots, k
\end{aligned}
$$

Where w_p is the relative efficiency of the decision-making unit (DMUp). In other words, it seeks to maximize output with respect to the institutional constraints. *Xi* and *yr* represent *k* input and s output for n units, respectively. *V* and *u* vectors also show the weights of inputs and outputs, respectively. The first limitation is actually the denominator of the primary objective function of the fraction, which allows the model to be solved in a linear programming framework. The second limitation ensures that, under the selected set of weights, the efficiency score of any one of the decision units is not greater than 1. The above model must be implemented for each decision unit to determine the relative efficiency of each unit. According to the literature, it was found that in the CCR model, if the number of units does not differ significantly from the inputs, most units will usually be effective or be placed on the efficiency boundary. A dual model is used to solve this problem.

Equation 2

$$
\begin{aligned}
&CCR'_p - I\\
&MIN \;\; Zp = \Theta\\
&St:\\
&\sum_{j=1}^{n} \lambda j\, y_{rj} \ge y_{rp} \qquad r = 1, \ldots, s\\
&\Theta\, xip - \textstyle\sum_{j=1}^{n} \lambda_j\, x_{rj} \ge 0 \qquad i = 1, \ldots, k\\
&\lambda_j \ge 0 \qquad\qquad j = 1, \ldots, n\\
&\\
&\text{free in } \Theta
\end{aligned}
$$

DMUp is efficient if and only if (1) and (2) constraints are required in model (2) (surplus variables are equal to zero) and (Cooper et al,2004:12).

$$Z_p^* = w_p^* = \theta^* = 1$$

For DMUp functionality to be only determined using a linear programming method, program (2) has been developed as follows:

Equation 3

$$
\begin{aligned}
&CCRp - I\\
&MIN \;\; Zp = \Theta - \textstyle\sum_{r=1}^{s} s_r^+ - \sum_{r=1}^{s} s_r^-\\
&St:\\
&\sum_{j=1}^{n} \lambda j\, y_{rj} - s_r^+ \ge y_{rp} \qquad r = 1, \ldots, s\\
&\Theta\, xip - \textstyle\sum_{j=1}^{n} \lambda_j\, x_{rj} - s_i^- \ge 0 \qquad i = 1, \ldots, k\\
&\lambda_j \ge 0 \qquad\qquad j = 1, \ldots, n\\
&s_r^+ \ge 0 \qquad\qquad r = 1, \ldots, s\\
&s_r^+ \ge 0 \qquad\qquad i = 1, \ldots, k\\
&\\
&\text{free in } \Theta
\end{aligned}
$$

where, s_i^-, s_r^+, λ_j and *are dual variables. DMUp is efficient if $0 = s_r^* = s_i^*$ and $z_p^* = w_p^* = 1$. In order to ensure that we do not have any weights of 1, and all inputs and outputs can be achieved in the solution of the model, the program (1) is corrected using ε as follows, which is usually considered as small as 0.001 or 0.0001:

Equation 4

$$
\begin{aligned}
&CCR_D - I\\
&MAX \;\; wp = \textstyle\sum_{r=1}^{S} u_r\, y_{rp}\\
&St: \qquad\qquad (4)\\
&\sum_{i=1}^{k} v_i\, x_{ip} = 1\\
&\sum_{r=1}^{k} u_r\, y_{rp} - \sum_{i=1}^{k} v_i\, x_{ip} \le 0\\
&ur \ge \pounds \qquad\qquad j = 1, \ldots, n\\
&vj \ge \pounds \qquad\qquad r = 1, \ldots, s\\
&\qquad\qquad i = 1, \ldots, k
\end{aligned}
$$

In this model, both base input and output are assumed to produce a constant return, i.e. if the inputs are doubled, outputs are doubled too (Martinez & Waldo, 2014: 5)

BCC model*:*

This model is achieved by adding convexity constraint $\sum_{j=1}^{n} \lambda_j = 1$ to CCR initial linear programming so that the return to scale can be constant, increasing, or decreasing. This constraint in

CCR model will cause the new variable (u) to appear in BBC model.

Equation 5

$$\begin{aligned}&\text{BCCD} - \text{I}\\&\text{MAX} \quad wp=\textstyle\sum_{r=1}^{s} u_r\, y_{rp} + u\\&\text{St:}\\&\sum_{i=1}^{K} v_i\, x_{ip} = 1\\&\sum_{r=1}^{K} u_r\, y_{rp} - \sum_{i=1}^{K} v_i\, x_{ip} + u \le 0\\&ur \geq £ \qquad\qquad j = 1, \ldots, n\\&vj \geq 0£ \qquad\qquad r = 1, \ldots, s\\&\qquad\qquad i = 1, \ldots, k\\&\text{BCCp- I}\\&\text{MIN } Zp = \Theta - \textstyle\sum_{r=1}^{s} s_r^{+} - \sum_{r=1}^{s} s_r^{-}\end{aligned}$$

Equation 5

$$\begin{aligned}&\text{St:} \sum_{j=1}^{n} \lambda j\, y_{rj} - s_r^{+} \geq y_{rp} \qquad r = 1, \ldots, s\\&\Theta\, xip - \textstyle\sum_{j=1}^{n} \lambda_j\, x_{rj} - s_i^{-} \geq 0 \qquad i = 1, \ldots, k\\&\textstyle\sum_{j=1}^{n} \lambda_j = 1\\&\lambda_j \geq 0 \qquad j = 1, \ldots, n\\&s_r^{+} \geq 0 \qquad r = 1, \ldots, s\\&s_r^{+} \geq 0 \qquad i = 1, \ldots, k\\&\text{free in } \Theta\end{aligned}$$

The BCC model can also be based on outputs. It is just needed to add $\sum_{j=1}^{n} \lambda_j = 1$ constraint to the initial planning of CCR baseline output (Keshavarz & Toloo, 2014: 452).

Literature review

Data envelopment analysis was first introduced in the doctoral thesis of Charens guided by Cooper and Rhodes. It was first used to evaluate the relative efficiency of US National Schools and published in 1978. This model was named after its providers to CCR model (Charnes, 1978: 433). In 1984, Bunker, Charens and Cooper published a paper in which a model called BCC was introduced. The new model included return to scale (Vadodi Mofid, 2005). The literature shows that this method has been applied in several areas, but there is no report on measuring the efficiency of service centers. Worthington et al. measured the efficiency of 103 Australian local governments in internal management and recycling services using DEA method (Worthington & Dollery 2001). Michailove et al. measured the efficiency of 24 Bulgarian municipalities using DEA method (Michailova et al 1996). Sampaio and Stosic, using DEA method, estimated technical efficiency of 4,796 municipalities in Brazil (Sampaio & Stosic, 2003). Gonza'elz et al. (2011), in a study entitled "The importance of geographic analysis in life quality assessment: A case study of Spain", measured the efficiency of life quality indicators at three geographical levels (region, province and county) using Data Envelopment Analysis Method. In their study of "Measuring life quality in Canary islands" Martin and Mendoza (2013), using the DEA model, measured 19 life quality indicators in 87 counties of the Canary Islands in Spain. Poldaru and Roots (2014), in "The DEA model, a method for estimating life quality in Estonia," measured life quality in Estonian counties and analyzed 15 counties regarding their statistical indicators during 2000-2011. They rated counties using DEA model.

In Iran, Akbari and Basiri Parsa (2003) measured technical efficiency of Isfahan municipality development activities in urban areas using DEA method (Akbari et al., 2003). Zaryari et al. (2010) evaluated the developmental efficiency of 30 provinces in Iran using DEA. Based on their findings, ten provinces were efficient. However, the present study is the first attempt to address performance efficiency of counties in West Azerbaijan Province regarding distribution of service centers.

The study area

West Azerbaijan Province, including Urmia Lake, covers an area of 43,660 square kilometers. The province, which is located in the northwest of Iran, accounts for 2.65% of the total area of the country and is located between 35 degrees 58 minutes to 39 degrees and 46 minutes northern latitude and 44 degrees 3 minutes to 47 degrees 23 minutes East latitude. The province is adjacent to Azerbaijan and Armenia on the north and northeast, Turkey and Iraq to the west, Kurdistan province to the south and eastern Azerbaijan and Zanjan provinces to the east. According to the latest statistics and divisions, the province has 17

counties, 36 districts, 109 rural districts and 3728 villages. Its population is about 326, 5219 (Statistics Center, Iran, 2015).

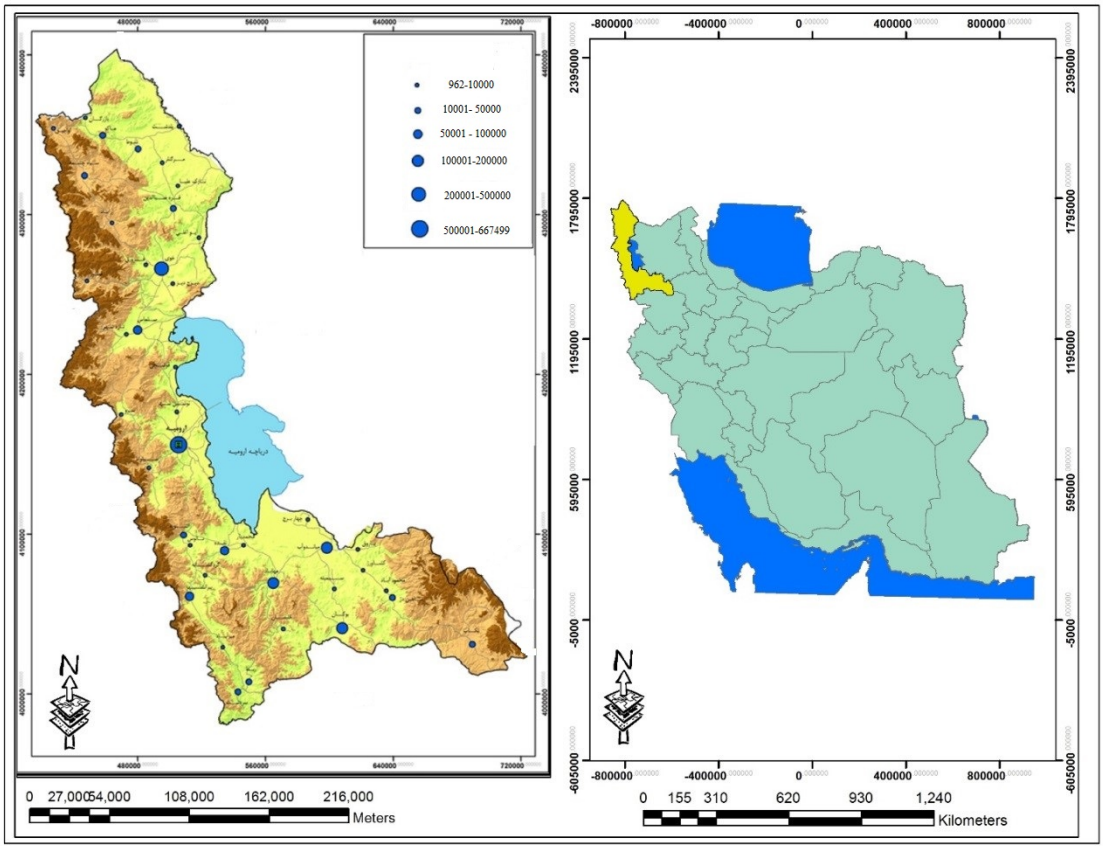


Figure 1: Geographic location of under studied area (Source: Authors, 2018)

Results and Discussion

Public services refer to those services that provide residents with needed facilities, and facilitate the production process which do not produce tangible goods. According to the definition of the Iranian Statistical Center and the facts of urban life, services are classified as follows:

Social services (including health services, educational services, etc.).

Welfare and leisure services (including artistic, recreational, sports services).

Reception and accommodation services (including hotel, restaurant, etc.)

Information services (including computer, print, visual and audio services, etc.)

Financial and commercial services (including banking, insurance, etc.)

Urban transport services (including transportation services, etc.), (Study Center of Urban and Rural Services, 2006: 3).

The decision-making units in data envelopment analysis are considered to be systems that convert inputs into outputs. A system that is able to produce more outputs using fewer inputs is more efficient, and has better performance. By providing a systematic approach to decision-making units, data envelopment analysis models aim to maximize their efficiency (Ziari et al., 2010: 262).

Higher Education

The socio-economic development of a country is significantly influenced by literacy indicator. In 2011, West Azerbaijan province had 75 higher education institutions. Urmia, Khoy and Miyandoab are the most

populated counties in west Azerbaijan, respectively. As in Table 1, 25.3% of the total number of institutions is located in Urmia. Khoy with 10.6%, Miyandoab with 10.6 and Mahabad with 6.6% are followed. Followed by Urmia, Khoy and Miyandoab have a higher percentage of higher educational institutions than other counties in the province. Therefore, it can generally be stated that at the provincial level, higher educational institutions are concentrated in the provincial capital.

Health centers (Hospitals) based on number of beds and doctors

With a quick look at the spatial distribution of various health services in the West Azerbaijan province, Urmia has the biggest number of hospitals, hospital beds and doctors working in the province which followed by Khoy and Miyandoab. Three newly-established counties of Chaypare, Poldasht and Shoot are in the lowest ranks, respectively. Cold storage rooms, silo and warehouses distribution. In 2014, West Azarbaijan province has 15 public warehouses, 4 silos and 122 cold storages. Urmia has the largest number of warehouses.

Table 1: Distribution of services (higher education, medical centers, cold storages warehouses and silos in the counties

County	*Cold storages, Warehouses and Silos*			*Health Centers*			*Higher Education Institutes*					
	Silo	Warehouse	Cold Storage	Doctors No	Bed No	Hospital No	State UNI	Azad UNI	PNU UNI	Non-Profit UNI	Vocational& other UNI	Vocational Institutes
Urmia	85	3	2	760	1786	11	4	1	2	4	6	2
Oshnaviyeh	3	0	0	20	25	1	0	0	1	0	0	0
Bookan	2	1	0	65	133	1	0	1	1	0	0	2
Poldasht	0	0	0	13	20	1	0	0	1	0	0	0
Piranshahr	0	0	0	21	62	1	0	1	1	0	0	2
Tekab	0	0	0	23	73	1	0	1	1	0	1	1
Chaldoran	0	0	0	19	25	1	0	1	1	0	0	0
Chaypare	0	0	0	-	30	1	0	1	1	0	0	0
Khoy	4	1	1	79	342	2	0	2	2	2	0	2
Sardasht	0	0	0	34	117	1	0	1	1	0	0	1
Salmas	4	2	0	80	165	1	0	1	2	0	0	1
Shahindezh	1	0	0	33	87	1	0	1	1	0	0	1
Shoot	0	0	0	17	10	1	0	0	1	0	0	0
Mako	1	1	0	35	120	2	0	1	1	0	0	1
Mahabad	8	4	1	111	244	1	0	1	1	0	1	2
Miyandoab	5	1	0	112	252	2	1	1	2	0	2	2
Naghade	9	2	0	70	142	2	0	1	1	0	0	1
Total	122	15	4	1492	3632	31	5	15	21	6	10	18

Hotel and hospitality centers distribution

In spite of many cultural, historical and, in particular natural, cultural heritages in the region, the border with three foreign countries has doubled the touristic attractions in this region. The importance of tourism in the economic dimension is such that other economic activities are organized in accordance with the demands of the tourism market.

Considering the statistics obtained in 2015 (Table 2, the largest number of hotels and hospitality centers are concentrated in Urmia which is followed by Khoy and Mako. Chaypare, Shoot and Chaldoran have the lowest rank in hotels and hospitalities.

Cultural service distribution

Cultural service centers are poorly and inefficiently distributed. Based on statistics and data obtained in

2015, the majority of these centers are located in Urmia. The following tables show the number of centers providing cultural services in the West Azerbaijan province. Urmia, Khoy and Miyandoab have the highest number of cultural centers in the province. Poldasht, Shoot and Chaypare are in the lowest ranks, respectively.

Table 2: Distribution of the services (tourist centers and cultural services centers) in the counties

	Cultural Services Centers												***Tourist centers***	
County	Press													
	Bindery	Lithography	TAMPO Print	Heligraver & Flexo	Digitala	Offset	Cultural products stores	The Movies	Advertising Agencies	News stand	Certificated Publications	THeaters	Restaurants & Dinners	Hotels & Inns
Urmia	6	6	10	6	34	32	129	3	135	94	38	2	1168	87
Oshnaviye	0	0	1	0	1	1	11	1	4	3	0	1	59	2
Bookan	0	1	0	1	4	1	33	1	6	5	3	2	183	6
Poldasht	0	0	0	0	1	0	0	0	1	0	0	0	32	0
Piranshahr	0	0	0	0	1	1	24	0	3	8	0	1	89	3
Tekab	0	0	0	0	1	1	13	0	1	7	1	1	54	1
Chaldoran	0	0	0	0	0	1	10	0	1	3	1	1	24	0
Chaypare	0	0	0	0	1	1	0	0	1	1	1	1	13	0
Khoy	0	1	3	2	3	13	32	3	15	10	9	1	717	24
Sardasht	0	0	1	0	1	1	13	1	4	1	0	1	130	6
Salmas	0	0	6	1	3	4	26	1	5	6	2	1	287	6
Shahindezh	0	0	0	1	1	1	37	1	2	3	1	1	79	3
Shoot	0	0	0	0	1	0	0	0	1	2	0	0	22	0
Mako	0	0	1	0	3	4	30	1	4	10	2	1	290	17
Mahabad	0	1	6	0	3	5	19	1	10	8	2	1	174	11
Miyandoab	0	0	1	0	4	7	84	1	7	7	3	1	268	7
Naghade	0	0	4	1	2	3	23	1	4	11	3	2	155	5
Total	6	9	33	12	64	77	480	15	204	179	64	18	3744	178

Banking unit's distribution

The majority of state-owned commercial banks are located in Urmia County, especially in Urmia County. In addition, the diversity of banks is higher in Urmia. Urmia, Khoy and Miyandoab have the greatest number of banks, respectively. Poldasht, Chayipare and Shoot are at lowest ranks, respectively.

Transportation services distribution

Based on data and statistics, the majority of passengers and transportation services (passengers, transportation companies, freight forwarding companies, public terminals and public cargo terminals) are located in Urmia which is followed by Mako and Khoy. Shoot.

Chaldoran and Poldasht are at lowest ranks, respectively.

Postal services distribution

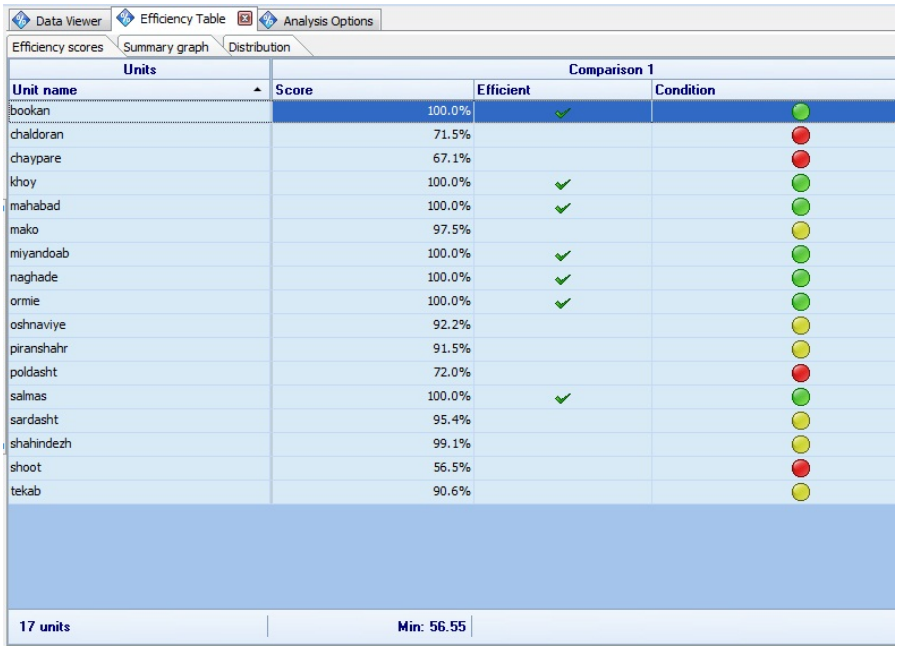
According to the analysis, the highest number of postal service providers with 31.6% is located in Urmia, followed by Khoy and Miyandoab. Shoot, Chaypare and Poldasht are in the lowest ranks, respectively.

Table 3: Distribution of the services (banking and transportation services) in the counties

County	Transportation services centers					Banking service centers									
	public cargo terminals	public terminals	freight forwarding	passengers	Post Bank	Tose Saderat	Sepah	Sanat	Maskan	Keshavarzi	Refah	Tejarat	Saderat	Melat	Meli
Urmia	2	1	63	30	4	1	25	1	17	14	15	29	37	36	38
Oshnaviye	0	1	3	2	0	·	1	0	1	1	1	1	1	1	1
Bookan	0	1	8	5	1	·	4	0	3	3	2	3	5	3	3
Poldasht	0	1	2	1	0	·	1	0	0	0	0	0	0	1	0
Piranshahr	0	1	3	5	0	·	1	0	1	1	1	1	1	1	2
Tekab	0	1	2	5	1	·	1	0	1	1	1	1	1	1	2
Chaldoran	0	1	0	1	0	·	1	0	1	2	1	1	1	1	1
Chaypare	0	0	4	2	0	·	1	0	1	0	0	1	0	1	0
Khoy	0	1	12	11	1	·	5	1	4	10	5	9	7	9	13
Sardasht	0	1	2	3	1	·	1	0	1	1	1	1	2	2	2
Salmas	0	1	6	11	2	·	3	0	2	7	2	4	2	2	6
Shahindezh	0	0	3	2	1	·	1	0	1	4	1	2	1	2	3
Shoot	0	1	0	1	0	·	1	0	1	0	0	1	0	1	0
Mako	0	1	18	5	0	·	3	0	1	6	3	2	4	2	8
Mahabad	0	1	9	10	1	·	2	0	4	3	4	3	4	2	4
Miyandoab	0	1	10	7	1	·	2	0	3	4	4	4	3	7	5
Naghade	0	1	5	8	1	·	1	0	3	3	2	3	2	2	4
Total	2	15	150	109	14	1	54	2	45	60	43	66	71	74	92

Efficiency measurement based on CCR and BCC models

CCR and BCC models are two basic models in data envelopment analysis. CCR measures efficiency by assuming a constant return to scale and BCC measures efficiency on the assumption of variable returns to scale. These models have two applications, one is based on minimizing the use of production factors and the other is based on maximizing production factors. This study utilizes both models to measure the efficiency of service centers in counties of West Azerbaijan province.



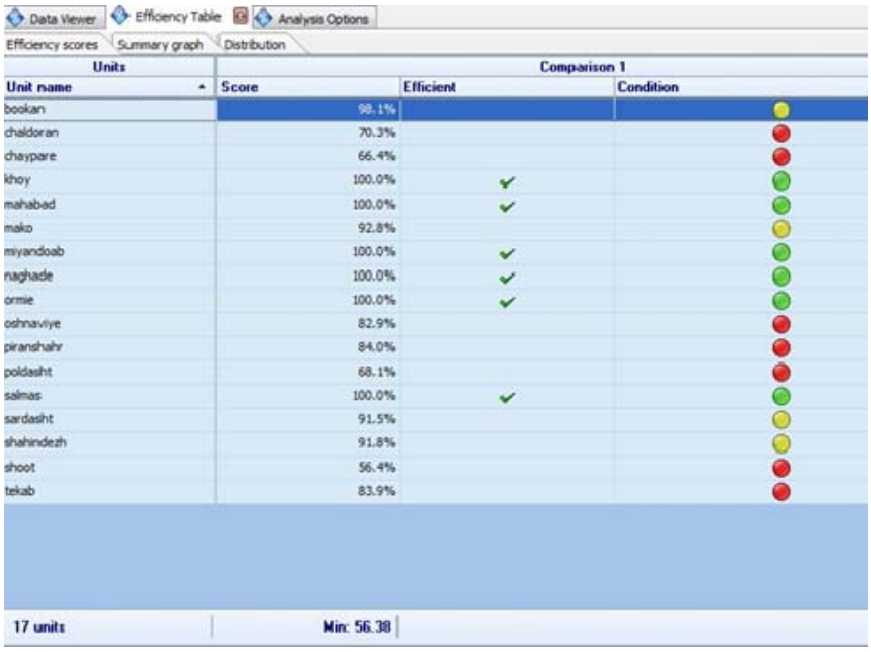
Data Viewer | Efficiency Table | Analysis Options

Efficiency scores | Summary graph | Distribution

Units	Comparison 1		
Unit name	Score	Efficient	Condition
bookan	100.0%	✓	
chaldoran	71.5%		
chaypare	67.1%		
khoy	100.0%	✓	
mahabad	100.0%	✓	
mako	97.5%		
miyandoab	100.0%	✓	
naghade	100.0%	✓	
ormie	100.0%	✓	
oshnaviye	92.2%		
piranshahr	91.5%		
poldasht	72.0%		
salmas	100.0%	✓	
sardasht	95.4%		
shahindezh	99.1%		
shoot	56.5%		
tekab	90.6%		

17 units | Min: 56.55

Figure 2: Ranking of counties based on BCC model



Data Viewer | Efficiency Table | Analysis Options

Efficiency scores | Summary graph | Distribution

Units	Comparison 1		
Unit name	Score	Efficient	Condition
bookan	98.1%		
chaldoran	70.3%		
chaypare	66.4%		
khoy	100.0%	✓	
mahabad	100.0%	✓	
mako	92.8%		
miyandoab	100.0%	✓	
naghade	100.0%	✓	
ormie	100.0%	✓	
oshnaviye	82.9%		
piranshahr	84.0%		
poldasht	68.1%		
salmas	100.0%	✓	
sardasht	91.5%		
shahindezh	91.8%		
shoot	56.4%		
tekab	83.9%		

17 units | Min: 56.38

Figure 3: Ranking of counties based on the CCR model

As seen in the figures above, 6 counties in CCR and 7 counties in BCC are efficient. Figures 4 and 5 show effective areas based on CCR and BCC. The number of inefficient counties for which an efficient county can serve as a model to achieve efficiency threshold has been identified. Figure 4, based on CCR model, shows that Khoy and Urmia are the most efficient counties and can be modeled for 10 counties, while Naghadeh can only be modeled on 2 counties. It is argued that (according to Figure 4) inefficient counties are needed to follow the model of efficient counties which is 6 according to the analysis performed by CCR which is 6 according to the analysis performed by CCR.

Data Viewer | Efficiency Table | Analysis Options | Reference Set Frequency

Graph | Table | Details

Unit name	Comparison 1	Maximum
khoy	10	10
ormie	10	10
miyandoab	9	9
mahabad	8	8
salmas	3	3
naghade	2	2

Figure 4: Efficiency model based on CCR model

In the following figure, efficient counties are identified based on BCC model. 41% of counties are efficient. The results of this model show Urmia can act as a model for 11 inefficient counties, while other counties such as Naghadeh and Salmas serve as a model for only 4 counties. Accordingly, based on the analysis, it is better to apply these seven counties as model counties in BCC.

Data Viewer | Efficiency Table | Analysis Options | Reference Set Frequency

Graph | Table | Details

Unit name	Comparison 1	Maximum
ormie	11	11
khoy	7	7
miyandoab	7	7
mahabad	7	7
bookan	5	5
salmas	4	4
naghade	4	4

Figure 5: Efficiency model based on BCC model

Conclusion

Establishing service centers in counties is among the main elements in improving social welfare. Nowadays, the majority of counties not only face a shortage in service centers but also an unbalanced distribution of services. In turn, efficiency measurement of counties regarding establishing service centers is of great importance. Hence, it is essential to improve the efficiency of urban services, while distributing services in a way by which all counties are provided with balanced service. This study measures the efficiency of counties in West Azerbaijan province regarding municipal services using CCR and BCC models. According to CCR model, 35.29% and according to BCC model, 17.14% of counties are efficient, and the remaining are inefficient and do not utilize their available resources and facilities in an optimal manner. Efficiency does not concern the amount of resources available, but also how to properly utilize and manage the facilities. The purpose of ranking counties is to identify efficient and inefficient counties in order to improve the status quo, to move towards the efficiency, to improve service centers in the province and to distribute them in a balanced manner. Therefore, using DEA model, through proper modeling from other efficient counties, with the allocation of appropriate resources and policies, it is possible to promote other counties and bring them to the efficiency frontier.

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