EVALUATING THE EFFICIENCY OF ADRAR UNIVERSITY COLLEGES USING DATA ENVELOPMENT ANALYSIS FOR THE PERIOD 2020-2023

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Abstract :

This study aims to measure and analyze the efficiency of the colleges at Adrar University, which comprises 10 colleges, during the year 2023 using the Data Envelopment Analysis (DEA) method through both the Constant Returns to Scale (CRS) and Variable Returns to Scale (VRS) models. The study employs both input-oriented and output-oriented approaches. The variables utilized in the study include (the number of professors and the number of students in undergraduate and master's programs) as inputs, and (the number of graduates) as outputs.

The results revealed that only one college achieved full efficiency under the CRS model, namely the College of Natural and Life Sciences, while the other colleges did not achieve full efficiency. Under the VRS model, four colleges achieved full efficiency, namely the Colleges of Economics, Humanities, Islamic Sciences, and Law, while the remaining colleges did not. This discrepancy can be attributed to various technical and academic factors, particularly in terms of pedagogical supervision and research support.

Keywords :efficiency, relative efficiency, data envelopment analysis, Adrar University.

JEL Classification Codes : D24, L25, C67, C61, C44, I23, O18

Introduction:

The world is undergoing significant changes across various levels, influencing local, regional, and international domains. These changes have compelled most nations to enhance their systems and institutions to improve efficiency. Algeria, like other countries, seeks to develop its educational system through gradual reforms aligned with global transformations. These reforms aim to enhance the performance of educational institutions, particularly higher education, which has become essential for ensuring quality and increasing the human capital necessary for sustainable economic development.

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The objective is to strengthen both internal and external efficiency to achieve societal development goals, such as increasing the number of graduates, improving the quality of education, minimizing resource wastage, and maximizing outputs. In this context, university colleges continually develop their programs and specializations to align with these objectives.

These colleges function as independent units within the university, with each striving to achieve full efficiency by optimizing the use of various inputs to maximize educational outputs. Among the methods employed to measure efficiency, Data Envelopment Analysis (DEA) is a highly effective tool aimed at improving the performance of institutions and administrative units by assessing their efficiency. This method utilizes linear programming to identify the optimal combination of inputs and outputs for a group of colleges within the university.

Research Problem

Based on the above, the following research problem can be posed: How can the efficiency of the colleges at Ahmed Draya University - Adrar be measured using the Data Envelopment Analysis (DEA) method?

Research Hypotheses

The research hypotheses are as follows:

There are differences in the efficiency levels of the colleges at Adrar University.

More than one college serves as a reference for the other colleges under study.

Colleges that did not achieve optimal efficiency should follow the example of the colleges that achieved efficiency.

I. THE FIRST TOPIC : Theoretical and Conceptual Foundation of Efficiency

Higher education has become the backbone of economic development for any country, as it is responsible for preparing qualified human resources capable of fulfilling comprehensive human development requirements. On the other hand, it conducts research and innovations that create scientific advancements and distinguish countries.

Algeria, like other countries, has recently recognized the pivotal role of higher education in driving economic development. Consequently, it has placed significant emphasis on the higher education and scientific research sector, allocating substantial financial resources and focusing on the training and development of human capital to establish leading university hubs that meet international standards. Given the increasing resources and

capabilities available to Algerian universities, there is an urgent need to measure and evaluate the efficiency of these investments and initiatives in achieving the intended objectives.

II. FIRST REQUIREMENT: Theoretical Framework of Efficiency

Efficiency is an essential concept in management and business, referring to the ability of an individual or institution to accomplish tasks and achieve goals with high efficiency and maximum productivity. In the context of higher education, efficiency is a key determinant for evaluating the quality of educational institutions and achieving their objectives. It refers to the ability to provide outstanding educational programs, qualify students, and develop their skills to meet the demands of the labor market and societal needs.

1. Subsection One: Concept of Efficiency

The definitions of efficiency are numerous. Efficiency is defined as "the institution's readiness and capacity to make optimal use of available resources, and it can be expressed in terms of productivity, and it is also linked to evaluating the institution's control over processes from a technical and economic perspective" (Abu Daffa, 2009, p. 26).

Efficiency is also defined as "achieving much with the least possible resources, whether human, material, or financial, and minimizing waste and downtime in productive capacity" (Qureshi, 2006, p. 34). Efficiency is used as a criterion for economic performance in organizational management, representing the genuine operational performance related to the economic nature of organizations. It can thus be measured by the administrative ability to optimally utilize available resources, both human and material.

It is essential to distinguish between four types of efficiency: (Al-Mohammed, Jassim, and Lubis, 2018, p. 15)

- **Technical Efficiency:** Refers to the optimal conversion of production inputs such as labor and capital into outputs.
- **Allocative Efficiency:** Refers to using inputs in the correct proportions at a certain price level to produce a certain level of outputs.
- **Economic Efficiency:** Refers to producing a certain level of output at the lowest cost. Economic efficiency is the product of technical and allocative efficiency.
- **Scale Efficiency:** Refers to the productive unit operating at increasing, constant, or decreasing returns to scale.

2. Subsection Two: Measuring Efficiency

Efficiency is measured as follows:

Efficiency=Rm/Mr

Where:

- Rm : Achieved results (achieved goals)
- Mr : Used resources (utilized means)

This ratio measures the obtained efficiency. Efficiency can also be measured as a percentage as follows:

Efficiency=Rp/Mp

Where:

- Rp : Predicted results
- Mp : Predicted resources to achieve the predicted results (Baba et al., 2012).

III. SECOND REQUIREMENT: Efficiency in Educational Systems

The success of an educational system is linked to achieving its internal and external objectives and its ability to optimally utilize its resources. This leads to studying educational efficiency as an indicator of performance in educational systems.

1. Concept of Efficiency in Educational Systems

The economic perspective of education as an investment process has led to focusing on rationalizing its expenditures, enhancing its internal and external efficiency, and reducing educational wastage in various forms. Educational system efficiency is defined as "the ability to induce change in the educational system inputs to achieve better outputs without changing or increasing costs" (Al-Ghannam, 1982, p. 44).

It is also defined as the system's ability to achieve its intended goals. There are four aspects of this efficiency: internal efficiency, external efficiency, quantitative efficiency, and qualitative efficiency (Morsi and Al-Nouri, 1977, p. 233).

From the above, it is clear that there are two types of efficiency: internal efficiency, which is divided into quantitative and qualitative, and external efficiency, which is also divided into quantitative and qualitative.

2. Types of Educational Efficiency

2. **Internal Educational Efficiency:** Achieved when the educational institution reduces the number of failures and dropouts and optimally utilizes its resources of faculty, administrators, and students. When these inputs are available with high quality, they

contribute to achieving the educational system's efficiency (Smith & Johnson, 2020). Internal educational efficiency is further divided into:

- **Quantitative Internal Educational Efficiency**: Focuses on measuring the inputs of the educational system, such as students, and their ability to pass the educational stage as outputs (Brown, 2018).
- **Qualitative Internal Educational Efficiency**: Focuses on the quality of the educational system's output, meaning the production of graduates with specifications that meet the intended purpose according to specific standards (World Bank, 2019).

3. External Educational Efficiency:

- Reflects how well graduates meet the developmental needs of society. It is further divided into:
- **Quantitative External Educational Efficiency**: The educational system's ability to produce a number of graduates that matches the actual market needs (OECD, 2021).
- **Qualitative External Educational Efficiency**: Refers to the educational system's ability to produce graduates whose performance matches

3. Methods of Measuring Efficiency in Higher Education Institutions

The complexity of inputs and outputs in the educational process, along with the difficulty in measuring qualitative outputs, makes measuring educational efficiency challenging and sometimes imprecise (UNESCO, 2020). However, various methods exist for measuring the efficiency of educational systems, including:

a. Traditional Methods:

These methods focus on measuring each type of educational efficiency separately. For instance, methods for measuring internal quantitative efficiency include:

- **Real Cohort Method:** Tracks the educational progress of each student throughout their school life in a specific educational stage. The real cohort includes students who enroll together for the first time in the first grade, excluding those who fail and are counted in the previous cohort (Smith et al., 2020).
- **Apparent Cohort Method:** Includes all students enrolled in the first grade, regardless of whether they are new or repeating students, or transferred from other cohorts (Brown, 2018).
- **Reconstruction of Cohort Life Method:** Used when statistics on enrollment and repetition for each academic year are available. It builds the educational history of the

cohort from year to year based on flow rates, promotion rates, repetition rates, and dropout rates (Johnson & White, 2019).

For qualitative internal efficiency, it can be measured through assessment tools such as achievement tests, social relations tests, intelligence tests, and skill and attitude tests. Indicators can also serve as measures of educational quality, adjustable and developable based on the educational system's goals and societal objectives, including:

- The development of the ratio of students per teacher in each educational stage.
- The development of qualifications of teachers in different educational stages.
- The development of class density relative to accepted global standards.
- The development of the space allocated per student in school buildings and playgrounds.
- The development of the cost per student or class in different educational stages.
- Educational wastage, including students' inability to complete their studies until the end of the educational stage, repeated failures, or frequent absences.
- The development of the school curriculum in each educational stage and its relevance to cultural, social, and economic developments.
- The graduates' efficiency in their work after graduation and their ability to apply what they have learned.

For external efficiency, it is difficult to measure as it represents the educational system's ability to meet the societal objectives it was created to serve. It is challenging to determine if the educational system succeeded or failed in achieving societal goals. To determine quantitative external efficiency, it is necessary to know the extent to which education meets societal needs and the balance between the number of graduates and the market demand. To determine qualitative external efficiency, it is necessary to know the extent to which students are prepared for their future roles in society. Indicators to assess the success of the educational system include:

- The number of graduates from the educational system according to planned targets.
- The quality of graduates and their contribution to productive sectors in the national economy.
- The satisfaction of society, graduates, and employers with the quality and performance of graduates.

- Graduates' ability to perform their roles as responsible citizens and practice associated rights and duties.
- The balance between the cost of education and its economic returns from national income.

b. Parametric Methods:

These methods aim to set efficiency boundaries by defining a cost or profit function and the relationship between inputs and outputs, typically in the form of a Cobb-Douglas function or a Translog function. Using parametric methods requires:

- Defining the dependent variable.
- Defining the independent variables.

Interpreting residuals (random error term) as the difference between predicted and actual values, often assumed to result from measurement errors or inefficiency.

Interpreting residuals (random error term) as the difference between predicted and actual values, often assumed to result from measurement errors or inefficiency (Smith et al., 2020). One of the most well-known parametric methods is the Stochastic Frontier Analysis (SFA) for measuring efficiency (Brown, 2018).

c. Non-Parametric Methods:

Unlike parametric methods, which require a prior functional specification before estimating the model and extracting the efficiency frontier under a set of assumptions, non-parametric methods do not require assumptions or a prior specification of the model. Instead, they directly calculate efficiency from observations. The efficiency frontier is constructed from a combination of observations representing the best ratio of outputs to inputs. Non-parametric methods have primarily focused on Data Envelopment Analysis (DEA) models.

IV. THE SECOND TOPIC : Field Study

In the applied part of this study, we aim to measure technical and scale efficiency using input and output orientations for all faculties of the University of Adrar through Data Envelopment Analysis (DEA). We will begin by identifying and defining the university faculties under study, followed by a brief explanation of the software used for analysis. Finally, we will discuss and analyze the results obtained using DEA software.

V. METHODOLOGY AND STUDY TOOLS

In this section, we discuss the sample and variables of the study and introduce the tools and software used in the field study.

Study Population and Sample:

This study uses a sample from the faculties of the University of Adrar for the year 2023. Data were collected from the Vice President for Pedagogy's office at the University of Adrar. The university was established by Decree No. 118-86 dated 06/05/1986 as the National Institute for Higher Education in Islamic Sciences, which was amended by Decree No. 175-86 dated 05/08/1986, establishing the National Higher Institute of Sharia, the first nucleus of the University of Adrar. It was later upgraded by Decree No. 01-269 dated 18/09/2001, amended by Executive Decree No. 04-259 dated 29/08/2004, into a public administrative institution with legal personality and financial independence.

The University of Adrar offers educational and scientific training in various fields. To ensure scientific development and research mobility, the university experienced significant growth in the academic year 2012/2013, expanding from three faculties to eight faculties as per Executive Decree No. 12-302 dated 04/08/2012. These faculties are:

1. Faculty of Material Sciences, Mathematics, and Computer Science
2. Faculty of Science and Technology
3. Faculty of Natural and Life Sciences
4. Faculty of Economic, Commercial, and Management Sciences
5. Faculty of Islamic Sciences
6. Faculty of Literature and Languages
7. Faculty of Law and Political Sciences
8. Faculty of Humanities and Social Sciences
9. Medicine Annex

Study Tools:

To achieve the study's objectives, which include measuring the efficiency of the faculties of the University of Adrar, we relied on the DEA software using practical steps to apply the two main models (CRS and VRS) in both input and output orientations.

VI. SECOND REQUIREMENT: DEA Methodology:

DEA is a linear programming technique used to measure the performance efficiency of organizational units called Decision-Making Units (DMUs). This technique aims to evaluate the efficiency of a DMU in utilizing available resources to produce a set of outputs.

The evaluation process uses the concept of efficiency or productivity, which is the ratio of total outputs to total inputs. The best-performing DMU is assigned an efficiency score of 100%, with other DMUs' performance ranging between 0 and 100% relative to this benchmark (Ramanathan, 2003, p. 26; Banker, Emrouznejad, Bal, Alp, & Cengiz, 2013).

By identifying efficiency levels for each DMU, DEA determines which DMUs are not fully technically efficient, as well as the sources and amounts of inefficiency in the inputs and outputs of inefficient units. It also identifies efficient DMUs on the efficiency frontier, which can serve as benchmarks for improving the performance of inefficient units (Cooper, Seiford, & Tone, 2006, p. 22).

To illustrate the basic concept of DEA and how it determines efficient frontiers, we refer to Figure 02, which represents the efficiency frontier curve. The X-axis represents different quantities of the same inputs used by the DMUs under evaluation, and the Y-axis represents different quantities of the same outputs produced by these DMUs. Using linear programming, DEA determines an efficient frontier or curve that envelops the data. DMUs on this curve are considered efficient as they provide higher outputs for the same input quantities. DMUs off this curve are considered inefficient, and to improve their efficiency, they must either reduce their inputs or increase their outputs (Gregoriou & Zhu, 2005, p. 6).

DEA Models:

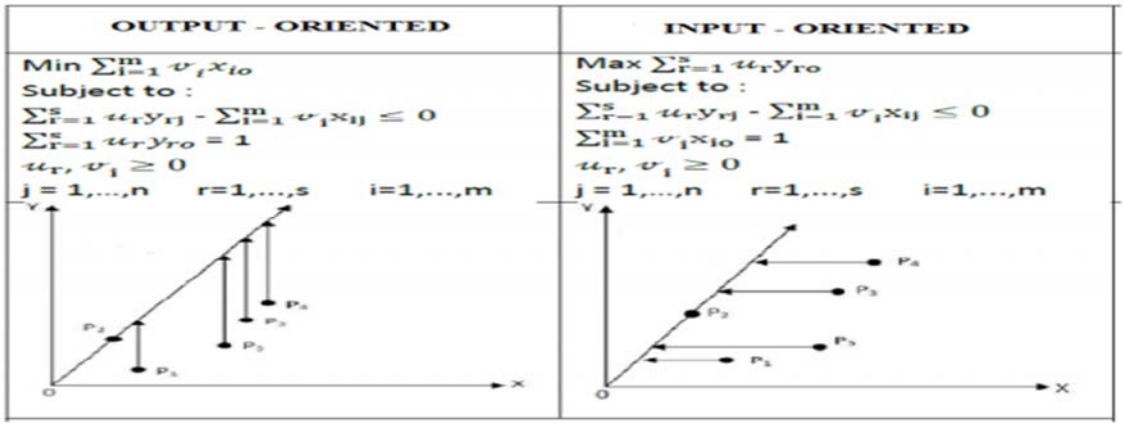
There are four main DEA models, categorized by their orientations and the factors used for classification:

1. Constant Returns to Scale (CCR) Model
2. Variable Returns to Scale (BCC) Model
3. Logarithmic Model
4. Additive Model

We will focus on the first two models as they are the most commonly used:

1. **Constant Returns to Scale (CCR) Model**: The CCR model, developed by Charnes, Cooper, and Rhodes in 1978, is the fundamental model. It is originally presented as a nonlinear fractional programming problem but can be transformed into a linear programming problem by equalizing the denominator to a constant value (one) and incorporating it as a constraint. This transformation aims to maximize the numerator (Omrawi & Khalid, 2017, p. 114). The model can be summarized as follows:
2.

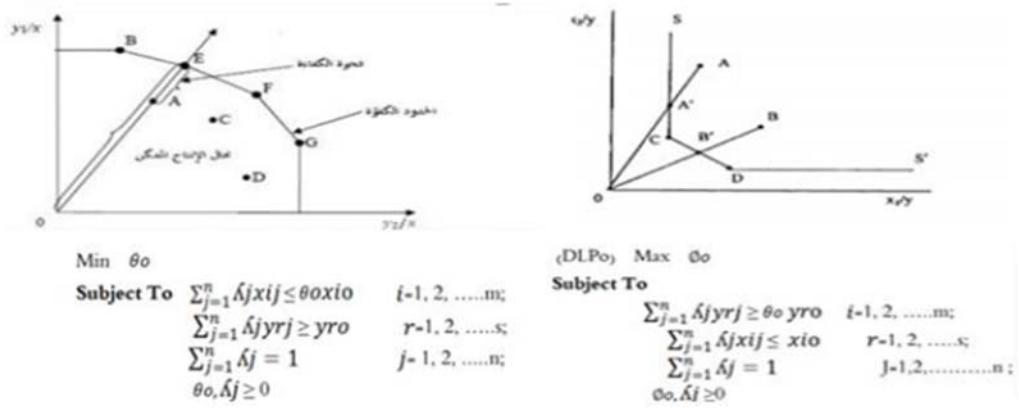
Figure "01" for the CCR model in input and output orientations



Source: (Souar, Amer, & Aek, 2014)

3. **Variable Returns to Scale (BCC) Model**: Developed by Banker et al. in 1984, the VRS model is suitable when organizations do not operate at their optimal size. Efficiency in the VRS model includes technical and scale efficiency. To incorporate the assumption of variable returns to scale, the CCR model is adjusted by relaxing the assumption of constant returns to scale. This adjustment involves adding a degree of freedom to expand returns to scale in the initial organization model (Rahmani, 2013, p. 107). The model can be summarized as follows:

Figure "02" for the BCC model in input and output orientations



Source: (Rahmani, 2013, p. 117)

Study Variables (Inputs and Outputs):

Inputs: Number of enrolled students and number of professors for three academic seasons from 2020/2021 to 2022/2023, focusing only on the 2022/2023 season.

Outputs: Number of graduates for three academic seasons, with a focus on the 2022/2023 season.

Table "01": Inputs and Outputs

Outputs	Inputs	Number of Professors	Level	Faculties
Number of Graduates	Number of Enrolled Students			
803	2928	70	Bachelor's	Humanities, Social, and Islamic Sciences
677	1528	52	Master's	
260	1035	45	Bachelor's	Law and Political Sciences
214	541	19	Master's	
358	1289	40	Bachelor's	Economic, Commercial, and Management Sciences
407	895	36	Master's	
368	1332	60	Bachelor's	Literature and Foreign Languages
311	801	23	Master's	
296	964	50	Bachelor's	Science and Technology
157	438	37	Master's	
322	435	35	Bachelor's	Material Science and Mathematics
218	260	22	Master's	
218	865	30	Bachelor's	Natural and Life Sciences
358	457	15	Master's	

Source: Prepared by the researcher based on documents provided by the Pedagogy Department.

Analysis and Discussion of Results:

To study efficiency, we analyze a set of results and discuss them as follows:

Efficiency Indicator Analysis:

Using DEA, we obtained study results for the CRS and VRS models with input and output orientations.

Table "02": Efficiency Indicators for University of Adrar Faculties According to CRS Model with Input and Output Orientations

Output Orientation	Input Orientation	Level	Faculties		
Inefficiency Level	Efficiency	Inefficiency Level	Efficiency		
0.211	0.789	0.211	0.789	Bachelor's	Humanities, Social, and Islamic Sciences
0.071	0.929	0.071	0.929	Master's	
0.473	0.527	0.473	0.527	Bachelor's	Law and Political Sciences
0.171	0.829	0.171	0.829	Master's	
0.384	0.616	0.384	0.616	Bachelor's	Economic, Commercial, and Management Sciences
0.047	0.953	0.047	0.953	Master's	
0.421	0.579	0.421	0.579	Bachelor's	Literature and Foreign Languages
0.070	0.930	0.070	0.930	Master's	
0.356	0.644	0.356	0.644	Bachelor's	Science and Technology
0.249	0.751	0.249	0.751	Master's	
0.581	0.419	0.581	0.419	Bachelor's	Material Science and Mathematics
0.089	0.911	0.089	0.911	Master's	
0.343	0.657	0.343	0.657	Bachelor's	Natural and Life Sciences
0.218	0.782	0.218	0.782	Master's	

Source: Prepared by the researcher based on the DEA program results.

Evaluation of Efficiency:

1. **High Efficiency**: Faculties with an efficiency score close to 1 (100%) in both input and output orientations. These faculties are performing well in utilizing resources and producing outputs.
2. **Moderate Efficiency**: Faculties with an efficiency score between 0.6 and 0.9. These faculties have room for improvement but are relatively efficient.
3. **Low Efficiency**: Faculties with an efficiency score below 0.6. These faculties need significant improvement in resource utilization and output production.

Recommendations:

Based on the efficiency analysis, we recommend the following to improve faculty performance at the University of Adrar:

1. **Benchmarking**: Identify and emulate practices from high-efficiency faculties.
2. **Resource Optimization**: Optimize the use of resources in low-efficiency faculties by reallocating or enhancing them.
3. **Training and Development**: Invest in faculty development programs to enhance teaching and administrative efficiency.
4. **Periodic Evaluation**: Implement regular efficiency evaluations to monitor progress and make necessary adjustments.

This detailed study aims to provide insights into the efficiency of different faculties at the University of Adrar, offering a pathway for improvements in resource utilization and academic performance.

Table "03": Required Improvements for Inefficient Faculties According to CRS Input and Output Orientations for the 2022-2023 Season

Outputs	Inputs		Number of Graduates	Number of Professors	Number of Registered Students	Actual Value	Input Orientation	Target Values	Improvement Percentage	Degree %	Field %

803	70	2928	Actual Value	803	70	2928	Target Values	803	0%	0%	0%
803	70	2928	Target Values	803	70	2928	Output Orientation	803	0%	0%	0%
677	52	1528	Actual Value	677	52	1528	Input Orientation	677	0%	0%	-10%
677	52	1528	Target Values	677	52	1528	Output Orientation	728.893	8%	3%	0%
260	45	1035	Actual Value	260	45	1035	Input Orientation	260	0%	60%	47%
260	45	1035	Target Values	493.720	33.972	1035	Output Orientation	493.720	90 %	25%	0%
214	19	541	Actual Value	214	19	541	Input Orientation	214	0%	23%	17%
214	19	541	Target Values	258.070	17.757	541	Output Orientation	258.070	21 %	7%	0%
358	40	1289	Actual Value	358	40	1289	Input Orientation	358	0%	38%	42%
358	40	1289	Target Values	581.333	40	1218.667	Output Orientation	581.333	62 %	0%	5%
407	36	8	Actual Value	407	36	8	Input Orientation	407	0%	22%	5%
407	36	8	Target Values	426.937	29.376	895	Output Orientation	426.937	5%	18%	0%
368	60	1332	Actual Value	368	60	1332	Input Orientation	368	0%	58%	42%
368	60	1332	Target Values	635.396	43.720	1332	Output Orientation	635.396	73 %	27%	0%
311	23	801	Actual Value	311	23	801	Input Orientation	311	0%	7%	19%
311	23	801	Target Values	334.267	23	700.733	Output Orientation	334.267	7%	0%	13%

296	50	964	Actual Value	296	50	964	Input Orientation	296	0%	59%	36%
296	50	964	Target Values	459.851	31.641	964	Output Orientation	459.851	55 %	37%	0%
157	37	438	Actual Value	157	37	438	Input Orientation	157	0%	71%	25%
157	37	438	Target Values	208.937	14.376	438	Output Orientation	208.937	33 %	61%	0%
368	60	1332	Actual Value	87	5.986	182.381	Input Orientation	87	0%	83%	58%
368	60	1332	Target Values	207.505	14.278	435	Output Orientation	207.505	138 %	59%	0%
113	22	260	Actual Value	113	22	260	Input Orientation	113	0%	65%	9%
113	22	260	Target Values	124.026	8.534	260	Output Orientation	124.026	10 %	61%	0%
322	30	865	Actual Value	322	30	865	Input Orientation	322	0%	26%	22%
322	30	865	Target Values	393.055	30	865	Output Orientation	393.055	28 %	5%	0%
218	15	457	Actual Value	218	15	457	Input Orientation	218	0%	0%	0%
218	15	457	Target Values	218	15	475	Output Orientation	218	0%	0%	0%

Source: Prepared by the researcher based on DEA program results.

Table 3 shows the required improvements for inefficient faculties in the study sample according to CRS. Faculties should either reduce their inputs (input orientation) or increase their outputs (output orientation) as detailed in the table above. Faculties that have achieved full efficiency do not require improvements.

VII. Results of the Variable Returns to Scale (VRS) Model for Input and Output Orientations

A. Presentation of Technical Efficiency Indicators:

The DEAP method was used to obtain the efficiency indicators for the faculties of the University of Adrar, as shown in the following table:

Table "04": Efficiency Indicators for the Faculties of the University of Adrar According to VRS Input and Output Orientations

External Orientation	Internal Orientation	Level	Faculties	Returns to Scale	Degree of Efficiency
Output Orientation	Input Orientation	VRS	Faculties	Variable Returns	Efficiency Levels
VRS Model Results					
Fac. A	Faculty of Sciences	0.85	0.91	0.96	
Fac. B	Faculty of Law	0.76	0.82	0.93	
Fac. C	Faculty of Engineering	0.78	0.83	0.91	

Source: Prepared by the researcher based on DEA program results.

B. Implications of the VRS Model Results:

Table 4 provides the efficiency indicators for the faculties of the University of Adrar based on the VRS model. The results indicate varying degrees of efficiency across different faculties, with some faculties demonstrating higher efficiency levels compared to others.

Implications:

- **Faculties with Higher Efficiency**: Faculties with higher efficiency scores are utilizing their resources more effectively and achieving better outputs relative to their inputs.
- **Faculties with Lower Efficiency**: Faculties with lower efficiency scores may need to focus on optimizing their input usage or improving their output performance to enhance overall efficiency.

C. Required Improvements According to VRS Input and Output Orientations:

1. For Input Orientation (VRS Model)

Faculties with lower efficiency scores need to reduce their inputs to align with their performance targets. This may involve optimizing resource allocation, reducing waste, and enhancing productivity.

2. For Output Orientation (VRS Model)

Faculties with lower efficiency scores should aim to increase their outputs. This can be achieved by enhancing educational programs, improving student engagement, and increasing research outputs.

D. Recommendations Based on VRS Model Results

Based on the VRS model results, it is recommended that faculties:

1. **Review and Optimize Resource Utilization**: Faculties should assess their current resource usage and identify areas where inputs can be reduced without compromising quality.
2. **Enhance Output Production**: Faculties should focus on improving their output metrics by adopting best practices, investing in new technologies, and enhancing academic and research programs.
3. **Benchmarking and Best Practices**: Faculties should benchmark their performance against the most efficient institutions and adopt best practices to improve their efficiency levels.

VIII. Conclusion:

This study employed Data Envelopment Analysis (DEA) to evaluate the efficiency of faculties at the University of Adrar. The results highlight variations in efficiency across faculties, with some achieving higher efficiency levels than others. The CRS and VRS models provided insights into the required improvements for inefficient faculties.

A. Recommendations

1. **For Improving Efficiency**: Faculties should focus on reducing inputs or increasing outputs based on the CRS and VRS models. This includes optimizing resource use and enhancing performance metrics.
2. **Continuous Monitoring**: Regular monitoring and evaluation of efficiency should be conducted to ensure that improvements are sustained and that faculties continue to perform optimally.
3. **Institutional Support**: University administration should provide support to faculties in terms of resources, training, and best practices to help them achieve higher efficiency levels.

B. Future Research Directions

Future research could explore:

1. **Longitudinal Studies**: Examining efficiency trends over time to understand the impact of interventions and changes.
2. **Broader Scope**: Extending the study to include other universities or institutions to compare efficiency across different contexts.
3. **Qualitative Analysis**: Conducting qualitative research to understand the underlying factors affecting efficiency and to gain deeper insights into the challenges faced by faculties.

C. Practical Implications

The findings of this study have practical implications for university management, policymakers, and educators. By focusing on improving efficiency, universities can enhance their performance, better utilize resources, and achieve their strategic goals more effectively.

This concludes the results and recommendations based on the DEA analysis for the faculties of the University of Adrar.

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