Prioritizing Efficiency Improvement Actions for Inefficient Audit Firms Using an Integrated Data Envelopment Analysis and Wasserman Interaction Matrix Approach

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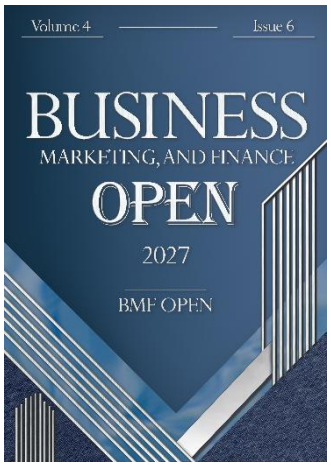

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Citation: Aliari, M., Dasineh, M., Salari, H., & Rostami Jaz, H. (2027). Prioritizing Efficiency Improvement Actions for Inefficient Audit Firms Using an Integrated Data Envelopment Analysis and Wasserman Interaction Matrix Approach. *Business, Marketing, and Finance Open*, 4(6), 1-20.

Received: 08 June 2026
Revised: 27 August 2026
Accepted: 04 September 2026
Initial Publication: 05 September 2026
Final Publication: 01 November 2027

Abstract: This study aims to bridge the gap between objective inefficiency diagnosis and operational prescription by designing and testing an integrated framework for prioritizing improvement actions in inefficient audit firms. The study is applied in purpose and was conducted using a sequential mixed-methods design. In the quantitative phase, the efficiency of nine audit firms serving listed companies was evaluated using a window-based Slacks-Based Measure (SBM) model, and critical units were identified through Pareto analysis. In the qualitative phase, an initial list of causes and actions was extracted through interviews and validated using Lawshe's and Waltz and Bausell's methods (CVR/CVI). The causes were then prioritized using the Analytic Hierarchy Process (AHP), and the final priorities of improvement actions were determined using the Wasserman Interaction Matrix method. The quantitative findings indicated that the dominant pattern of inefficiency was a "severe output shortfall." The qualitative analysis identified six valid causes and nine valid actions. According to the AHP results, "weakness in marketing strategy" was the most important cause. The final Wasserman roadmap revealed that "developing an aggressive and targeted marketing plan," as a leverage action with the highest driving power and a relatively moderate level of dependence, represents the absolute priority and the starting point for transformation. In contrast, actions such as reengineering internal processes were assigned the lowest priority. The study demonstrates that the principal challenge lies in weaknesses in the business model. The solution requires a paradigm shift from cost management to value management and an immediate focus on strategic, outward-looking leverage actions. The proposed framework provides managers with an operational roadmap extending from "diagnosis" to "prescription."

Keywords: Data Envelopment Analysis (DEA), Wasserman Interaction Matrix, Pareto analysis, content validity (CVR and CVI), prioritization, audit firms.

1. Introduction

Audit firms occupy a critical position in contemporary corporate governance because they provide independent assurance regarding the credibility, reliability, and transparency of financial information used by investors, creditors, regulators, boards of directors, and other stakeholders. The effectiveness of audit firms is therefore not limited to the technical accuracy of audit procedures; it also depends on their ability to transform professional, human, financial, and organizational resources into high-quality audit outputs in an efficient manner. In increasingly competitive professional service markets, audit firms must simultaneously maintain professional independence, comply with auditing standards, manage highly skilled

human resources, control engagement costs, respond to technological change, and attract clients whose characteristics are compatible with the firm's capabilities. Accordingly, the assessment of audit-firm performance increasingly requires a multidimensional perspective that goes beyond conventional profitability or financial-ratio measures. Recent research has emphasized that audit quality and audit effectiveness are shaped by governance structures, organizational competencies, internal control arrangements, professional expertise, and the quality of oversight mechanisms [1-3]. These developments have increased the importance of identifying not only whether an audit firm is inefficient, but also why inefficiency occurs and which managerial interventions should be implemented first.

The business environment of auditing has also changed substantially as audit organizations are expected to respond to more complex transactions, digitalized accounting systems, data-intensive assurance processes, and rapidly evolving client expectations. Strategic data analytics can enhance audit effectiveness by enabling auditors to process larger volumes of information, identify anomalies, improve risk assessment, and direct professional attention toward areas of greater significance [4]. At the same time, information technology has become an important determinant of the design and effectiveness of internal audit and assurance activities, making technological capability increasingly relevant to professional performance [5]. Organizational drivers such as managerial support, professional competence, structural arrangements, and access to appropriate resources can likewise influence audit effectiveness, particularly in developing and emerging markets [6]. Consequently, audit-firm efficiency should be understood as the outcome of interactions among strategy, human resources, technology, pricing, client selection, professional specialization, and internal processes rather than merely as a function of operating cost.

This broader interpretation is particularly important because audit firms are knowledge-intensive professional service organizations. Their primary productive resources include the expertise and experience of partners and managers, the time devoted to engagements, organizational knowledge, professional reputation, and the ability to establish and maintain relationships with clients. Human-resource structure has consequently been identified as a major determinant of accounting-firm operating efficiency, and different configurations of professional staff may lead to materially different efficiency outcomes [7]. Earlier evidence similarly showed that the efficiency of medium-sized audit firms can be decomposed into overall technical efficiency, pure technical efficiency, and scale efficiency, demonstrating that observed underperformance may arise from different operational sources rather than from a single deficiency [8]. Research on the future of auditing also points to significant environmental, technological, regulatory, professional, and organizational drivers that may reshape audit practices and the competitive position of audit firms [9]. Thus, audit-firm management requires a systematic mechanism for identifying the sources of inefficiency before allocating scarce managerial resources to corrective action.

Traditional performance evaluation approaches, however, frequently rely on isolated financial ratios or accounting indicators. Although such measures are useful for describing specific dimensions of organizational performance, they may be inadequate when multiple inputs and outputs must be evaluated simultaneously. Data Envelopment Analysis (DEA) provides an important alternative because it enables the relative efficiency of comparable decision-making units to be assessed without requiring a predetermined functional relationship between inputs and outputs. DEA has therefore been proposed as a complement to conventional financial-ratio analysis, particularly where organizational performance cannot be represented adequately by a single financial measure [10]. Comparative evidence from financial institutions has further demonstrated that DEA-based super-efficiency measures and conventional financial ratios may produce different rankings, highlighting the additional

information provided by frontier-based efficiency analysis [11]. Applications of DEA to various organizations have also shown its capacity to identify inefficient units, rank decision-making units, and quantify the extent to which resources or outputs require adjustment [12].

Within the auditing context, DEA is especially suitable because audit firms use multiple heterogeneous inputs to generate multiple forms of output. Empirical applications have demonstrated that the method can be used directly to evaluate the efficiency of audit firms and identify differences in their productive performance [13, 14]. Studies of auditing firms have also moved beyond simple efficiency scoring by examining the drivers of efficiency and the productive slacks that reveal where inefficiencies are concentrated [15]. Such research is valuable because two firms with similar efficiency scores may require substantially different corrective strategies if one suffers mainly from excessive resource consumption while the other suffers from inadequate output generation. Accordingly, the managerial usefulness of DEA increases substantially when efficiency scores are interpreted together with slack variables and benchmark information.

Among the methodological developments in DEA, the Slacks-Based Measure (SBM) introduced by Tone represents an important advancement because it explicitly incorporates input excesses and output shortfalls into the efficiency assessment [16]. Unlike purely radial efficiency models, which may overlook remaining slacks after proportional adjustment, the SBM model can capture non-proportional inefficiencies and therefore provide a more detailed diagnosis of operational deficiencies. This property is particularly relevant for audit firms because inefficiency may arise from a severe shortage in audited business volume, weak corrective audit performance, excessive engagement costs, or an unsuitable professional-experience structure. The SBM approach has consequently been adopted in efficiency studies where decision-makers need to identify the precise sources and magnitude of inefficiency rather than merely distinguish efficient from inefficient units [17]. More broadly, the development of network and advanced DEA models has expanded the analytical capacity of frontier methods to represent complex organizational systems and interconnected production structures [18].

Despite these advantages, DEA remains fundamentally a diagnostic and benchmarking method. It can indicate which units are inefficient, estimate the distance from the efficiency frontier, identify reference units, and calculate input or output slacks; however, these outputs do not automatically reveal the organizational causes that produced the observed inefficiency. A large output shortfall, for example, may originate from weak marketing, inappropriate pricing, insufficient industry specialization, a weak professional brand, poor client selection, ineffective processes, or a combination of these conditions. From a managerial perspective, therefore, the critical question is not simply whether inefficiency exists, but what explains it and which action should receive priority. This distinction separates performance measurement from managerial intervention and constitutes a major challenge in converting DEA results into operational decisions.

The need to move from diagnosis toward prescription is also consistent with broader approaches to organizational performance management. Integrated evaluation frameworks have shown that DEA can be combined with other decision-support techniques to create richer managerial interpretations. For example, the integration of DEA with the Balanced Scorecard and the Analytic Hierarchy Process (AHP) has been used to combine efficiency measurement with strategic performance dimensions and expert-based weighting [19]. Similarly, hybrid AHP–DEA approaches have been employed to evaluate organizational performance by combining relative efficiency analysis with hierarchical judgment and prioritization [20]. Such integrations reflect a general principle: quantitative efficiency analysis becomes more actionable when it is connected to structured expert judgment capable of explaining causal factors and evaluating alternative interventions.

AHP is particularly useful in this regard because causes of inefficiency rarely have equal managerial importance. When several plausible root causes are identified, managers need a systematic method for comparing their relative contribution to the observed problem. AHP converts pairwise judgments into a set of relative weights while also providing a consistency criterion for evaluating the logical coherence of expert assessments. This capability is important in audit-firm management, where factors such as market strategy, professional specialization, pricing, client risk, branding, and internal processes may interact but differ in strategic importance. The use of structured weighting procedures can therefore prevent improvement programs from treating all diagnosed causes as equally important and can support more disciplined allocation of managerial attention.

The quality of the causal factors and improvement actions included in such decision frameworks also depends on their content validity. Expert-derived items should not be accepted solely because they emerge from interviews; rather, their necessity, relevance, clarity, and simplicity should be evaluated systematically before they are incorporated into quantitative prioritization. Lawshe-type content validity procedures are rooted in the logic that expert agreement can distinguish essential items from those that are merely useful or peripheral. The broader measurement literature likewise emphasizes the need for careful item construction, expert evaluation, and validity assessment when developing instruments and structured evaluative criteria [21, 22]. Such validation is especially important when qualitative judgments are converted into formal decision matrices because poorly defined or redundant factors can distort subsequent weighting and prioritization.

Nevertheless, weighting root causes alone does not solve the managerial prioritization problem. An improvement action can address an important cause while still being a poor starting point if its implementation depends heavily on other actions. Conversely, an action that directly addresses several moderately important causes may have substantial leverage if it influences other interventions and can be implemented with relatively little dependence on them. Therefore, the final prioritization of improvement actions requires analysis not only of the relationship between causes and actions but also of the interdependencies among the actions themselves. This systems perspective is particularly relevant to audit firms because marketing, professional specialization, branding, pricing, personnel development, service diversification, client portfolio management, strategic alliances, and process improvement are not independent managerial domains.

Interaction and network-based perspectives provide a useful conceptual foundation for examining these interdependencies. Wasserman and Faust's work on network analysis formalized the examination of relational structures in which the position and importance of an element depend on its connections with other elements rather than solely on its isolated characteristics [23]. Translated into a managerial prioritization context, this logic permits improvement actions to be evaluated according to both their driving influence on the system and their dependence on other actions. An influence–dependence map can consequently distinguish leverage actions, key actions, dependent actions, and relatively autonomous actions. Such a classification can be more informative than a simple ranked list because it indicates where transformation should begin and which actions should be postponed until enabling conditions have been created.

This prioritization problem is closely linked to business planning. Effective business planning requires managers to identify strategic objectives, allocate resources, select feasible courses of action, and determine the sequence through which those actions should be implemented [24]. Cost information is also relevant to managerial planning and control because resource allocation decisions require an understanding of the relationship between expenditures and organizational outputs [25]. However, excessive emphasis on cost reduction may be misleading in professional service firms if the principal inefficiency arises from insufficient output rather than excessive inputs.

Audit-firm managers may, for example, attempt to reduce administrative costs or compress engagement resources even when the more fundamental problem is a weak client portfolio, inadequate market penetration, or lack of differentiated expertise. In such circumstances, efficiency improvement requires a shift from a predominantly cost-oriented logic toward strategic value creation.

The professional audit literature reinforces the importance of this broader managerial perspective. Audit quality depends on multiple organizational and professional factors that extend beyond compliance with prescribed procedures [26]. Audit committees, governance arrangements, competencies, and oversight mechanisms can materially shape the effectiveness of assurance processes [1, 2]. Internal audit effectiveness likewise reflects organizational support, professional conditions, and institutional context [3, 6]. These findings collectively suggest that audit performance should be approached as a multidimensional organizational capability. Therefore, improving an inefficient audit firm requires interventions that address the structural and strategic mechanisms generating inadequate performance rather than relying exclusively on technical adjustments.

Professional auditing guidance also emphasizes that auditing is a systematic, evidence-based process requiring structured planning, assessment, documentation, and follow-up [27]. The same logic can be extended to the management of audit organizations themselves: inefficiency should be diagnosed through objective evidence, probable causes should be validated, alternatives should be evaluated systematically, and corrective actions should be sequenced according to their likely systemic effects. The challenge is thus methodological as much as managerial. A framework is required that can integrate objective performance measurement with validated expert knowledge and a structured model of causal and action interdependence.

Despite the substantial literature on DEA, audit effectiveness, audit quality, and decision-support methods, a notable gap remains between identifying inefficient audit firms and providing an operational roadmap for improving them. Existing DEA studies in auditing have generated important evidence regarding efficiency scores, resource utilization, human-resource structures, and productive slacks [7, 8, 13, 15]. However, an efficiency score by itself does not specify which underlying managerial deficiencies should be addressed first. Similarly, studies identifying determinants of audit quality or effectiveness provide important lists of influential factors but do not necessarily establish whether a specific inefficient firm's problem is driven predominantly by those factors or how corrective actions should be sequenced [9, 26]. This creates a practical gap between "diagnosis" and "prescription."

A second methodological gap concerns the identification of critically inefficient units. When multiple firms display varying degrees of inefficiency, conducting equally intensive qualitative investigation for every unit may be inefficient and unnecessary. Pareto analysis provides a practical mechanism for concentrating analytical and managerial attention on the "vital few" units that account for a substantial proportion of the aggregate problem. When combined with DEA, this approach can transform a broad set of inefficient decision-making units into a focused set of critical cases requiring deeper investigation. Such targeting is particularly valuable in studies involving expert interviews because qualitative analysis is resource-intensive and is most useful when directed toward cases with the greatest performance deficit.

A third gap concerns the sequence of corrective actions. Even after root causes are identified and weighted, managers may still face a portfolio of competing actions. Some actions may directly address important causes but exhibit high dependence on other actions; others may have strong cross-system effects and therefore function as leverage points. An integrated influence–dependence perspective can address this issue by assessing not only the relevance of each action to each cause but also the internal influence structure among the actions themselves. This makes it possible to distinguish actions that should initiate change from those whose successful execution depends

on prior interventions. Such an approach is especially useful for audit firms operating under resource constraints, because ineffective sequencing may dissipate managerial resources without resolving the main source of inefficiency.

Accordingly, combining window-based SBM-DEA, Pareto analysis, expert-based content validation, AHP, and the Wasserman Interaction Matrix can provide a coherent multistage framework. Window-based SBM-DEA objectively identifies inefficient firms and quantifies the structure of their input and output slacks; Pareto analysis isolates the critical units responsible for the majority of inefficiency; expert interviews translate quantitative inefficiency patterns into plausible organizational causes and improvement actions; content-validity procedures ensure that these causes and actions are sufficiently necessary, relevant, clear, and simple; AHP determines the relative importance of validated root causes; and the Wasserman Interaction Matrix converts the resulting evidence into an influence–dependence roadmap for sequencing improvement actions. This combination extends efficiency analysis beyond ranking and benchmarking toward a prescriptive decision-support system.

Therefore, the aim of this study is to develop and empirically apply an integrated DEA–Pareto–AHP–Wasserman framework for diagnosing the root causes of inefficiency in audit firms and prioritizing improvement actions according to their strategic influence and interdependence.

2. Methods and Materials

In terms of purpose, this study is applied, and in terms of its data collection and analysis design, it follows a sequential exploratory mixed-methods design. In the first, quantitative phase, secondary data and Data Envelopment Analysis are used to calculate the efficiency of audit firms, after which critically inefficient units are identified through Pareto analysis. In the second, qualitative phase, the findings of the first phase are provided as inputs to an expert panel to conduct content validation, prioritize the causes, and ultimately prioritize the improvement actions. From a temporal perspective, this study employs a panel (longitudinal–cross-sectional) design because it examines firm performance over a three-year period corresponding to the 2020/2021–2022/2023 fiscal years.

The statistical population consisted of all audit firms that were members of the Iranian Association of Certified Public Accountants and were engaged in auditing companies listed on the Tehran Stock Exchange during the study period. Given the limited availability of accurate and complete financial data, purposive sampling was employed. The criteria for selecting the final nine firms were continuity of operations, availability of financial data, and relative diversity in terms of firm size. To address the limitation associated with the sample size in DEA, window analysis was employed using two moving windows: 2020/2021–2021/2022 and 2021/2022–2022/2023.

Following a review of the literature and preliminary consultation with experts, the research variables were defined as presented in Table 1. It should be noted that the corrective performance index (Y_2) was quantified through content analysis of auditors' reports and restated financial statements.

Table 1. Input and Output Variables of the DEA Model

No.	Variable	Symbol	Type	Operational Definition and Measurement
1	Audit fee	X_1	Input	Total fees received by the audit firm for auditing the financial statements of all listed companies audited during a fiscal year (unit: million IRR).
2	Average experience of key auditors	X_2	Input	Average number of years of professional experience of the firm's partners and senior managers responsible for final supervision of audit engagements (unit: years).
3	Amount of audited financial statements	Y_1	Output	Sum of the total assets of companies whose financial statements were audited and certified by the audit firm during that year (unit: billion IRR).

4	Corrective performance index	Y_2	Output	Ratio of the number of material issues or adjustments identified by the auditor that resulted in management correcting the financial statements to the total number of material findings reported.

The core of the quantitative analysis is the non-oriented SBM mathematical model proposed by Tone (2001), which is solved for each decision-making unit $k$under evaluation within a time window as follows:

$$\rho_k = \min \left(\frac{1 - \frac{1}{m} \sum_{i=1}^{m} \frac{s_i^{-*}}{x_{ik}}}{1 + \frac{1}{s} \sum_{r=1}^{s} \frac{s_r^{+*}}{y_{rk}}} \right)$$

subject to:

$$\sum_{j=1}^{n} \lambda_j \, x_{ij} + s_i^- = x_{ik}, \; i = 1, \dots, m$$

$$\sum_{j=1}^{n} \lambda_j \, y_{rj} + s_r^+ = y_{rk}, \; r = 1, \dots, n$$

$$\sum_{j=1}^{n} \lambda_j = 1, \; \lambda_j, \; s_i^-, \; s_r^+ \geq 0$$

In this model:

$\rho_k$represents the efficiency of unit $k(1 = 100\%)$.

$x_{ij}$and y_{rj}denote, respectively, the values of input $i$and output $r$for the unit under evaluation.

$s_i^-$and $s_r^+$are the shortfall and surplus variables, respectively, also referred to as "Russell measures," whose optimal values, $s_i^{-*}$and s_r^{+*}, constitute key outputs of the model.

$\lambda_j$denotes the optimal weights that identify the efficient reference units for the unit under evaluation.

After running the model for all units, Pareto analysis is performed to prioritize the inefficient units. For this purpose, for each inefficient unit, a composite inefficiency index (I) is calculated as the mean of the relative shortfall/waste percentages across the four variables examined:

$$I_k = \frac{1}{4} \left(\sum \frac{s_i^-}{x_{ik}} + \sum \frac{s_r^+}{y_{rk}} \right)$$

The units are ranked in descending order according to this index, and a Pareto curve based on cumulative frequency is plotted. Units that collectively account for approximately 70%–80% of total sample inefficiency are selected as the critical units constituting the "vital few" for in-depth analysis in the qualitative phase.

After identifying the critical units in the quantitative phase, an expert panel comprising 12 individuals was selected through purposive and chain-referral (snowball) sampling. The panel composition was designed to ensure face and content validity: five senior partners of audit firms with more than 15 years of experience, four university faculty members specializing in accounting and auditing, and three financial managers of large listed companies. A semi-structured interview was first conducted with each expert, during which the quantitative DEA findings, particularly the extreme inefficiency values, were presented. The experts were asked to propose possible root causes

(CFs) and potential improvement actions (IAs) based on these objective data. The interviews produced an initial list comprising nine causes and 13 actions.

To validate the content of the root causes and required improvement actions using Lawshe's Content Validity Ratio (CVR) and Waltz and Bausell's Content Validity Index (CVI) approaches, the initial list was provided to the same 12 experts in the form of a validation questionnaire. Two sections were designed for each cause and action:

The first section, based on Lawshe's method, asked experts to rate the necessity of each item using a three-point scale: "1) essential, 2) useful but not essential, and 3) not necessary." The CVR was then calculated for each item. Given the panel size of 12 experts, the minimum acceptable CVR was set at 0.56 according to Lawshe's critical-value table. Items with lower CVR values were eliminated.

The second section, based on Waltz and Bausell's method, asked experts to evaluate each remaining item in terms of relevance, clarity, and simplicity using a four-point Likert scale ranging from 1 = very poor to 4 = excellent. The CVI for each item and each dimension was calculated as the ratio of evaluators assigning a score of 3 or 4 to the total number of evaluators. The minimum acceptable CVI was set at 0.79. The mean CVI across the three dimensions was used as the final index for each item. Items that failed to reach this threshold were reviewed and reworded and were ultimately eliminated if they still failed to meet the criterion. This stage resulted in a final validated list comprising six root causes, CF1 through CF6, and nine improvement actions, IA1 through IA9.

The Analytic Hierarchy Process (AHP) was used to determine the weights and priorities of the six final root causes. A pairwise comparison questionnaire was developed in which experts were asked to compare the importance of each cause relative to the others in producing the "financial output shortfall" observed in the critical units, using a 1–9 scale. The questionnaire was distributed to eight experts. After collection, the consistency ratio (CR) of each matrix was calculated, and matrices with a consistency ratio greater than 0.10 were revised or excluded. Finally, the geometric mean of the judgments was used to construct the group pairwise comparison matrix and calculate the final weight of each cause.

In addition, the Wasserman Interaction Matrix method was used to determine the priorities of the nine improvement actions. This process was conducted by the eight-member expert panel in four steps as follows:

The action–factor relationship matrix (R) was constructed. The strength of the relationship between each improvement action (IA) and each root cause (CF) was rated on a scale from 0 = no relationship to 3 = very strong relationship. Each cause was also assigned a weight (W) based on the AHP results obtained in the preceding stage.

The internal influence matrix (L) was constructed. The extent to which each improvement action influenced the success of the other actions was evaluated on a scale from 0 to 3.

Final calculations were then performed. By integrating matrices $R$and $L$with the factor-weight vector W, the total driving power (D) and dependence degree (R) were calculated for each action.

Finally, a roadmap was developed. The actions were positioned on an influence–dependence diagram according to their $D$and Rindices. Actions characterized by high driving power and low dependence were identified as first-priority leverage actions.

3. Findings and Results

After implementing the non-oriented SBM model within a window-analysis framework, the efficiency of each of the nine firms was calculated across two time windows. Table 2 presents the final efficiency results and relative slack values for the second window, corresponding to the 2021/2022–2022/2023 fiscal years and representing the end-of-period condition.

Table 2. Efficiency Results of the Window-Based SBM Model and Relative Slack Values, Second Window: 2021/2022–2022/2023

DMU ID	Efficiency ($\boldsymbol{\rho}^*$)	Efficiency Rank	Relative Shortfall $\boldsymbol{Y_1}$(Amount)	Relative Shortfall $\boldsymbol{Y_2}$(Performance)	Relative Waste $\boldsymbol{X_1}$(Cost)	Relative Waste $\boldsymbol{X_2}$(Experience)
B18	0.141	9	2.148 (214.8%)	0.321	-0.179	-0.055
B15	0.407	8	0.892 (89.2%)	0.154	-0.201	-0.008
B12	0.789	7	0.184	0.021	-0.051	-0.033
B07	0.854	6	0.092	0.010	-0.022	-0.012
B03	0.902	5	0.045	0.005	-0.008	0.000
B05	0.950	4	0.021	0.000	0.000	-0.002
B09	0.972	3	0.008	0.000	0.000	0.000
B01	0.988	2	0.000	0.000	0.000	0.000
B11	1.000	1	0.000	0.000	0.000	0.000
Overall mean	0.780	—	0.388 (38.8%)	0.057	-0.051	-0.012
Mean of inefficient units (B18, B15, B12, B07)	0.548	—	0.854 (85.4%)	0.127	-0.113	-0.027

As shown in Table 2, only one firm (B11) is fully efficient. The dominant inefficiency pattern across all inefficient units is a severe output shortfall, particularly in Y_1, the amount audited. For example, firm B18 would need to increase its financial output by approximately 215% to reach the efficiency frontier. In contrast, waste in inputs, including cost and experience, is substantially lower.

Pareto analysis was used to prioritize interventions. The composite inefficiency index (I) was calculated for each inefficient unit, and the results are presented in Table 3.

Table 3. Pareto Analysis for Identifying the Critical "Vital Few" Units

Rank	DMU ID	Inefficiency Index ($\boldsymbol{I}$)	Share of Total Inefficiency	Cumulative Share	Status
1	B18	0.676	48.1%	48.1%	Critical unit
2	B15	0.314	22.3%	70.4%	Critical unit
3	B12	0.072	5.1%	75.5%	Normal unit
4	B07	0.034	2.4%	77.9%	Normal unit
5	B03	0.015	1.1%	79.0%	Normal unit
Total for 2 critical units	—	0.990	70.4%	—	—

According to the Pareto principle, firms B18 and B15, which constitute only approximately 22% of the sampled units, account for more than 70% of total inefficiency. Accordingly, these two firms were selected as the "critical vital-few units" for in-depth qualitative analysis and development of improvement solutions.

Subsequently, after conducting the expert interviews, the initial list of nine causes and 13 actions was submitted to 12 experts. The validation results based on Lawshe's CVR and Waltz and Bausell's CVI criteria are summarized in Tables 4 and 5.

Table 4. Content Validation Results for Root Causes Based on the Criteria $CVR \geq 0.56$ and $CVI \geq 0.79$

Initial Code	Proposed Root Cause	CVR	CVI (Mean of Three Dimensions)	Final Status	Final Code
CF01	Weakness in marketing strategy and acquisition of high-quality clients	0.83	0.92	Approved	CF1
CF02	Noncompetitive, cost-based pricing	0.58	0.85	Approved	CF2
CF03	Lack of distinctive industry specialization	0.92	0.96	Approved	CF3
CF04	Inefficient and time-consuming internal processes	0.67	0.88	Approved	CF4

CF05	Weakness in knowledge management and organizational learning	0.50	0.76	Eliminated	—
CF06	Weak professional brand and low market recognition	0.75	0.90	Approved	CF5
CF07	Inability to attract and retain high-caliber human resources	0.42	0.72	Eliminated	—
CF08	Concentration on small and high-risk clients	0.67	0.89	Approved	CF6
CF09	Weakness in information technology	0.33	0.70	Eliminated	—

Table 5. Content Validation Results (CVR and CVI) for Improvement Actions (IAs)

Initial Code	Proposed Improvement Action	CVR	CVI (Mean of Three Dimensions)	Final Status	Final Code
IA01	Develop an aggressive and targeted marketing plan	1.00	0.94	Approved	IA1
IA02	Shift the pricing model to value-based pricing	0.83	0.86	Approved	IA2
IA03	Develop deep specialization in one or two specific industries	0.92	0.98	Approved	IA3
IA04	Reengineer and standardize key processes	0.75	0.83	Approved	IA4
IA05	Design and implement a professional brand-enhancement program	0.92	0.95	Approved	IA5
IA06	Establish a knowledge management system	0.50	0.75	Eliminated	—
IA07	Implement a human-resource recruitment and empowerment program	0.58	0.82	Approved	IA6
IA08	Redefine the client portfolio and gradually exit high-risk clients	0.67	0.85	Approved	IA7
IA09	Invest in specialized audit software	0.42	0.77	Eliminated	—
IA10	Establish strategic alliances with specialized firms	0.58	0.80	Approved	IA8
IA11	Develop consulting services based on audit expertise	0.67	0.84	Approved	IA9
IA12	Increase scholarly activities and article publication	0.33	0.71	Eliminated	—
IA13	Reduce general administrative costs	0.25	0.65	Eliminated	—

The output of this stage consisted of six valid root causes (CF1–CF6) and nine valid improvement actions (IA1–IA9), which formed the basis for the subsequent stages.

After constructing the group pairwise comparison matrix, with a consistency ratio of $0.048 < 0.10$, the final weight of each of the six causes was calculated. The geometric mean of the values assigned by the group members was calculated, subsequently rounded, and entered into the matrix. The results are presented in Table 6.

Table 6. Group Pairwise Comparison Matrix and Final Weights of Root Causes (AHP)

Root Cause	Symbol	CF1	CF2	CF3	CF4	CF5	CF6	Final Weight (Priority)
Weakness in marketing strategy	CF1	1	3	2	4	2	5	0.245 (1)
Noncompetitive pricing	CF2	1/3	1	1/2	2	1/2	3	0.097 (5)
Lack of industry specialization	CF3	1/2	2	1	3	1	4	0.178 (2)
Inefficient internal processes	CF4	1/4	1/2	1/3	1	1/3	2	0.056 (6)
Weak professional brand	CF5	1/2	2	1	3	1	4	0.178 (2)
Concentration on high-risk clients	CF6	1/5	1/3	1/4	1/2	1/4	1	0.047 (4)

As the results indicate, "weakness in marketing strategy and acquisition of high-quality clients (CF1)," with a weight of 0.245, was identified by experts as the most important root cause of inefficiency. It was followed by "lack of industry specialization (CF3)" and "weak professional brand (CF5)," each with a weight of 0.178, jointly ranking second in importance.

Subsequently, to determine the final prioritization of improvement actions using the Wasserman Interaction Matrix, the nine final improvement actions were evaluated using the Wasserman method. The computational steps and final results are presented in Tables 7–9 and Figure 1.

Step 1: Action–Factor Relationship Matrix (*R*) and Weighted Influence

The strength of the relationship between each action and each cause, rated from 0 to 3, together with the AHP-derived weight vector of the causes, forms the weighted *R*matrix. For example, IA1 has a strong relationship, with a score of 3, with CF1, which has a weight of 0.245. The weighted row sum of this matrix represents the total relationship index (*T*) for each action.

Table 7. Action–Factor Relationship Matrix (*R*) and Total Relationship Index (*T*)

Improvement Action	Symbol	CF1 (0.245)	CF3 (0.178)	CF5 (0.178)	CF6 (0.097)	CF2 (0.056)	CF4 (0.047)	***T*Index**
Aggressive marketing program	IA1	3	1	2	3	1	0	1.62
Value-based pricing	IA2	1	0	1	2	3	0	0.79
Development of industry specialization	IA3	2	3	2	1	0	1	1.52
Process reengineering	IA4	0	0	0	0	1	3	0.20
Professional brand enhancement	IA5	2	2	3	1	1	0	1.53
Recruitment and empowerment of personnel	IA6	1	2	1	0	2	2	0.99
Redefinition of the client portfolio	IA7	2	1	2	3	0	0	1.32
Establishment of strategic alliances	IA8	1	2	1	1	0	0	0.88
Development of consulting services	IA9	1	3	2	1	1	0	1.29

Steps 2 and 3: Internal Influence Matrix (*L*) and Calculation of the Final Indices

The mutual influence matrix of the actions (*L*) was constructed, after which the total driving power (*D*) and total dependence degree (*R*) for each action were calculated according to the following relationships:

$$D_i = T_i + \sum_j L_{ij}$$

which represents the overall power of action *i*to influence the system, and:

$$R_i = \sum_j L_{ji}$$

which represents the extent to which action *i*depends on the other actions.

Table 8. Internal Influence Matrix of Actions (*L*) and Driving Power (*D*) and Dependence (*R*) Indices

Action	IA1	IA3	IA5	IA7	IA9	IA6	IA2	IA8	IA4	***D***	***R***	D_n	R_n
IA1	—	2	2	3	1	1	3	1	0	14.62	10	1.00	0.88
IA3	1	—	2	2	3	2	0	2	1	12.79	11	0.84	1.00
IA5	3	2	—	2	2	1	1	1	0	10.52	8	0.64	0.63
IA7	2	1	1	—	2	0	0	1	0	5.20	10	0.17	0.88
IA9	1	2	1	2	—	1	0	1	0	8.53	10	0.46	0.88
IA6	1	2	1	0	1	—	1	0	2	7.99	8	0.41	0.63
IA2	2	0	1	0	0	1	—	0	0	3.32	5	0.00	0.25
IA8	0	1	0	1	1	0	0	—	0	3.88	6	0.05	0.38
IA4	0	1	0	0	0	2	0	0	—	4.29	3	0.09	0.00
Maximum value										14.62	11	—	—
Minimum value										3.32	3	—	—

Step 4: Development of the Influence–Dependence Map and Determination of Final Priorities

By normalizing the $D$and Rindices and plotting them on a two-dimensional diagram (Figure 1), the actions were divided into four categories and their final implementation priorities were determined (Table 9). For normalization, the minimum and maximum values of the indices in columns $D$and Rwere first identified, after which the following formula was used to calculate the normalized value for each action:

$$X' = \frac{X - \min(X)}{\max(X) - \min(X)}$$

The values calculated in this manner are reported in Table 8 under columns $D_n$and R_n.

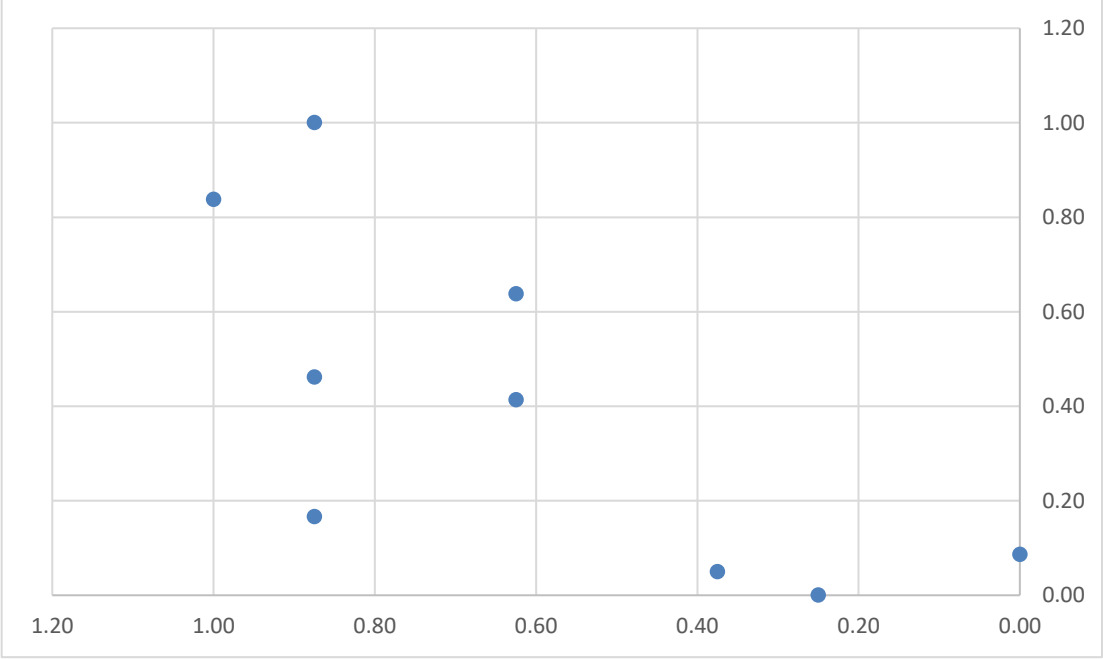

Figure 1. Influence–Dependence Map (Causal Map) of Improvement Actions

By dividing the diagram using a threshold of 0.50, the status of each action and its implementation priority can be determined.

Table 9. Final Priorities and Classification of Improvement Actions Based on the Wasserman Map

Quadrant	Quadrant Name	Actions Included	Characteristics and Implementation Strategy
Quadrant I (upper right)	Key actions	IA3 (development of specialization)	High driving power and high dependence. These actions are critical to system success but themselves depend on other actions for implementation. They have the second implementation priority and, after groundwork has been established by leverage actions, become the principal focus of transformation.
Quadrant II (upper left)	Leverage actions	IA1 (aggressive marketing)	Very high driving power and moderate dependence. These represent the most important intervention points. Their implementation is relatively independent and generates broad effects throughout the system. They constitute the first and immediate priority for managers.
Quadrant III (lower left)	Independent actions	IA6, IA2, IA8, IA4	Low driving power and low dependence. They have limited systemic effects. They can be implemented as lower priorities or in parallel with the main actions while requiring relatively few resources.
Quadrant IV (lower right)	Dependent/subordinate actions	IA5, IA9, IA7	Moderate-to-low driving power and high dependence. These actions are primarily consequences of, or complements to, leverage and key actions. Their successful implementation depends on the implementation of preceding priorities.

The resulting map proposes a two-stage improvement strategy as follows:

Phase 1: Acceleration—Focus on the leverage action

All managerial energy and resources should be directed toward implementing IA1, namely, "developing and implementing an aggressive and targeted marketing plan." With the highest driving power ($D_n = 1.00$) and a relatively moderate dependence level ($R_n = 0.88$), this action represents an ideal leverage point for breaking the vicious cycle of inefficiency. The fundamental objective of this phase is to generate new revenue streams from target markets.

Phase 2: Consolidation—Development of the key action

Simultaneously with the initiation of Phase 1, the necessary groundwork should be established for implementing IA3, namely, "developing deep specialization in one or two specific industries." This key action, characterized by high driving power and high dependence, constitutes the foundation of the firm's long-term differentiation and capability-building strategy. Success in marketing (IA1) lends credibility to specialization (IA3), while the development of specialization progressively enhances the effectiveness of marketing.

The necessity of observing one fundamental consideration

IA5, namely, "professional brand enhancement," which might ordinarily be expected to constitute a leverage priority, was positioned in Quadrant IV, representing dependent actions, in this analysis. This finding indicates that effective branding is primarily an output or consequence rather than an independent input action. A strong brand results from the successful implementation of targeted marketing (IA1) and the provision of specialized services (IA3), rather than constituting the starting point.

This map clearly demonstrates that the solution to overcoming the efficiency crisis begins not with increasing the efficiency of internal processes, represented by Quadrant III actions, but rather with a planned market offensive and investment in specialization.

4. Discussion and Conclusion

The findings of the present study provide an integrated interpretation of inefficiency in audit firms and demonstrate that the principal source of underperformance in the examined firms is not excessive resource consumption but inadequate output generation. The window-based non-oriented SBM results showed that only one audit firm achieved full efficiency, whereas several firms exhibited varying degrees of inefficiency. More importantly, the dominant pattern was a substantial output shortfall, particularly in the amount of audited financial statements, while the relative waste associated with audit fees and professional experience was considerably smaller. This pattern indicates that the inefficient firms were not necessarily burdened by excessive inputs; rather, they were unable to convert their existing financial and professional resources into a sufficiently large volume of valuable audit outputs. This interpretation is consistent with the fundamental logic of the SBM approach, which explicitly incorporates input excesses and output shortfalls and therefore provides a more detailed representation of inefficiency than purely radial efficiency models [16]. Previous applications of SBM-based DEA have similarly demonstrated that the identification of slacks can reveal the exact operational dimensions in which inefficient units deviate from the efficient frontier [17]. Accordingly, the present findings suggest that management interventions in inefficient audit firms should primarily target output creation and market development rather than indiscriminate input reduction.

The observed efficiency differences among audit firms are also consistent with previous research emphasizing the usefulness of DEA for evaluating multidimensional organizational performance. Traditional financial ratios

may identify specific aspects of performance but cannot simultaneously account for multiple heterogeneous inputs and outputs. DEA addresses this limitation by comparing decision-making units relative to an empirically constructed best-practice frontier [10]. Evidence from Iranian financial institutions has shown that DEA-based rankings can differ materially from rankings derived from conventional financial ratios, implying that frontier methods reveal dimensions of performance not captured by traditional accounting measures [11]. Similarly, applications of DEA in other organizational settings have demonstrated its ability to distinguish efficient from inefficient units and identify opportunities for improving the utilization of organizational resources [12]. In the audit context, previous studies have specifically confirmed that DEA can effectively evaluate audit-firm efficiency and reveal considerable heterogeneity across firms [13, 14]. The present study extends these findings by showing that efficiency analysis becomes substantially more managerially meaningful when the resulting slacks are subsequently linked to validated root causes and concrete improvement actions.

The Pareto analysis further demonstrated that inefficiency was highly concentrated. Two audit firms, representing approximately 22% of the sampled units, accounted for more than 70% of total observed inefficiency. This concentration indicates that aggregate performance problems may be disproportionately driven by a small number of severely underperforming firms. From a managerial standpoint, this finding supports selective rather than uniform intervention. Instead of distributing diagnostic and improvement resources equally across all inefficient units, organizations and regulators can concentrate attention on the critical "vital few" units that account for the largest share of the performance deficit. This approach is particularly relevant when the subsequent stages require expert interviews, detailed causal analysis, and managerial redesign. The result also complements the broader efficiency literature, in which the identification of productive slacks and efficiency drivers has been considered essential for distinguishing between relatively minor underperformance and structurally significant inefficiency [15]. Thus, combining DEA with Pareto prioritization creates a more focused pathway from quantitative diagnosis to qualitative investigation.

The expert-validation phase identified six credible root causes of inefficiency: weakness in marketing strategy and acquisition of high-quality clients, noncompetitive pricing, lack of differentiated industry specialization, inefficient internal processes, weak professional branding, and concentration on small or high-risk clients. The identification of these causes indicates that audit-firm inefficiency is multidimensional and cannot be attributed solely to technical auditing procedures. Instead, it reflects the interaction of strategic positioning, market orientation, pricing architecture, client portfolio management, organizational capability, and operational design. This interpretation aligns with research showing that audit effectiveness is shaped by broad organizational factors, including managerial support, competence, institutional structure, professional resources, and organizational conditions [3, 6]. Research on audit quality similarly suggests that professional performance depends on multiple interacting factors rather than on any single technical attribute [26]. The present results therefore reinforce the view that inefficient audit firms should be understood as complex professional service systems whose performance depends on both technical auditing capability and strategic organizational management.

Among the six validated causes, weakness in marketing strategy and the acquisition of high-quality clients received the highest AHP weight and was therefore identified as the most important root cause of inefficiency. This result is particularly significant when interpreted alongside the DEA findings. Because the dominant inefficiency pattern was an output shortfall rather than excessive input utilization, weak market penetration provides a coherent explanation for why firms possessing professional expertise and operational capacity nevertheless fail to generate adequate audited business volume. In other words, the firms' primary problem appears to be insufficient

conversion of existing capabilities into market opportunities. This finding supports the broader business-planning perspective that organizational performance depends not merely on resource availability but on the capacity to direct those resources toward strategically selected markets and revenue-generating opportunities [24]. It also implies that managerial responses centered exclusively on cost containment may fail to address the underlying mechanism producing inefficiency.

The importance assigned to industry specialization provides further evidence that efficiency in auditing depends on differentiated professional capability. Lack of industry specialization and weak professional branding jointly ranked among the most important root causes after marketing weakness. Audit firms operate in environments where clients increasingly face sector-specific regulatory requirements, technological risks, financial reporting complexities, and business-model challenges. Deep expertise in particular industries may therefore improve audit planning, risk assessment, professional judgment, service quality, and client acquisition. Previous research has emphasized that the human-resource structure of accounting firms is closely associated with operating efficiency, demonstrating that differences in professional expertise and staffing configurations can materially influence organizational performance [7]. Earlier evidence on medium-sized audit firms also showed that technical and scale efficiency differ considerably among firms, suggesting that organizational capability and professional resource deployment are critical determinants of performance [8]. The current findings extend this argument by indicating that professional expertise should not merely be accumulated; it should be organized around strategically meaningful areas of specialization.

The importance of specialization is also consistent with broader changes affecting the auditing profession. Audit firms increasingly require capabilities in complex data analysis, information technology, industry-specific risk assessment, and technologically enabled assurance. Strategic use of data analytics can enhance audit effectiveness by improving anomaly detection, risk identification, and evidence evaluation [4]. Likewise, information technology capability has become an increasingly important determinant of internal audit effectiveness and professional performance [5]. Research examining future drivers of auditing also emphasizes technological, professional, environmental, and structural forces that are reshaping the competencies required from audit organizations [9]. Consequently, the current finding that specialization represents a major root cause and a key improvement priority can be interpreted as evidence that competitive audit firms must develop distinctive knowledge-based capabilities rather than relying on generalized service provision.

The identification of weak professional branding as another major cause of inefficiency is similarly understandable. In professional service markets, reputation acts as an important signal of competence, reliability, independence, and service quality. However, the Wasserman analysis produced an important qualification: professional brand enhancement did not emerge as the first leverage action but instead appeared as a relatively dependent action. This suggests that branding should be interpreted less as an isolated promotional exercise and more as the cumulative outcome of substantive organizational performance. A credible professional brand is likely to emerge when firms successfully acquire appropriate clients, demonstrate specialized expertise, deliver differentiated services, and build consistent market visibility. This interpretation is consistent with the broader audit-quality literature, in which competence, organizational mechanisms, governance structures, and professional practices jointly shape perceived and actual audit quality [1, 2]. Therefore, attempts to strengthen brand image without first improving strategic positioning and substantive professional capabilities may produce limited and unsustainable benefits.

A particularly important result of the study was the relatively low priority assigned to internal process reengineering. Although inefficient and time-consuming processes were validated as a legitimate root cause, they received the lowest AHP weight, and process reengineering was positioned among the relatively independent, low-driving actions in the final Wasserman map. This finding should not be interpreted as evidence that internal-process efficiency is unimportant. Rather, it suggests that under the specific inefficiency structure identified in this study, internal process reform is not the most powerful starting point for organizational transformation. Since the critical problem was output insufficiency, improving internal procedures alone would be unlikely to generate the required increase in revenue-generating audit activity. The result echoes the distinction in efficiency analysis between input-oriented and output-oriented improvement needs. Where inefficiency originates primarily from underproduction, reducing resource use may even intensify the problem if it further constrains organizational capacity. The SBM framework is particularly useful in revealing this distinction because it separately identifies input and output slacks [16].

This finding also has implications for the role of cost management. Traditional managerial accounting approaches emphasize cost measurement, resource control, and efficiency in the utilization of organizational inputs [25]. Such practices remain important, but the present results suggest that cost minimization should not automatically dominate strategic decision-making in audit firms. When the major deficiency is insufficient output, managers should focus on increasing the value generated from existing capabilities. This requires a transition from a cost-management orientation toward a value-management orientation, in which marketing, specialization, client portfolio quality, service development, and revenue-generating capabilities are treated as central components of efficiency improvement. In this respect, the study reinforces the notion that efficiency should not be equated simply with minimizing expenditure; it concerns the relationship between resources consumed and valuable outputs produced.

The final Wasserman analysis offered the most important prescriptive finding of the study. The development and implementation of an aggressive and targeted marketing plan (IA1) emerged as the principal leverage action because it exhibited the highest normalized driving power while maintaining a manageable level of dependence. In contrast to a conventional ranked list, the influence–dependence structure identifies actions according to their capacity to generate broader systemic effects. The theoretical logic of relational analysis emphasizes that the importance of an element depends partly on its position and connections within a wider network of relationships [23]. Applied to the present context, IA1 is important not only because it directly addresses the most highly weighted root cause, but also because its implementation can stimulate changes in other dimensions, including client portfolio composition, pricing opportunities, specialization, service development, and eventually professional branding. This makes it a strategic leverage point rather than merely another improvement initiative.

The second major action, developing deep specialization in one or two industries (IA3), was positioned as a key action characterized by both high influence and high dependence. This result implies a reciprocal relationship between market development and professional specialization. Marketing enables firms to access desirable clients and create revenue opportunities, whereas specialization makes marketing claims credible and allows the firm to differentiate itself from competitors. This mutually reinforcing structure is consistent with studies emphasizing the importance of professional competencies and organizational capability in audit effectiveness [6, 7]. It also aligns with research suggesting that the future of auditing will increasingly depend on firms' capacity to adapt their expertise and service models to changing technological and market environments [9]. Thus, the proposed two-stage

strategy—first activating market-oriented leverage and then consolidating specialized capability—offers a theoretically coherent sequence for organizational transformation.

The findings also illustrate the value of combining multiple decision-support methods. DEA alone identifies relative efficiency, but it does not explain the organizational causes of observed slacks. Expert elicitation generates possible explanations, but such explanations require content validation. AHP can weight validated causes but does not fully address the interdependence among corrective actions. Finally, the Wasserman Interaction Matrix can distinguish actions according to their systemic influence and dependence. This methodological integration is consistent with previous efforts to combine DEA with complementary management tools. Integrated DEA, Balanced Scorecard, and AHP frameworks have demonstrated that combining efficiency measurement with strategic and expert-based evaluation provides richer decision support than any individual method alone [19]. Likewise, combined AHP–DEA approaches have been used to improve organizational evaluation by linking efficiency analysis with structured prioritization [20]. Network DEA research further confirms the analytical value of considering internal relationships and interconnected structures rather than treating organizational components as isolated entities [18]. The present framework extends this integrative logic by connecting efficiency measurement directly to causal diagnosis and action sequencing.

The content-validation stage strengthened this integration by ensuring that the root causes and improvement actions entering the prioritization process were supported by expert judgment regarding necessity, relevance, clarity, and simplicity. Measurement and test-development literature emphasizes that valid decision criteria must be carefully defined and systematically evaluated before they are used for subsequent analytical purposes [21, 22]. This is particularly important in management research involving expert-generated constructs because the apparent sophistication of a quantitative ranking cannot compensate for poorly specified underlying items. By combining qualitative elicitation with quantitative content validation, the present study reduced this risk and created a more defensible basis for the AHP and Wasserman stages.

Overall, the results indicate that the efficiency crisis in the critically inefficient audit firms is fundamentally strategic rather than merely operational. The severe shortage of outputs, the high priority assigned to marketing weakness, the importance of industry specialization and professional reputation, and the emergence of targeted marketing as the dominant leverage action collectively point toward deficiencies in the business model. This conclusion is consistent with contemporary perspectives emphasizing that audit effectiveness is influenced by organizational governance, professional competence, technological capacity, strategic resources, and institutional support [2-4]. It also corresponds with the professional auditing perspective that effective auditing requires systematic planning, evidence-based assessment, and continuous improvement rather than isolated corrective measures [27]. Therefore, the practical meaning of efficiency improvement in audit firms is not simply "doing the same work with fewer resources," but developing the strategic capacity to generate higher-value outputs from existing and future resources.

This study has several limitations that should be considered when interpreting its findings. First, the quantitative analysis was based on nine audit firms for which sufficiently complete and comparable financial and operational data were available; although window analysis was used to mitigate the limitation associated with a small number of decision-making units, the sample size nevertheless restricts the generalizability of the efficiency estimates. Second, the study covered a three-year period, and longer-term fluctuations in market conditions, regulation, client composition, technology adoption, and professional labor markets may not have been fully captured. Third, some variables, particularly the corrective performance index, required operationalization through content analysis of

auditor reports and restated financial statements, which may involve measurement uncertainty. Fourth, the identification and prioritization of root causes and improvement actions relied partly on expert judgment. Although systematic content-validation procedures and consistency checks were employed, expert assessments may still reflect professional experience, organizational position, or subjective interpretation. Finally, the influence–dependence relationships among improvement actions were evaluated within the specific institutional and market context of the firms examined; consequently, the resulting roadmap should not be assumed to apply identically to all audit firms or jurisdictions.

Future studies should replicate the proposed framework using larger samples of audit firms and longer longitudinal periods to evaluate the stability of efficiency classifications and improvement priorities over time. Comparative studies could examine whether the dominant sources of inefficiency differ according to firm size, market segment, geographical location, ownership structure, affiliation with international audit networks, or the risk profile of client portfolios. Researchers may also incorporate additional inputs and outputs, including employee productivity, audit hours, number of engagements, technological investment, client retention, audit quality indicators, restatement rates, and non-audit advisory revenues. Dynamic, network, bootstrap, and stochastic frontier extensions could be compared with the SBM model to assess the robustness of results. Future studies could also use fuzzy AHP, DEMATEL, ANP, structural equation modeling, or longitudinal causal modeling to examine uncertainty and reciprocal relationships among root causes. In addition, researchers should evaluate the proposed roadmap experimentally or through longitudinal case studies by observing whether implementation of high-leverage actions actually produces subsequent improvements in DEA efficiency scores. Cross-country studies would also be valuable for assessing whether regulatory structures, competition intensity, professional institutions, and capital-market development alter the relative importance of marketing, specialization, pricing, branding, and process efficiency.

Managers of inefficient audit firms should avoid beginning improvement programs with indiscriminate cost cutting and should first determine whether inefficiency originates primarily from excessive inputs or insufficient outputs. For firms exhibiting the pattern identified in this study, managerial resources should initially be concentrated on developing and executing a disciplined, targeted marketing strategy directed toward high-quality and strategically appropriate clients. At the same time, firms should select one or two industries in which they can build distinctive professional expertise and gradually align recruitment, training, service development, knowledge accumulation, and client acquisition with those sectors. Pricing should increasingly reflect delivered value and specialist expertise rather than relying predominantly on cost-based calculations. Client portfolios should be reviewed to reduce excessive dependence on small or disproportionately risky engagements, while strategic alliances and advisory services can be developed where they reinforce the firm's chosen areas of specialization. Professional branding should be treated as the visible consequence of substantive capabilities and successful market performance rather than as an isolated promotional campaign. Internal process reengineering and administrative cost reduction should remain part of continuous improvement, but they should not displace higher-leverage strategic interventions when the fundamental problem is inadequate output generation. Finally, managers should periodically repeat the efficiency and influence–dependence analyses so that improvement priorities can be revised as the firm's market position, capabilities, and performance profile change.

Authors' Contributions

Authors equally contributed to this article.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

Acknowledgments

Authors thank all participants who participate in this study.

Conflict of Interest

The authors report no conflict of interest.

Funding/Financial Support

According to the authors, this article has no financial support.

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