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Modeling Organizational Excellence with Data Envelopment Analysis Approach in Kerman Municipality

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Abstract

In this study, recognizing the importance of performance evaluation and achieving organizational excellence, an effort has been made to combine both qualitative and quantitative approaches. This involves using models derived from Total Quality Management (TQM), under the label of Organizational Excellence Models, and mathematical models of Data Envelopment Analysis (DEA). The aim is to present a model for organizational excellence in the Kerman Municipality in 2015 that incorporates the benefits of both methods while minimizing their drawbacks. By examining Organizational Excellence Models, suitable criteria for performance evaluation and organizational excellence are identified. These criteria and elements are then applied in the DEA approach, which primarily evaluates organizations using tangible inputs and outputs (resources and outcomes). It is important to note that this study was conducted in 2015 using Excel and SPSS 12 software. A comparison between the EFQM and DEA methods was carried out, and the ranking results for both models regarding efficient units showed identical outcomes. However, differences were observed in inefficient units. The correlation coefficient between leadership and key results is 0.91, with a P-Value of 0.000; the correlation coefficient between leadership and strategy is 0.81, with a P-Value of 0.000; and the correlation coefficient between resources and key results is 0.79, with a P-Value of 0.000.

Key words: *Organizational Excellence, Data Envelopment Analysis, Kerman Municipality*

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Introduction

The organizational excellence model serves as a tool to help organizations establish an effective management system. The application of modern evaluation methods aligned with organizational excellence models is growing in Iranian organizations. Practical experience in applying this model in public organizations has highlighted its key advantages for internal evaluation. This is because the organizational excellence model is comprehensive, practical, and well-suited to the nature of municipal work, making it the most effective method for evaluating municipal performance. The model quantitatively identifies a municipality's strengths and areas for improvement, both relative to an ideal state and in comparison with competitors. It also helps in setting priorities for improvement and defining corrective and preventive actions. In general, when implemented correctly, the organizational excellence model is an effective tool for institutionalizing self-assessment and continuous improvement within organizations, facilitating the identification of best practices and the process of benchmarking (Anvari Rostami, 2002). Essentially, these models utilize elements of Total Quality Management as the main evaluation criteria, assigning predetermined weights to each area, which are assessed through audits to gauge organizational performance.

Fathi and Mohammad-Hadi (2013) assessed the performance of the Development and Resource Management Deputy (Support) at medical universities across the country using the organizational excellence model. The results revealed that the highest score achieved by the universities was in the "processes" criterion, with a score of 91%, followed by 67% for "resources and partnerships," 65% for "policies and strategies," 42.93% for "key performance results," 42.7% for "leadership," 38.13% for "customer results," and 35.56% for the "employees" criterion.

Mahani-Pour (2012) conducted an evaluation of the performance of the municipalities of Rafsanjan and Sirjan based on the organizational excellence model. The findings of the study showed that in the Rafsanjan Municipality, the highest score was given to "community results," followed by the second-highest score for "partnerships and resources," and the ninth score for "customer results." In contrast, the Sirjan Municipality assigned the highest score to "community results," the second-highest score to "partnerships and resources," and the lowest score to "customer results."

Nazari et al. (2012) proposed a model that combines organizational excellence and Data Envelopment Analysis (DEA) to assess the relative efficiency of organizations and rank them. The proposed model utilized enablers and results from the organizational excellence model, incorporating transformations and weighted controls as inputs and outputs. This approach enables the measurement of organizational efficiency in comparison to all organizations, regardless of their different characteristics. Furthermore, the model is capable of identifying improvement areas and prioritizing projects to achieve greater efficiency.

In recent times, the scale and complexity of urban management services have greatly increased. Municipalities have evolved into large organizations with numerous and intricate processes required to deliver a wide range of services. This necessitates that urban management focus on reforming administrative and executive processes, enhancing systems and methods, and, in other words, achieving organizational excellence. The municipality of Kerman, as a prominent and influential entity within the city, is accountable to citizens and stakeholders in urban affairs. Therefore, enhancing quality and achieving improved management have always been central objectives. As a result, transitioning to Total Quality Management (TQM) through the establishment of a comprehensive systemic approach and the structured performance evaluation of the entire Kerman municipality has become essential.

In this study, in light of the previously discussed points and the need for performance evaluation and the pursuit of organizational excellence, an effort has been made to combine both qualitative and quantitative approaches in the evaluation process. This is achieved through the use of models derived from Total Quality Management, known as organizational excellence models, alongside the mathematical models of Data Envelopment Analysis (DEA). The aim is to present a model for organizational excellence that retains the advantages of both approaches while minimizing their drawbacks. Specifically, the study first identifies appropriate criteria for performance evaluation and organizational excellence through an examination of organizational excellence models. Then, the criteria and elements of the Data Envelopment Analysis approach, which primarily evaluates organizations based on tangible inputs and outputs, are applied.

Theoretical Foundations of the Research

Organizational Excellence

Organizational excellence is a management framework that, by focusing on fundamental principles and concepts and emphasizing key criteria of Total Quality Management (TQM) and self-assessment systems, promotes progress and improvement. The excellence model functions as a tool to assess the extent of system implementation within an organization, enabling self-assessment and offering guidance to help managers identify and follow a path to performance enhancement. Consequently, the core message of the excellence model revolves around answering two essential questions: How is this model recognized as an appropriate and logical management structure, and who plays a crucial role in the communication and interaction chain? At the first level, the model focuses on overarching objectives, and at the subsequent level, these objectives are further broken down into measurable and quantifiable scales (Rodriguez et al., 2014).

The EFQM model, introduced in 1991, is a business excellence framework designed to guide organizational judgment and self-assessment, ultimately enabling organizations to earn the European Quality Award. This initiative was launched in 1992. The model emphasizes the sustainability benefits that an excellent organization must achieve, and it quickly captured the attention of European companies. It was soon recognized by public sector organizations and small industries as well. In 1995, a version tailored for the public sector was developed, followed by a version for small organizations in 1996. The most significant revision of the EFQM model occurred in 1999, and in 2001, the model for small and medium-sized enterprises was updated. In 2003, a newer version of the EFQM model was released, incorporating notable changes compared to the 1999 revision. Fundamentally, the EFQM model shares many similarities with the Malcolm Baldrige model, particularly in terms of concepts and principles.

This model consists of nine criteria: five enabler criteria–Leadership, Policy and Strategy, People, Partnerships and Resources, and Processes–and four result criteria–Customer Results, People Results, Society Results, and Key Performance Results. The enabler criteria represent the actions an organization takes and the factors that allow it to achieve excellent results. The result criteria, on the other hand, reflect the outcomes an organization attains, representing the achievements that arise from the effective implementation of the enabler criteria (Shahroudi, 2009).

Organizational Excellence Models in Iran

The concept of organizational excellence in Iran emerged in a context where over 70 national excellence models and 90 quality awards existed worldwide, most of which were based on the EFQM and Malcolm Baldrige models, gradually converging towards each other. It appears that the language of competition is universal, and economic institutions must inevitably adopt the principles of Total Quality Management (TQM) for organizational success.

The need to enhance the competitiveness of the industrial and mining sectors with a global outlook, alongside recommendations for industrial partnerships and mergers to gain international credibility, led to the adoption of a global model by Iran's Ministry of Industry and Mines. These models have been accepted and followed by global industrial communities for several years.

Between 1999 and 2002, the Ministry of Industry and Mines, in collaboration with the Institute for Productivity and Human Resources Studies, reviewed the two primary models—Malcolm Baldrige and EFQM—and the modifications made by other countries. The selection process involved expert groups, information gathering, and communication with institutions that had implemented these models. Preliminary drafts were prepared, and after numerous meetings with scientific committees composed of management systems experts, the EFQM Excellence Model was approved by the scientific committee on 31 May 2003.

Since its approval in 2003, the EFQM model has been implemented by the subsidiaries of the Ministry of Industry and Mines. Alongside the Institute for Productivity and Human Resources Studies, they laid the groundwork for the National Productivity and Organizational Excellence Award. Over two cycles of this award, several large public sector companies and a limited number of private sector companies adopted the model. After completing the self-assessment phase, these companies successfully submitted their applications for certification (Langroudi et al., 2008).

Research Background

Mohammadpoor Zarandi et al. (2014) evaluated organizational excellence in Tehran Municipality from the perspective of human resource management, based on the organizational excellence model. The results revealed that the human resource managers of Tehran Municipality assigned a score of 609.85 to the municipality. In this evaluation, the enabler area received a score of 296.34, while the results area scored 313.51. The findings suggest that the evaluation, using the described model, is an effective tool for identifying the performance status, strengths, and areas for improvement within Tehran Municipality.

Farajpahlou et al. (2009) assessed the quality of performance in the library management of Shahid Chamran University of Ahvaz using the organizational excellence model. They found that the quality of management in the university's libraries was below average, with a score of 421.3 out of 1000 on the organizational excellence model. They concluded that the European Foundation for Quality Management (EFQM) model, which had primarily been used in industrial institutions and rarely in non-library service institutions, could be adapted with minor modifications to fit the library environment, making it applicable in this context as well.

Azar et al. (2004), recognizing the necessity of performance evaluation and achieving organizational excellence, aimed to develop a model for organizational excellence by combining qualitative and quantitative approaches. This model involved frameworks derived from Total Quality Management (TQM), specifically organizational excellence models, and mathematical models like Data Envelopment Analysis (DEA). The goal was to create a model that would leverage the advantages of both methods while minimizing their disadvantages. In this research, appropriate criteria for performance evaluation and organizational excellence were identified through the examination of organizational excellence models. These criteria were then used in the DEA approach, which evaluates organizations primarily based on tangible inputs and outputs.

Farhadi Mahali (2013) applied the organizational excellence model to measure the performance of a steel industry company. The findings revealed that the highest scores were attributed to partnerships and resources, suggesting that enhancing these areas could lead to organizational excellence.

Kartmel et al. (2011), in their study titled "The Expanding Role of Transformational Leadership: How Can the Organizational Excellence Model Be Effectively Applied in the Educational Sector?", found a positive relationship between the application of the organizational excellence model in the educational sector and improvements in financial performance. The model's application led to a better balance of stakeholder expectations and process improvements.

Langroudi et al. (2008) investigated the credibility of the results derived from the organizational excellence model using Data Envelopment Analysis. In this study, some weaknesses of the organizational excellence model were examined. By applying the input-output structure and DEA, a method was proposed for identifying the mismatch between enablers and the results achieved by the organization. This mismatch could stem from hidden problems and barriers within the organization's core.

Research Methodology

The research method used in this study is descriptive-analytical and falls within the framework of applied (transformational) research. It combines both library-based and field-based approaches. The statistical population of the study includes the municipalities of Kerman city. Given the nature of the research, there is no specific sample size; instead, data from four years will be used for calculating the indicators. The sources for data collection are categorized into two types: primary and secondary. Secondary sources consist of articles, books, research, studies, and theses relevant to the subject, collected through libraries and websites. Primary data is gathered using a field-based method, specifically a questionnaire.

In this study, both a questionnaire and documents were utilized for data collection. It is important to note that the questionnaire was chosen due to its higher efficiency in managerial research in Iran (Azar, 2004). The first step involved identifying processes, followed by determining input and output indicators, with scores assigned using the EFQM model. By calculating the percentage score for each enabler and result, the overall performance of the Decision-Making Unit (DMU) was evaluated using the model, represented as a simple weighted sum (pre-determined), and the score for each element was determined.

The alternative approach proposed in this research treats enablers as inputs and results as outputs. In this method, no specific percentage or weight is assigned to inputs and outputs; instead, all elements are treated with equal weight and entered into the model. The optimal weights for each element are then determined by solving the model using data envelopment analysis.

Findings

Table (1) presents the descriptive statistics for the input and output variables used in the data envelopment analysis models. The data spans four years, covering stock exchange banks in Tehran from 2010 to 2013. The descriptive statistics reveal that the high standard deviation values for the four variables suggest a significant degree of dispersion in each variable. Part (a) of Table (1) indicates that the process variable among the input variables has the highest value, with an average of 28.52, while the strategy variable has the lowest value, with an average of 6.31.

Table 1: Descriptive Statistics of the Research Variables

Variables	**Aver age**	Standard Deviation	Mini mum	Maxi mum
Section A: Input Variables				
Leadership (MAN)	36.5 0	31.39	84.36	03.75
Strategy (STA)	6.31	18.14	83.27	94.43

Employees (EMP)	8.42	22.19	94.25	05.58
Resources (SOU)	35.37	37.09	82.30	17.56
Processes (PRO)	28.52	17.23	93.45	8.79
Section B: Output Variables				
Customer Results (CUS)	41.82	17.23	15.68	20.117
Employee Results (EMP)	41.39	33.16	44.28	15.51
Societal Results (SOC)	25.28	17.12	30.23	69.43
Key Results (IMP)	66.74	89.18	44.56	09.96

Part (b) of Table (1) shows that among the output variables, the facilities have the highest value, with an average of 41.82, while the community outcomes variable has the lowest value, with an average of 25.28. The EFQM Excellence Model is an organizational evaluation framework that, based on its nine criteria, allows for a comprehensive assessment of an organization, helping identify its weaknesses and areas for improvement. By pinpointing key aspects of municipal activities and establishing quantitative criteria for them, the long and complex processes of municipal development in the country can be effectively monitored and evaluated. This ensures the achievement of both quantitative and qualitative goals for provincial municipalities, facilitating the identification of effective and efficient units while also enabling the establishment of a rewards and recognition system, which is supported by the municipality's oversight and control system.

Table 2: EFQM Scores

Organizational Excellence Model (EFQM)		
Municipality	Score	Ranking
1	551	3
2	294	16
3	419	7
4	340	14
5	399	10
6	408	9
7	276	17
8	258	18
9	382	11
10	601	1
11	411	8
12	478	6
13	504	5
14	346	13

15	376	12
16	527	4
17	334	15
17	246	19
19	579	2

Table (3) presents the typical efficiency scores, the bias of the efficiency scores, the standard deviation of the bias values, and the adjusted efficiency scores, based on data from 5 input variables and 4 output variables. These criteria are among the most common and accessible performance measures and have been widely utilized in various studies. The table shows the average efficiency scores of the municipalities during the study period. The efficiency scores for the period from 2011 to 2014 are listed in Table (3). According to this table, municipalities 1, 10, 16, and 19 achieved full efficiency (with an efficiency score of 1), while municipalities 2, 4, and 11 exhibited the highest levels of inefficiency, with a 2% inefficiency rate.

Table 3: Efficiency Scores

	1390	1391	1392	1393	Average	Efficient or Inefficient		
Municipality	Section A: Efficiency Scores			$\hat{\lambda}_{DEA}(x_0, \lambda_0) = max \begin{cases} \lambda \vert \lambda y_0 \le \sum_{i=1}^{n} y_i Y_i; \quad x_0 \ge \sum_{i=1}^{n} y_i X_i; \\ \sum_{i=1}^{n} y_i = 1; \; y_i \ge 0; i = 1, \dots, n. \end{cases}$				
1	1	1	1	1	1	Efficient		
2	0.046	0.071	0.054	0.056	0.05	Inefficient		
3	0.186	0.161	0.151	0.149	0.162	Inefficient		
4	0.05	0.074	0.053	0.071	0.06	Inefficient		
5	0.091	0.091	0.088	0.074	0.08	Inefficient		
6	0.228	0.21	0.241	0.233	0.23	Inefficient		
7	0.079	0.136	0.149	0.232	0.149	Inefficient		
8	0.121	0.163	0.191	0.289	0.191	Inefficient		
9	0.277	0.353	0.369	0.477	0.369	Inefficient		
10	1	1	1	1	1	Efficient		
11	0.044	0.053	0.077	0.106	0.07	Inefficient		
12	0.338	0.418	0.339	0.271	0.339	Inefficient		
13	0.149	0.153	0.165	0.193	0.165	Inefficient		
14	0.594	0.69	0.531	0.141	0.489	Inefficient		
15	0.48	0.73	0.91	0.592	0.678	Inefficient		
16	1	1	1	1	1	Efficient		
17	1	0.989	0.846	0.421	0.814	Inefficient		
18	0.450	0.521	0.402	0.88	0.552	Inefficient		
19	1	1	1	1	1	Efficient		
Average	0.428	0.463	0.45	0.43	0.442			
Standard Deviation	0.372	0.372	0.36	0.35	0.35			
Minimum	0.044	0.053	0.053	0.056	0.05			
Maximum	1	1	1	1	1			

The efficiency test based on the Anderson-Peterson model has been calculated for all years, as shown in Table (4).

Table 4: Efficiency Scores Based on the Anderson-Peterson Model in 2011

Municipality	Efficiency Score	Anderson-Peterson Score	
1	1	1.547	Efficient
2	0.046		Inefficient
3	0.186		Inefficient
4	0.05		Inefficient
5	0.091		Inefficient
6	0.228		Inefficient
7	0.079		Inefficient
8	0.121		Inefficient
9	0.277		Inefficient
10	1	3.227	Efficient
11	0.044		Inefficient
12	0.338		Inefficient
13	0.149		Inefficient
14	0.594		Inefficient
15	0.48		Inefficient
16	1	1.047	Efficient
17	1	1.254	Efficient
18	0.450		Inefficient
19	1	2.068	Efficient

Based on the results of Table (4), it can be concluded that Municipality 10, with a score of 3.227, has the highest efficiency among the efficient municipalities using the Anderson-Peterson method.

Table 5: Efficiency scores based on the Anderson-Petersen model in the year 2012

Municipality	Efficiency score	Anderson-Peterson Score	
1	1	1.19	Efficient
2	0.071		Inefficient
3	0.161		Inefficient
4	0.074		Inefficient
5	0.091		Inefficient
6	0.21		Inefficient
7	0.136		Inefficient
8	0.163		Inefficient
9	0.353		Inefficient
10	1	3.48	Efficient
11	0.053		Inefficient
12	0.418		Inefficient
13	0.153		Inefficient
14	0.69		Inefficient
15	0.73		Inefficient
16	1	1.16	Efficient
17	0.989	1.299	Efficient

18	0.521		Inefficient
19	1	2.16	Efficient

According to the results of Table 5, among the efficient units, using the Anderson-Petersen method, it can be concluded that Municipality 10, with a score of 3.48, has the highest efficiency among the efficient municipalities.

Table 6: Efficiency scores based on the Anderson-Petersen model in the year 2013

Municipality	Efficiency Score	Anderson-Peterson Score	
1	1	1.74	Efficient
2	0.054		Inefficient
3	0.151		Inefficient
4	0.053		Inefficient
5	0.088		Inefficient
6	0.241		Inefficient
7	0.149		Inefficient
8	0.191		Inefficient
9	0.369		Inefficient
10	1	4.17	Efficient
11	0.077		Inefficient
12	0.339		Inefficient
13	0.165		Inefficient
14	0.531		Inefficient
15	0.91		Inefficient
16	1	1.84	Efficient
17	0.846		Inefficient
18	0.402		Inefficient
19	1	2.77	Efficient

According to the results of Table 7, among the efficient units, using the Anderson-Petersen method, it can be concluded that Municipality 10, with a score of 4.17, has the highest efficiency among the efficient municipalities.

Table 8: Efficiency scores based on the Anderson-Petersen model in the year 2014

Municipality	Efficiency Score	Anderson-Peterson score	
1	1	1.49	Efficient
2	0.056		Inefficient
3	0.149		Inefficient
4	0.071		Inefficient
5	0.074		Inefficient
6	0.233		Inefficient
7	0.232		Inefficient
8	0.289		Inefficient
9	0.477		Inefficient
10	1	3.06	Efficient
11	0.106		Inefficient
12	0.271		Inefficient

13	0.193		Inefficient
14	0.141		Inefficient
15	0.592		Inefficient
16	1	1.44	Efficient
17	0.421		Inefficient
18	0.88		Inefficient
19	1	2.73	Efficient

According to the results of Table 8, among the efficient units, using the Anderson-Petersen method, it can be concluded that Municipality 10, with a score of 3.06, has the highest efficiency among the efficient municipalities.

Table 9: Average efficiency scores based on the Anderson-Petersen model

Efficiency Score Based on the Anderson-Peterson Model				
Municipality	Efficiency Score	Anderson-Peterson score	Ranking	
1	1	1.674	3	Efficient
2	0.05		17	Inefficient
3	0.162		11	Inefficient
4	0.06		19	Inefficient
5	0.08		14	Inefficient
6	0.23		7	Inefficient
7	0.149		12	Inefficient
8	0.191		9	Inefficient
9	0.369		5	Inefficient
10	1	3.921	1	Efficient
11	0.07		15	Inefficient
12	0.339		6	Inefficient
13	0.165		10	Inefficient
14	0.489		16	Inefficient
15	0.678		13	Inefficient
16	1	1.228	4	Efficient
17	0.814		8	Inefficient
18	0.552		18	Inefficient
19	1	2.771	2	Efficient

According to the results of Table 9, among the efficient units, using the Anderson-Petersen method, it can be concluded that Municipality 10 has the highest efficiency among the efficient municipalities.

Table 10: Comparison of the EFQM and DEA methods

Municipality	Rank based on EFQM model:	Rank based on DEA model:
1	3	3
2	16	17
3	7	11
4	14	19

5	10	14
6	9	7
7	17	12
8	18	9
9	11	5
10	1	1
11	8	15
12	6	6
13	5	10
14	13	16
15	12	13
16	4	4
17	15	8
18	19	18
19	2	2

Table 10 compares the two methods, EFQM and DEA, showing that the ranking results for the efficient units are consistent between the two models. However, differences are observed in the results for the inefficient units, indicating that the methods yield varying assessments for these units.

Table 11 provides the correlation analysis between the input and output variables of the study. It presents the values of the Spearman correlation coefficient and the corresponding P-values. A detailed examination of Table 11 reveals a high correlation between the input variables, with these correlations being statistically significant at the 5% level. Specifically, the correlation coefficient between Leadership and Key Results is 0.91, with a P-value of 0.000. The correlation between Leadership and Strategy is 0.81, with a P-value of 0.000, and the correlation between Resources and Key Results is 0.79, with a P-value of 0.000.

Table 11: Spearman correlation coefficient between input and output variables

Variables	Statistics	MAN	STA	EMP	SOU	PRO	CUS	EMP	SOC	IMP
MAN	Correlation coefficient	1	0.897	0.752	0.645	0.680	0.986	0.54	0.13	0.91
	P-value		0.000	0.000	0.004	0.002	0.000	0.04	0.008	0.000
STA	Correlation coefficient		1	0.699	0.585	0.612	0.915	0.33	0.64	0.72
	P-value			0.001	0.011	0.007	0.000	0.003	0.001	0.000
EMP	Correlation coefficient			1	0.428	0.414	0.581	0.047	0.66	0.81
	P-value				0.076	0.088	0.011	0.187	0.000	0.000

SOU	Correlation coefficient				1	0.714	0.632	0.61	0.29	0.79
	P-value					0.000	0.000	0.000	0.000	0.000
PRO	Correlation coefficient					1	0.767	0.134	0.55	0.08
	P-value						0.000	0.017	0.068	0.54
CUS	Correlation coefficient						1	0.93 0.000	0.027 0.019	0.097 0.22
	P-value									
EMP	Correlation coefficient							1	0.48 0.000	0.37 0.008
	P-value									
SOC	Statistics								1	0.748 0.000
	Correlation coefficient									
IMP	P-value									1
	Correlation coefficient									

Conclusion

In this research, the objective was to explore organizational excellence modeling using Data Envelopment Analysis (DEA) in the municipality of Kerman in 2015. The study compared the EFQM and DEA methods, and the ranking results for efficient units were consistent between the two models. However, differences were noted for inefficient units. The correlation coefficients revealed strong relationships between certain variables, such as the correlation between Leadership and Key Results (0.91), Leadership and Strategy (0.81), and Resources and Key Results (0.79), all with P-values of 0.000, indicating statistically significant correlations.

The primary purpose of this model was to measure and compare the relative efficiency of organizational units like schools, hospitals, bank branches, and municipalities, which use multiple inputs and outputs. DEA, a non-parametric mathematical programming method, was employed to assess Decision-Making Units (DMUs). These units, whether they are organizations or departments, are assessed based on similar inputs and outputs. DEA constructs an empirical production function from observed data, forming a boundary function that envelops all the data, which is why it is termed "Data Envelopment" or "Envelopment Analysis."

Since DEA does not rely on estimation parameters, it is a non-parametric method and does not impose restrictions on the number of inputs and outputs. It evaluates units by comparing them to the most efficient virtual unit constructed from the data.

A limitation of this research was the lack of cooperation from several municipalities, as many declined to participate in interviews, which led to their exclusion from the study. Future work could involve a more comprehensive analysis by using DEA with a variable trend (BCC) model for more detailed insights. Additionally, extending the study period over a longer timeframe (such as one year) could yield more reliable and nuanced results.

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