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Measuring the Efficiency of Islamic Financing Modes Using Data Envelopment Analysis: Evidence from Al Salam Bank, Adrar (2020–2023)

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Abstract:

This study applies Data Envelopment Analysis (DEA) to assess the efficiency of Islamic financing modes at Al Salam Bank in Adrar, Algeria (2020–2023). It evaluates Murabaha, Mudarabah, Ijarah, Salam, and Istisna using input-oriented models with constant and variable returns to scale. Results show that while some modes faced inefficiency due to underutilized outputs, Mudarabah for institutions and Murabaha for individuals consistently achieved full efficiency. Efficiency trends were shaped by scale effects and operational changes. The findings provide guidance on optimizing resource allocation, enhancing Islamic financing performance, and offer empirical insights from a branch-level view in an emerging market.

Keywords: Islamic banking, efficiency, Data Envelopment Analysis, financing modes, branch-level analysis, Algeria, Al Salam Bank, CRS, VRS.

Jel Classification Codes: G21, G24, C61, D24, O16

1. Introduction:

The global Islamic banking industry has seen remarkable growth and transformation over the past twenty years. It is projected to hold over $4 trillion in total assets by 2023 (Islamic Financial Services Board, 2023). The sector continues to expand due to rising consumer demand for Sharia-compliant financial products, its resilience during financial crises, and increasing awareness of ethical finance principles (Abduh & Omar, 2012; Hasan & Dridi, 2010). Algeria's Islamic banking sector has grown rapidly, with institutions like Al Salam Bank leading the way in expanding access to Islamic financial services across the country (Belkhaoui, 2020 ; khoualed, aboubaker , 2025).

The foundation of Islamic banking comprises a variety of financing techniques, including Murabaha, Mudarabah, Ijarah, Salam, and Istisna, all designed to adhere to Islamic law and support social welfare and economic growth (Iqbal & Mirakhor, 2011; Hanif, 2011). Each mode has a distinct set of agreements, risks, and outcomes for banks and customers. To optimise resource use, encourage long-term growth, and strengthen the sector's role in financial inclusion, it is essential to assess the effectiveness of different financing methods as competition intensifies and regulators anticipate increased scrutiny (Emrouznejad & Yang, 2018; Bahrini, 2017).

Although the industry is expanding rapidly, little is known about how well Islamic finance functions at the branch level, especially in areas with unique social and economic conditions like southern Algeria's Adrar (Belkhaoui, 2020; Musajeva, 2017). So far, most research has focused on the overall effectiveness of banks or comparing banks across countries; it has not explored the effectiveness of different types of financing or the impact of local circumstances (Gul et al., 2023; Majeed, 2021).

1.2 Research Problem

This study employs data and analytical models to evaluate the effectiveness of Islamic finance products at the branch level in Algeria. Specifically, during periods of economic volatility and regulatory change,

little is known about how effectively each financing instrument used by Al-Salam Bank, Adrar branch, transforms allocated financial resources into measurable outcomes.

Hence, this study concentrates on the following primary research question:

Using the Data Envelopment Analysis (DEA) method, how effective does Al-Salam Bank's Adrar branch employ the Islamic financing instruments from 2020 to 2023 at transforming allocated resources into measurable outcomes ?

1.3 Research Hypotheses

To address this problem, the study tests the following hypotheses:

- H1: There are significant differences in technical efficiency among the various Islamic financing modes at the branch level.
- H2: Modes such as Mudarabah and Murabaha are expected to demonstrate higher efficiency due to their operational maturity and broader client acceptance.
- H3: External factors, including economic shocks and regulatory developments during the study period (2020–2023), have a measurable impact on the efficiency of certain financing modes.

1.4 Research Objectives

The primary aims of this research are :

- To measure and compare the technical efficiency of major Islamic financing modes at the branch level.
- To identify the most and least efficient modes and analyze underlying factors.
- To provide actionable recommendations for bank management and policymakers to improve resource allocation and product performance.
- This research contributes to both academic literature and banking practice by offering empirical evidence on the efficiency of Islamic financing modes at the micro (branch) level, applying DEA in a novel context, and providing a framework for similar assessments in other settings (Cooper et al., 2011; Emrouznejad & Yang, 2018).

1.5 Literature Review

1.5.1 Efficiency in Islamic Banking: Global and Regional Evidence

- Global Studies :

With Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) being the most extensively utilized approaches, research on Islamic bank efficiency has evolved tremendously (Emrouznejad & Yang, 2018). Research has demonstrated that, particularly in times of financial turbulence, Islamic banks frequently provide efficiency that is on par with or better than that of traditional banks (Hasan & Dridi, 2010; Gul et al., 2023). However, the growth of Islamic financial markets, regulatory frameworks, and geographic context can all affect efficiency levels (Bahrini, 2017).

- Financing Modes as Efficiency Drivers :

There are many different ways to get Islamic financing, which is both a good and a bad thing. Many people use modes like Murabaha and Ijarah because they are easy to use and people are used to them in the market. This often leads to higher efficiency scores (Hanif, 2011; Kulmie et al., 2023). On the other hand, equity-based modes like Mudarabah and Musharakah may not be as efficient because of practical and regulatory problems (Iqbal & Mirakhor, 2011).

- Branch-Level and Product-Level Analysis :

According to Majeed (2021) and Gul et al. (2023), the majority of efficiency studies concentrate on the bank or national level. Research at the branch or product level is scarce, especially in developing markets. The significance of micro-level analysis in capturing the variation in performance across products and regions has been highlighted in recent works (Belkhaoui, 2020; Musajeva, 2017).

- Context of Algeria and North Africa :

With ongoing market education and regulatory reforms, Islamic banking in Algeria is still in its infancy (Belkhaoui, 2020). The advantages and disadvantages of Islamic finance have been emphasized by empirical research on Algerian banks, which has shown that a lack of qualified staff, unclear regulations, and a lack of new products frequently impede efficiency (Belkhaoui, 2020; Kulmie et al., 2023).

1.5.2 Research Gaps

- Insufficient Evidence at the Branch Level :

Most previous research has not looked at efficiency at the branch or product level in Algeria. This leaves a gap in our understanding of how local conditions and operational realities affect performance.

- Neglect of Output Diversity :

Many studies ignore social outcomes like the number of beneficiaries, which are critical in the Islamic banking paradigm, in favor of concentrating only on financial outputs (Hanif, 2011; Iqbal & Mirakhor, 2011).

- Limited Analysis During Economic Shocks :

Particularly in less-researched areas, there is a dearth of empirical data regarding the performance of Islamic financing methods during economic shocks like the COVID-19 pandemic.

2. Methods

2.1 Study Design and Setting

This study uses a quantitative, descriptive-analytical approach to evaluate the efficiency of Islamic financing modes at the branch level. The empirical analysis focuses on Al Salam Bank, Adrar branch, in Algeria, during the period 2020–2023, a timeframe marked by both regulatory changes and economic uncertainty.

2.2 Data Collection

Annual data were collected for all active Islamic financing modes offered by the branch. For each mode and year, the following variables were recorded:

- Input: Allocated funds for the financing mode (in Algerian Dinar, DZD)
- Outputs: Number of beneficiaries; Profit generated (in DZD)

Modes with no disbursed funds or no beneficiaries in a given year were excluded from the efficiency benchmarking for that year.

2.3 **Efficiency Measurement:** Mathematical Formulation of DEA Models

This study employs Data Envelopment Analysis (DEA) to evaluate the efficiency of Islamic financing modes, using both the Constant Returns to Scale (CRS) and Variable Returns to Scale (VRS) input-oriented models. DEA is a non-parametric linear programming method that assesses the relative efficiency of decision-making units (DMUs) in this context—the different financing modes—by comparing the weighted sum of outputs to the weighted sum of inputs (Cooper et al., 2011; Emrouznejad & Yang, 2018).

2.3.1 Input-Oriented CRS (CCR) Model

The input-oriented CCR model, introduced by **C**harnes, **C**ooper, and **R**hodes (1978), assumes constant returns to scale. The linear programming formulation for DMU_O is as follows:

$$\min_{\theta,\lambda} \theta$$

$$\textbf{subject to } Y\lambda \geq y_0$$

$$\theta x_0 - X\lambda \geq 0$$

$$\lambda \geq 0$$

Where:

- $\boldsymbol{\theta}$ is the efficiency score (scalar) for DMUo (with $\boldsymbol{\theta \leq 1}$; $\boldsymbol{\theta = 1}$ indicates efficiency),
- $\boldsymbol{x_0}$ and $\boldsymbol{y_0}$ are the input and output vectors of DMUo,
- X and Y are the matrices of all DMUs' inputs and outputs,
- λ is a vector of weights assigned to peer DMUs.

2.3.2 Input-Oriented VRS (BCC) Model

The input-oriented BCC model, introduced by **B**anker, **C**harnes, and **C**ooper (1984), extends the CCR model to allow for variable returns to scale by adding a convexity constraint:

$$\min_{\boldsymbol{\theta},\boldsymbol{\lambda}} \boldsymbol{\theta}$$

$$\textbf{subject to } \mathbf{Y\lambda} \geq \boldsymbol{y_0}$$

$$\boldsymbol{\theta x_0 - X\lambda \geq 0}$$

$$\boldsymbol{e^T\lambda = 1}$$

$$\boldsymbol{\lambda \geq 0}$$

where:

- $\boldsymbol{e}$ is a vector of ones (of appropriate dimension),
- the constraint $\boldsymbol{e^T\lambda = 1}$ ensures convexity and thus variable returns to scale.

2.3.3 Scale Efficiency

Scale efficiency (SE) is computed as the ratio of the CRS efficiency score (θ_{CRS}) to VRS efficiency score (θ_{VRS}) for each DMU:

$$\boldsymbol{SE = \frac{\theta_{CRS}}{\theta_{VRS}}}$$

A value of $SE = 1$ indicates operation at optimal scale, while $SE < 1$ suggests scale inefficiency (cooper et al., 2011).

2.3.4 Output Slacks and Targets

After solving the DEA model, output slacks (s^+) and input slacks (s^-) are calculated to identify any additional improvements possible in outputs or reductions in inputs, even after proportional scaling. The target values for each DMU can be determined as:

$$Target\ Input = \theta^* x_o - s^-$$

$$Target\ Output = y_o + s^+$$

Where θ^* is the optimal efficiency score.

2.3.5 Model Implementation

This study chose an input-oriented DEA model for both managerial and technical reasons. From a management point of view, branch management in Islamic banks usually has more control over how resources (inputs) are used and distributed than over the demand for financing products or the outside factors that affect outputs, such the number of beneficiaries and profits. This is in line with what the DEA literature says, which is that when the main goal is to utilize fewer resources while keeping or improving service delivery, input orientation is the way to go (Cooper et al., 2011; Emrouznejad & Yang, 2018).

From a technical standpoint, DEA is well-suited to handle multiple inputs and outputs of varying types and scales, which is a key advantage in banking efficiency studies (Othman et al., 2016; Huguenin, 2012). In this study, the number of outputs (two: beneficiaries and profit) exceeds the number of inputs (one: allocated funds). Although DEA can support

this structure, it is crucial to remember that the discriminatory power of the model may diminish as the number of outputs and inputs rises in comparison to the number of DMUs, which could make more DMUs appear efficient (Huguenin, 2012). Nevertheless, this technical feature does not determine the model's orientation; rather, orientation is established by which.

Therefore, even in situations where there are more outputs than inputs, the decision to use an input-oriented approach in this analysis is supported by the methodological standards in the DEA literature as well as the practical realities of resource management at the branch level (Cooper et al., 2011; Maniati, 2017; Othman et al., 2016; Emrouznejad & Yang, 2018).

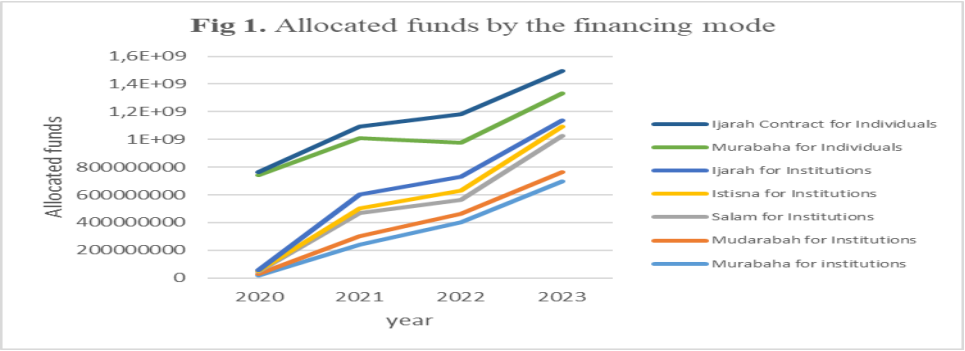
3 Results:

3.1 Descriptive Statistics of Input and Output Variables (2020–2023):

The key characteristics of the input (allocated funds) and output variables (number of beneficiaries and profit generated) for each Islamic financing mode at the Al Salam Bank - Adrar during 2020-2023 are compiled in this section.

3.1.1.1 Input Variable: Allocated Funds for the Financing Mode

Al Salam Bank - Adrar has allocated amounts for each financing formula during the study period, the development of which can be represented in the following figure**:**



Source: Based on Microsoft Excel

Table 1. Descriptive statistics - Allocated Funds for the Financing Mode DZD

Financing Product	Mean	Std. Dev.	Min	Max
Murabaha for Institutions	3,600,000,000	2,327,105,263	20,000,000	7,000,000,000
Mudarabah for Institutions	54,500,000	26,870,057	8,000,000	65,000,000
Salam for Institutions	18,250,000	10,059,823	10,000,000	26,000,000
Istisna for Institutions	4,875,000	2,849,326	1,000,000	7,000,000
Ijarah for Institutions	16,750,000	17,728,436	5,000,000	42,000,000
Murabaha for Individuals	2,535,250,000	2,010,230,788	69,000,000	4,110,000,000
Ijarah Contract for Individuals	13,050,000	8,191,442	2,000,000	21,000,000

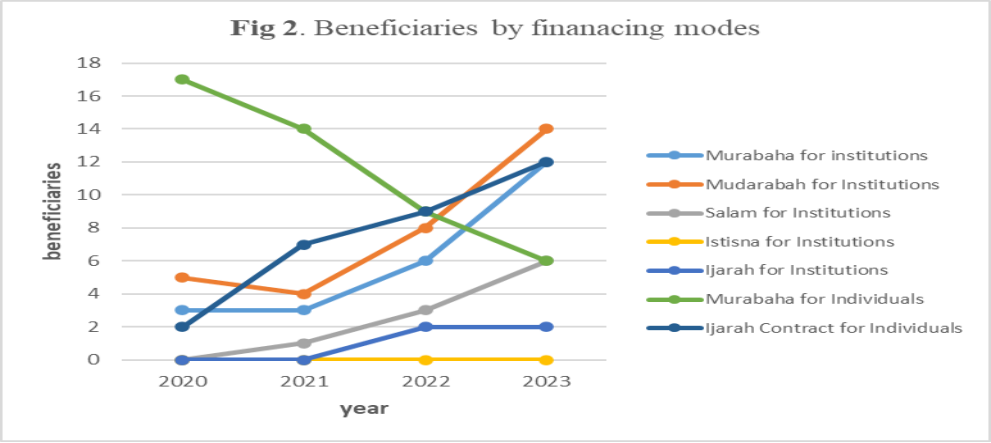
Source: Based on Microsoft Excel

- **Murabaha for Institutions** and **Murabaha for Individuals** received the highest average allocations, with significant increases over the years and high variability.
- **Mudarabah for Institutions** and **Salam for Institutions** allocations were relatively stable, with modest growth and less variability.
- **Istisna for Institutions** and **Ijarah for Institutions** had the lowest allocations, though **Ijarah for Institutions** showed a notable jump in 2023.
- **Ijarah Contract for Individuals** displayed steady growth, with increasing allocations each year.

3.1.1.2 Output variables: Number of Beneficiaries and Profit Generated

❖ **Number of Beneficiaries:**

The variable representing the number of beneficiaries from each financing mode showed noticeable changes, as some of them decreased during the period and others increased, as shown in the following figure.



Source: Based on Microsoft Excel

Table 2. Descriptive statistics- Number of Beneficiaries

Financing Product	Mean	Std. Dev.	Min	Max
Murabaha for Institutions	6.00	4.24	3	12
Mudarabah for Institutions	7.75	4.50	4	14
Salam for Institutions	2.50	2.65	0	6
Istisna for Institutions	0.00	0.00	0	0
Ijarah for Institutions	1.00	1.15	0	2
Murabaha for Individuals	11.50	4.93	6	17
Ijarah Contract for Individuals	7.50	4.20	2	12

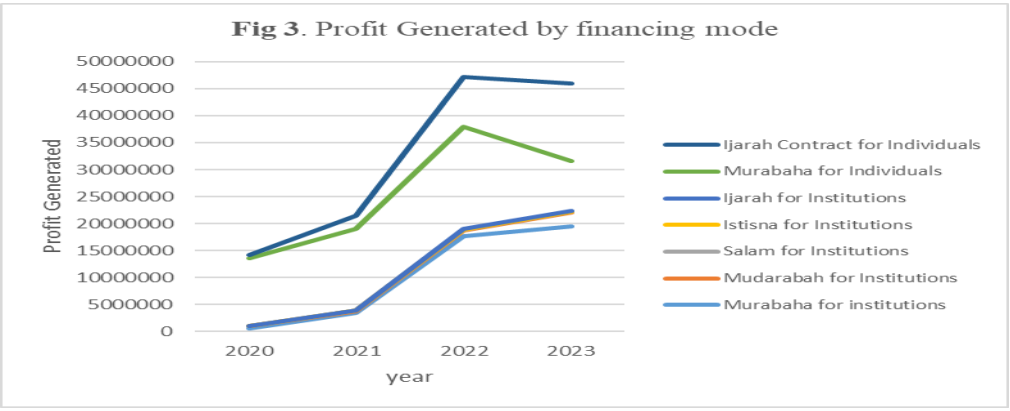
Source: Based on Microsoft Excel

- **Murabaha and Mudarabah for Institutions** show the highest average number of beneficiaries among institutional products, with a clear upward trend and relatively high variability.
- **Salam for Institutions** started from zero and grew steadily, but the average remains low compared to other products.

- **Istisna for Institutions** had no beneficiaries during the period.
- **Ijarah for Institutions** was introduced later, showing a low mean and variability.
- **Murabaha for Individuals** had the highest average among individual products but showed a declining trend over the years.
- **Ijarah Contract for Individuals** displayed consistent growth, with the number of beneficiaries increasing each year.

❖ Profit Generated:

This variable representing the profit from each financing mode showed noticeable changes, with some decreasing and others increasing during the period, as shown in the following figure.



Source: Based on Microsoft Excel

Table 3. Descriptive statistics- Profit Generated from the Financing Mode DZD

Financing Product	Mean	Std. Dev.	Min	Max
Murabaha for Institutions	10,780,000	8,765,985	540,000	19,460,000
Mudarabah for Institutions	1,132,500	1,009,053	320,000	2,590,000
Salam for Institutions	102,000	73,205	0	180,000
Istisna for Institutions	0	0	0	0
Ijarah for Institutions	60,000	70,711	0	140,000
Murabaha for Individuals	13,952,500	4,073,424	9,310,000	18,800,000
Ijarah Contract for Individuals	6,625,000	5,554,042	540,000	14,280,000

Source: Based on Microsoft Excel

- **Murabaha for Institutions** had the highest mean profit among institutional products, with significant year-to-year variability.

- **Murabaha for Individuals** led among individual products but showed a drop in 2023, reflected in its standard deviation.
- **Ijarah Contract for Individuals** displayed strong growth, with a high maximum in 2023.
- **Istisna for Institutions** generated no profit throughout the period.
- Most products showed growth trends, but some, like Salam and Istisna, remained modest or inactive.

3.2 Efficiency of Islamic Financing Modes (2020–2023)

This section presents the empirical findings of the Data Envelopment Analysis (DEA) for active Islamic financing modes at Al Salam Bank, Adrar branch, covering the period 2020–2023. Both Constant Returns to Scale (CRS) and Variable Returns to Scale (VRS) input-oriented models were employed, with "allocated funds" as input and "number of beneficiaries" and "profit generated" as outputs.

3.2.1 2020 Results

Table 3. Efficiency Scores for 2020

Financing Mode (DMU)	CRS TE	VRS TE	Scale Efficiency	Returns to Scale
Murabaha for Institutions	0.450	0.569	0.791	Decreasing (DRS)
Mudarabah for Institutions	1.000	1.000	1.000	Constant (CRS)
Murabaha for Individuals	0.304	1.000	0.304	Decreasing (DRS)
Ijarah Contract for Individuals	0.450	0.569	0.791	Decreasing (DRS)
Source: based on DEAP Version 2.1				

In 2020, only a subset of financing methods was active. Mudarabah for Institutions and Murabaha for Individuals achieved full technical efficiency under VRS, serving as benchmarks. The other methods showed moderate efficiency, with scale inefficiency indicating that resource allocation exceeded optimal levels relative to output.tput.

3.2.2 Output Slacks and Improvement Targets

Table 4. Output Slacks and Improvement Targets from year 2020

Financing Mode	Output Slack (Beneficiaries)	Output Slack (Profit)	Input Slack (Funds)
Murabaha for Institutions	2.06	0.00	0.00
Mudarabah for Institutions	0.00	0.00	0.00
Murabaha for Individuals	0.00	0.00	0.00

Ijarah Contract for Individuals	3.06	0.00	0.00

Source:Based on DEAP Version 2.1

Murabaha for Institutions and Ijarah Contract for Individuals exhibited output slacks in the number of beneficiaries, indicating they could have served more clients using the same resources. No profit or input slacks were observed, confirming that inefficiency was primarily due to underutilization of outreach.

3.2.3 Output and Input Targets

Table 5. Input and Output Targets from 2020 DZD

Financing Mode	Current Beneficiaries	Target Beneficiaries	Current Profit	Target Profit	Current Funds	Target Funds
Murabaha for Institutions	3.00	5.06	540,000	540,000	20,000,000	11,381,818
Mudarabah for Institutions	5.00	5.00	480,000	480,000	8,000,000	8,000,000
Murabaha for Individuals	17.00	17.00	12,580,000	12,580,000	690,000,000	690,000,000
Ijarah Contract for Individuals	2.00	5.06	540,000	540,000	20,000,000	11,381,818

Source:Based on DEAP Version 2.1

For Murabaha for Institutions and Ijarah Contract for Individuals, efficiency could be achieved by either increasing the number of beneficiaries to at least 5.06 or reducing allocated funds to about 11.4 million DZD. The other two modes were already operating at optimal levels.

3.3 2021 Results

Table 6. Efficiency Scores for 2021

Financing Mode (DMU)	CRS TE	VRS TE	Scale Efficiency	Returns to Scale
Murabaha for Institutions	0.399	0.453	0.880	Increasing (IRS)
Mudarabah for Institutions	0.762	1.000	0.762	Increasing (IRS)
Salam for Institutions	0.067	0.353	0.190	Increasing (IRS)
Istisna for Institutions	1.000	1.000	1.000	Constant (CRS)
Ijarah for Institutions	1.000	1.000	1.000	Constant (CRS)

Source:Based on DEAP Version 2.1

With the activation of new financing modes, Istisna for Institutions and Ijarah for Institutions achieved full efficiency. Murabaha for Institutions and Salam for Institutions remained less efficient, with output slacks indicating underperformance in outreach. Most inefficient modes operated under increasing returns to scale, suggesting that scaling up could improve efficiency.

3.3.1 Output Slacks and Improvement Targets

Table 7. Output Slacks and Improvement Targets from year 2021

Financing Mode	Output Slack (Beneficiaries)	Output Slack (Profit)	Input Slack (Funds)
Murabaha for Institutions	4.61	0.00	0.00
Mudarabah for Institutions	0.00	0.00	0.00
Salam for Institutions	3.00	200,000	0.00
Istisna for Institutions	0.00	0.00	0.00
Ijarah for Institutions	0.00	0.00	0.00

Source:Based on DEAP Version 2.1

Murabaha for Institutions and Salam for Institutions had significant output slacks, especially in the number of beneficiaries and profit for Salam, indicating substantial room for improvement without increasing inputs.

3.3.2 Output and Input Targets

Table 8. Input and Output Targets from 2021 DZD

Financing Mode	Current Beneficiaries	Target Beneficiaries	Current Profit	Target Profit	Current Funds	Target Funds
Murabaha for Institutions	3.00	7.61	3,520,000	3,520,000	240,000,000	108,669,291
Mudarabah for Institutions	4.00	4.00	320,000	320,000	60,000,000	60,000,000
Salam for Institutions	1.00	4.00	120,000	320,000	170,000,000	60,000,000
Istisna for Institutions	14.00	14.00	15,120,000	15,120,000	411,000,000	411,000,000
Ijarah for Institutions	7.00	7.00	2,420,000	2,420,000	80,000,000	80,000,000

Source:Based on DEAP Version 2.1

To achieve efficiency, Murabaha for Institutions and Salam for Institutions would need to increase their outputs or decrease their inputs significantly. The other modes were already functioning at their efficiency targets.

3.4 2022 Results

Table 9. Efficiency Scores for 2022

Financing Mode (DMU)	CRS TE	VRS TE	Scale Efficiency	Returns to Scale
Murabaha for Institutions	0.572	0.581	0.986	Increasing (IRS)
Mudarabah for Institutions	1.000	1.000	1.000	Constant (CRS)
Salam for Institutions	0.244	0.650	0.375	Increasing (IRS)
Istisna for Institutions	0.162	0.650	0.250	Increasing (IRS)
Ijarah for Institutions	1.000	1.000	1.000	Constant (CRS)
Murabaha for Individuals	0.723	1.000	0.723	Decreasing (DRS)

Source: Based on DEAP Version 2.1

Efficiency became more varied, with several modes reaching full efficiency and others falling behind, especially Salam and Istisna. Scale inefficiency continued, with some modes operating under increasing or decreasing returns to scale.

3.4.1 Output Slacks and Improvement Targets

Table 10. Output Slacks and Improvement Targets from year 2022

Financing Mode	Output Slack (Beneficiaries)	Output Slack (Profit)	Input Slack (Funds)
Murabaha for Institutions	2.93	0.00	0.00
Mudarabah for Institutions	0.00	0.00	0.00
Salam for Institutions	5.00	960,000	0.00
Istisna for Institutions	6.00	1,040,000	0.00
Ijarah for Institutions	0.00	0.00	0.00
Murabaha for Individuals	0.00	0.00	0.00

Source:Based on DEAP Version 2.1

Murabaha for Institutions, Salam, and Istisna had significant potential to grow both in beneficiaries and profit with existing resources. The other modes were already efficient.

3.4.2 Output and Input Targets

Table 11. Input and Output Targets from 2022 DZD

Financing Mode	Current Beneficiaries	Target Beneficiaries	Current Profit	Target Profit	Current Funds	Target Funds
Murabaha for Institutions	6.00	8.93	17,640,000	17,640,000	400,000,000	232,242,356
Mudarabah for Institutions	8.00	8.00	1,140,000	1,140,000	65,000,000	65,000,000
Salam for Institutions	3.00	8.00	180,000	1,140,000	100,000,000	65,000,000
Istisna for Institutions	2.00	8.00	100,000	1,140,000	100,000,000	65,000,000
Ijarah for Institutions	9.00	9.00	18,800,000	18,800,000	244,000,000	244,000,000
Murabaha for Individuals	9.00	9.00	9,360,000	9,360,000	210,000,000	210,000,000

Source:Based on DEAP Version 2.1

Murabaha for Institutions, Salam, and Istisna would need to substantially increase their outputs or reduce their inputs to become efficient. Other modes were already at their targets.

3.5 2023 Results

Table 12. Efficiency Scores for 2023

Financing Mode (DMU)	CRS TE	VRS TE	Scale Efficiency	Returns to Scale
Murabaha for Institutions	0.315	1.000	0.315	Decreasing (DRS)
Mudarabah for Institutions	1.000	1.000	1.000	Constant (CRS)
Salam for Institutions	0.107	0.191	0.561	Increasing (IRS)
Istisna for Institutions	0.221	1.000	0.221	Increasing (IRS)
Ijarah for Institutions	0.542	0.614	0.881	Increasing (IRS)

Murabaha for Individuals	1.000	1.000	1.000	Constant (CRS)

Source:Based on DEAP Version 2.1

Murabaha for Institutions, Mudarabah for Institutions, Murabaha for Individuals, and Istisna for Institutions achieved full efficiency under VRS. Ijarah for Institutions and Salam for Institutions remained less efficient, with output slacks in beneficiaries and profit, respectively.

3.5.1 Output Slacks and Improvement Targets

Table 13. Output Slacks and Improvement Targets from year 2023

Financing Mode	Output Slack (Beneficiaries)	Output Slack (Profit)	Input Slack (Funds)
Murabaha for Institutions	0.00	0.00	0.00
Mudarabah for Institutions	0.00	0.00	0.00
Salam for Institutions	0.00	848,667	0.00
Istisna for Institutions	0.00	0.00	0.00
Ijarah for Institutions	2.49	0.00	0.00
Murabaha for Individuals	0.00	0.00	0.00

Source:Based on DEAP Version 2.1

Ijarah for Institutions could have served more beneficiaries with the same resources, and Salam for Institutions could have generated higher profit. The other modes were already efficient.

3.5.2 Output and Input Targets

Table 14. Input and Output Targets from 2023 DZD

Financing Mode	Current Beneficiaries	Target Beneficiaries	Current Profit	Target Profit	Current Funds	Target Funds
Murabaha for Institutions	12.00	12.00	19,460,000	19,460,000	700,000,000	700,000,000
Mudarabah for Institutions	14.00	14.00	2,590,000	2,590,000	65,000,000	65,000,000
Salam for Institutions	6.00	6.00	108,000	956,667	260,000,000	49,666,667
Istisna for Institutions	2.00	2.00	140,000	140,000	42,000,000	42,000,000
Ijarah for Institutions	6.00	8.49	9,310,000	9,310,000	195,000,000	119,821,782
Murabaha for Individuals	12.00	12.00	14,280,000	14,280,000	162,000,000	162,000,000

Source: Based on DEAP Version 2.1

Ijarah for Institutions and Salam for Institutions would need to increase their outputs or reduce their inputs to reach the efficiency frontier. Other modes were already at their targets.

4 Discussion

The four-year analysis reveals a dynamic and instructive evolution in the efficiency of Islamic financing modes at Al Salam Bank, Adrar branch.

- **2020:** Only a few modes were efficient, and the majority of inefficiencies resulted from underusing outputs. Consistent with findings in the literature that emphasise the significance of optimising outreach and resource allocation in Islamic banking, output slacks showed that multiple products could serve more beneficiaries with the same resources (Kulmie et al., 2023).
- **2021:** Some of the new modes, such as Istisna for Institutions and Ijarah for Institutions, achieved full efficiency. However, there were still output slacks for some modes, particularly in Salam for Institutions' profit and beneficiary count. This is consistent with studies that demonstrate scale effects are important and that Islamic financing product adoption and maturity can take time (Belkhaoui et al., 2020); (Karanlioglu & Musajeva, 2017).
- **2022:** Scale-related inefficiencies continued, and efficiency scores grew increasingly varied. Significant output slacks were still present in some modes, suggesting unrealised potential. This supports research showing that operational scale and product mix have a significant impact on technical efficiency in Islamic banking (Bahrini, 2017).
- **2023:** Ijarah for Institutions and Salam for Institutions still showed output slacks, suggesting more space for improvement, even though the majority of modes reached full efficiency under VRS. Even as products mature, continued focus on marketing, outreach, and operational improvement is necessary, as evidenced by the persistence of output slacks, particularly in the number of beneficiaries and profit (Kulmie, Abdulle, Hussein, & Mohamud, 2023; Gul & Khan, 2023).

In every year, Mudarabah for Institutions and Murabaha for Individuals were the standard, achieving superior social and economic results. This is in line with research showing that these modes are frequently essential to Islamic banking's efficiency and profitability (Kulmie, Abdulle, Hussein, & Mohamud, 2023). Ongoing performance monitoring and strategic resource realignment are necessary, though, as evidenced by persistent inefficiencies in other modes, especially those pertaining to scale and output utilisation (Belkhaoui et al., 2020); Karanlioglu & Musajeva, 2017).

The fact that returns to scale have both increased and decreased over time suggests that efficiency cannot be ensured by merely expanding or contracting resources. Rather, for long-term improvement, operational scale must be in line with real demand, and outreach and marketing must be improved. These results underline the significance of ongoing innovation and adaptation in product delivery and support the findings of comparative studies on the effectiveness of Islamic banks (Bahrini, 2017); (Majeed & Zainab, 2021).

5. Conclusion

This study focused on Al Salam Bank in Adrar between 2020 and 2023 and used data envelope analysis (DEA) to compare and assess the efficacy of Islamic financing options at the branch level. The study offered a comprehensive evaluation of how well each financing method converted allocated funds into observable outcomes, specifically the number of beneficiaries and profits made, using both CRS and VRS input-oriented models.

The findings showed a dynamic environment for efficiency growth. Other modes, such as Istisna and Ijarah for Institutions, later attained full efficiency, reflecting operational learning and product maturity, while Murabaha for Individuals and Murabaha for Institutions continuously served as standards for best practices. However, recurring inefficiencies were observed in modes like "Salam for Institutions," "Murabaha for Institutions," and "Ijarah for Institutions," primarily as a result of underutilisation of outputs rather than overuse of inputs. With both rising

and falling returns to scale noted across various years and products, the analysis also emphasised the significance of scale effects.

The study looks at Islamic banking's flexible management and continuous performance monitoring. To increase efficiency and maximise the financial and social benefits, it is imperative to improve outreach, allocate resources more effectively, and match operational size to actual demand. The results also highlight the significance of branch- and product-level analysis for bank managers and policymakers looking to improve Islamic finance's efficacy and sustainability.

This research improves the general understanding of Islamic banking efficiency and provides a methodological framework for comparable assessments elsewhere by addressing a major gap in the literature and offering empirical evidence from a less-studied region. Future studies could broaden this analysis to other fields, incorporate more outputs like social impact or customer satisfaction, and look more closely at the consequences of economic shocks and regulatory changes.

5 References

1- Abduh, M., & Omar, M. A. (2012). Islamic banking and economic growth: The Indonesian experience. *International Journal of Islamic and Middle Eastern Finance and Management, 5*(1).
2- Bahrini, R. (2017). Efficiency analysis of Islamic banks in the MENA region: A bootstrap DEA approach. *International Journal of Islamic and Middle Eastern Finance and Management, 10*(4).
3- Banker, R. D., Charnes, A., & Cooper, W. W. (1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management Science, 30*(9.
4- Belkhaoui, A. (2020). Islamic banking in Algeria: Development, challenges and prospects. *Journal of Islamic Banking and Finance, 8*(2).
5- Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European Journal of Operational Research, 2*(6).
6- Cooper, W. W., Seiford, L. M., & Zhu, J. (2011). Data Envelopment Analysis: History, Models, and Interpretations. In W. W. Cooper, L. M. Seiford, & J. Zhu (Eds.), *Handbook on Data Envelopment Analysis*. Springer.
7- Emrouznejad, A., & Yang, G.-L. (2018). A survey and analysis of the first 40 years of scholarly literature in DEA: 1978–2016. *Socio-Economic Planning Sciences, 61*.

8- Gul, M., & Khan, A. U. (2023). Impact of the Islamic modes of finance on the profitability of Islamic banking sector in Pakistan. *Islamic Banking & Finance Review, 10*(1). https://doi.org/10.32350/ibfr.101.01
9- Hanif, M. (2011). Differences and similarities in Islamic and conventional banking. *International Journal of Business and Social Science, 2*(2), 166–175.
10- Hasan, M., & Dridi, J. (2010). The effects of the global crisis on Islamic and conventional banks: A comparative study. *IMF Working Paper No. 10/201*.
11- Huguenin, J. M. (2012). Data Envelopment Analysis (DEA): A performance measurement technique. Serval, University of Lausanne.
12- Iqbal, Z., & Mirakhor, A. (2011). *An Introduction to Islamic Finance: Theory and Practice*. John Wiley & Sons.
13- Islamic Financial Services Board. (2023). *Islamic Financial Services Industry Stability Report 2023*.
14- Jiang, H. (2018). Applying Data Envelopment Analysis in Measuring the Efficiency of Bank Branches. *Mathematics, 6*(10), 184.
15- Karanlioglu, G., & Musajeva, S. (2017). Comparison of Efficiency and Productivity between Islamic Banks in the GCC region: A quantitative study using DEA and Malmquist index (Master's thesis, Umeå School of Business and Economics). DiVA Portal.
16- khoualed, aboubaker. (2025). Islamic Banking in Algeria: Reality and Challenges. مجلة إضافات إقتصادية, 9(1), 571-590. https://asjp.cerist.dz/en/article/265194
17- Kulmie, D. A., Abdulle, M. A., Hussein, M. S., & Mohamud, H. A. (2023). Effects of Islamic Modes of Financing on Profitability of Banking Institutions. *International Journal of Business and Management, 18*(5).
18- Majeed, M. T. (2021). Efficiency and productivity of Islamic banks: Evidence from panel data. *Borsa Istanbul Review, 21*(2).
19- Maniati, M. (2017). Measuring the Technical Efficiency for the Shipping Banks Using Data Envelopment Analysis. *Modern Economy, 8*.
20- Musajeva, J. (2017). Efficiency of Islamic banks: A review of the literature. *Journal of Islamic Economics, Banking and Finance, 13*(2).
21- Othman, F. M., Isa, C. R., & Abdul Rahman, R. (2016). Data Envelopment Analysis: A Tool of Measuring Efficiency in Banking Sector. *International Journal of Economics and Financial Issues, 6*(3).