Ferdowsi University of Mashhad Press (FUMP)



IJAAF

IRANIAN JOURNAL OF
ACCOUNTING, AUDITING and FINANNCE

Volume 10, Issue 1, Winter 2026

Serial Number: 34

Print - ISSN: 2717-4131
Online - ISSN: 2588-6142

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Ferdowsi University of Mashhad

Iranian Journal of Accounting, Auditing & Finance (IJAAF)

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Volume 10, Number 1, Winter 2026, Serial 34

ISSN (Print): 2717-4131, ISSN (Online): 2588-6142
Editorial Office: Faculty of Economics and Administrative sciences, Ferdowsi University of Mashhad, Azadi Sq., Mashhad; IRAN; P.O. Box: 1793; Postal Code: 9177948974; Tel: +98 51 38803742; Fax: +98 51 38763852
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I am pleased to announce that the Ferdowsi University of Mashhad is publishing Iranian Journal of Accounting, Auditing & Finance (IJAAF). On behalf of the board of the IJAAF and my co-editors, I am glad to present the Volume 1, Issue 1 of the journal in December 2017; the journal will publish four issues in a year. The board includes experts in the fields of accounting, finance and auditing, all of whom have proven track records of achievement in their respective disciplines. Covering various fields of accounting, *IJAAF* publishes research papers, review papers and practitioner oriented articles that address significant issues as well as those that focus on Asia in particular. Coverage includes but is not limited to:

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Yours faithfully,
Mahdi Moradi
Editor in Chief

IJAAF; Vol. 10, No. 1, Winter 2026, Serial 34

Iranian Journal of
Accounting, Auditing & Finance

Ferdowsi University of Mashhad

Quarterly

RESEARCH ARTICLE

The Primacy of Control: A Risk-Centric TCO Framework for Generative AI and the Financial Irrelevance of Productivity

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How to cite this article:
Ebrahimi Kordlar, A. and Safaei, M. (2026). The Primacy of Control: A Risk-Centric TCO Framework for Generative AI and the Financial Irrelevance of Productivity. Iranian Journal of Accounting, Auditing and Finance, 10(1), 1-19. doi: 10.22067/ijaaf.2026.47321.1574
https://ijaaf.um.ac.ir/article_47321.html

ARTICLE INFO

Article History
Received: 2024-12-24
Accepted: 2025-06-15
Published online: 2026-02-01

Abstract

Generative AI is framed as a productivity enhancer in the prevailing narrative. This paper challenges this view as financially incomplete and potentially misleading for strategic investment. A new framework for financial evaluation was proposed, based on control and risk. Application Programming Interfaces (APIs) and fine-tuned Open-Source (OS) techniques were compared using a stochastic Total Cost of Ownership (TCO) framework that we developed and tested. To deconstruct the key drivers of financial performance, the model incorporates probabilistic estimates for operational and risk variables. These estimates were then analyzed using Monte Carlo simulation and Sobol sensitivity analysis, and the classical value logic of Information Technology (IT) was fundamentally inverted. Sensitivity analysis demonstrates that traditional productivity gains are financially irrelevant in determining the optimal strategy. The model's result was mostly determined by the critical error probability and cost (λ, P). The simulation revealed that the OS strategy has a low likelihood of being financially superior (6.58%) due to the high cost of its insourced risk management (the HIL process), which significantly affects its total cost of ownership (TCO).

Keywords:
Generative AI, Investment Appraisal, Risk Management, Technology Strategy, Total Cost of Ownership (TCO)

https://doi.org/10.22067/ijaaf.2026.47321.1574

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NUMBER OF REFERENCES
46

NUMBER OF FIGURES
2

NUMBER OF TABLES
7

Homepage: https://ijaaf.um.ac.ir
E-Issn: 2717-4131
P-Issn: 2588-6142

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1. Introduction

Quick and widespread use of Generative Artificial Intelligence (Gen AI) is changing the face of modern business. According to Kshetri et al. (2024) and Marshall et al. (2024), GenAI is a general-purpose technology that has the potential to revolutionize operational efficiency, strategic innovation, and value creation. As a result, there is a growing feeling of strategic urgency around this technology across all industries. Consequently, corporate leaders are under immense pressure to invest in this transformative technology to secure a competitive advantage. Chief Financial Officers and strategic decision-makers face a significant problem in assessing the financial feasibility of GenAI initiatives due to the investment imperative. Traditional investment appraisal frameworks are not suitable for this type of work.

Deterministic, point-estimate inputs for costs and benefits are fundamental to traditional evaluation methods like Net Present Value (NPV) or basic Total Cost of Ownership (TCO). Since GenAI is a technology with its own distinct and complicated set of traits, this method is not suitable. Firstly, it's important to note that AI "hallucinations" result from its probabilistic rather than deterministic outputs, which adds an extra layer of performance uncertainty and risk (Kaate et al., 2025). The second issue is that human variables, such as review efficiency and rapid engineering competence, are highly variable, and the financial outcome depends on them because GenAI is often valued through a human-AI collaborative process. Lastly, current accounting regulations do not specifically address the classification, valuation, or amortization of a proprietary, fine-tuned GenAI model, despite the fact that it is a substantial, internally generated intangible asset (Leitner-Hanetseder and Lehner, 2023). Boone et al. (2025) noted that GenAI poses a new risk profile that includes security flaws, algorithmic bias, and data privacy breaches. These issues might lead to substantial financial liabilities that are hard to estimate.

Since these factors—probabilistic performance, human-in-the-loop relationships, unclear asset classification, and a new risk landscape—traditional financial models do not work anymore. Comparing the cost of an API subscription to an employee's compensation is a very incomplete way to look at the situation. We need a complete financial framework that can bring all of these different parts together. A well-tuned AI can be viewed as a capital-generating asset; the costs of human-AI interaction can be calculated, unique probabilistic risks can be taken into account, and deep uncertainty can be addressed. The lack of such a framework creates a big hole in both the academic literature and real-world financial management. This means that companies have to make decisions about investments worth millions of dollars based on limited information and wrong assumptions.

This study fills this important gap by creating and showing a stochastic Total Cost of Ownership (TCO) framework that is specifically made for figuring out the costs of corporate Generative AI. Our research is directed by the following inquiries:

RQ1: Is it possible to systematically integrate capitalizable intangible assets, variable operational costs, human-centric inefficiencies, and probabilistic risk provisions into the full lifecycle cost of enterprise GenAI?

RQ2: Considering uncertainty, what are the key financial drivers and risk factors that determine which GenAI implementation should be opted for: the operational expenditure-heavy (API-based) or the capital expenditure-heavy (fine-tuned)?

We create a multi-pillar TCO model that combines ideas from management accounting, corporate finance, and information technology to answer these concerns. We make a way to capitalize GenAI development costs that is in line with International Accounting Standard 38 (IAS 38). We also come up with new ways to figure out how much it costs to be inefficient right away and to account for mistakes made by AI that are very important. We choose a stochastic model that uses Monte Carlo simulation to account for uncertainty in key parameters over a deterministic

method. This paper addresses this critical gap by developing a novel framework that makes three principal contributions to theory and practice. Primarily, it presents the initial stochastic Total Cost of Ownership (TCO) model tailored to simulate the "make" (Open Source) vs. "buy" (API) choice for generative AI. The model gives a systematic framework for managing capital allocation decisions in the face of extreme uncertainty by moving the analysis away from a single point estimate and toward a probability distribution of outcomes. Secondly, this study uses the framework to provide empirical support for a significant change in how technology is valued: moving away from the old "economics of speed" and towards a new "economics of trust and control." We argue that financial viability is governed not by productivity gains, but by the novel agency costs required to manage a probabilistic, non-human agent. Thirdly, this study provides a fresh perspective on business strategy by shedding light on the rationale behind the multi-billion-dollar valuations of AI safety corporations. These organizations were able to outsource the enormous monitoring expenses associated with the "make" strategy. Sobol sensitivity analysis is used in conjunction with this to determine which factors have the greatest impact on financial results.

The remainder of this paper is structured as follows: Section 2 reviews the relevant literature across four key domains to establish the theoretical foundations and identify the research gap. Section 3 describes how we made our stochastic TCO model. The stochastic TCO model is formally described in Section 4, including its components, capitalization, and probability methodology. Section 5 then applies this model in a comparative simulation, presenting the quantitative results of the Monte Carlo and Sobol sensitivity analyses. Our next section, Section 6, discusses the implications of these results for corporate governance and financial practices from a managerial, theoretical, and strategic standpoint. Finally, Section 7 concludes the paper with a summary of its primary contributions, a transparent acknowledgment of its limitations, and a proposal for future research avenues.

2. Literature review

2.1. The TCO paradigm: a foundation and its deterministic limitations

The Total Cost of Ownership (TCO) framework has long been the most important way to judge technology expenditures. It is a strategy that looks at the whole financial picture, not just the original purchase price (Ellram, 1995). TCO includes all direct and indirect expenses throughout an asset's existence, improving long-term financial analysis (Saccani et al., 2017; Subiyanto and Asadi, 2023). The TCO framework, however, is more than just an accounting exercise; it is the theory of Transaction Cost Economics (TCE) put into practice. TCE explains why a corporation chooses to create or buy, depending on the situation (Friese et al., 2020). TCE posits that this decision is driven by minimizing both production costs and the transaction costs of using a market, such as searching, bargaining, and enforcement (Den Butter and Linse, 2008).

The TCO paradigm has been used in Information Technology (IT) to evaluate large-scale projects such as Enterprise Resource Planning (ERP) systems, as well as to compare the Operational Expenditures (OpEx) of cloud computing versus the Capital Expenditures (CapEx) of on-premise applications (Hanane et al., 2024).

However, a critical review of this literature reveals a significant limitation: traditional TCO models are predominantly static and deterministic, relying on single-point estimates for future costs (Gyarmathy et al., 2020). This approach is insufficient for environments characterized by high uncertainty. Therefore, there has been a growing chorus of academics calling for the addition of cutting-edge quantitative methodologies to TCO. Avenali et al. (2024) and Wang et al. (2023) used Monte Carlo simulations to simulate the distributions of uncertain cost variables, while Avenali et

al. (2023) used real options analysis to value managerial flexibility. In addition to the asset specificity and the uncertainty inherent in AI, the choice between buying a third-party API ("buy") and building your own AI system poses a classic TCE dilemma (Gyarmathy et al., 2020). This framework is directly applicable to modern strategic decisions.

These improvements are a subtle way of saying that a deterministic TCO isnot a good way to evaluate the financial performance of innovative, complex technology. This inherent limitation is particularly problematic when assessing a new class of enterprise technology defined by probabilistic behavior and novel risk profiles: Generative AI.

2.2. The accounting challenge: classifying and valuing AI as an intangible asset

Accounting rules outline how technology investments should be recognized and accounted for financially. One of these rules is IAS 38, which establishes a framework for capitalizing expenses incurred to create measurable intangible assets expected to generate future economic benefits (Mazzi et al., 2022). Research is expensed, whereas development can be capitalized if technical feasibility is established (Oswald, 2008). Conditional capitalization contrasts with the instant expensing of all Research and Development (R&D), which might disguise asset creation and lead to underinvestment (Lev and Sougiannis, 1996).

However, the discretion afforded by these standards creates a central tension. A project's capitalization of development costs can act as a reliable indicator for investors (Oswald and Zarowin, 2007). On the other hand, subjectivity can be exploited for opportunistic profit management, generating an agency problem in which accounting choices are influenced by managerial incentives (Markarian et al., 2008; Dinh et al., 2016). The most relevant precedent for GenAI is software development, where capitalization is common once technological feasibility is established (Canace et al., 2022). Intangible assets such as GenAI models are created through data curation, model training, and workflow integration, just like proprietary software.

Despite the fact that they are in sync, current accounting standards do not provide GenAI with any clear direction. This gives rise to critical valuation challenges: at what point does an AI project meet "technical feasibility" for capitalization? For amortization, how should the "useful life" of a rapidly evolving AI model be determined? How can its "useful life" be determined? The emerging literature recognizes that digital assets, particularly those driven by AI, are poorly represented on traditional balance sheets, creating a gap between book and market values (Moro-Visconti, 2024). From the perspective of the Resource-Based View (RBV), this capitalized model is an investment in a competitive advantage. However, the true inimitable asset is not the AI model itself, but the organizational dynamic capability to control it and manage its risks (Wang et al., 2025), a capability whose substantial cost must be recognized. This absence of a clear framework for capitalizing and valuing proprietary AI assets highlights a critical gap that a robust TCO model must address.

2.3. Generative AI: the duality of productivity and peril

Scholars have discussed GenAI in a dualistic way that describes it as both a powerful tool for increased productivity and a potential source of new and significant risks.

Chelliah et al. (2025) reference comprehensive research that identifies GenAI as a transformative factor in generating value for enterprises. Budhwar et al. (2023) and Heitmann (2024) say that the key selling point is that it can make operations much more efficient by automating boring chores like making code and content. This will free up human capital to focus on more strategic endeavors. GenAI is not just a tool for automating tasks, but it is also a strong instrument for boosting human creativity and working with people in the creative process (Chu et al., 2025). Sometimes human-AI collaboration is so successful that AI-generated content performs "superhuman" (Hartmann et al.,

2025). Jobstreibizer et al. (2025) and Ruokonen and Ritala (2024) say this functional enhancement allows companies to innovate their business models and gain a sustainable competitive advantage.

Parallel to the discourse on productivity, a growing body of research is dedicated to the novel risks inherent in GenAI adoption (Boone et al., 2025). The most fundamental challenge is the threat to information integrity posed by AI "hallucinations," the generation of plausible yet factually incorrect outputs (Lee et al., 2025). This lack of dependability adds a high hidden cost to proof, forcing companies to buy pricey systems with a person in the loop (Collier et al., 2021). The algorithms' use of huge training datasets enhances data leakage and introduces prompt injection (Zhou and Wu, 2025; Choudhary and Kar, 2025). Meanwhile, corporations risk legal and reputational problems when models trained on raw data duplicate and exacerbate preexisting social biases (Sadeghiani, 2025). Lastly, the research points out that relying too much on GenAI could make people less able to think critically, which is a long-term strategic danger of "deskilling" the workforce (Eisikovits et al., 2025).

In conclusion, this duality creates a new and unique agency problem for the company. In conventional agency theory, costs come from getting a human agent and a principal to agree on what to do. In this case, the "agent" is a non-human, probabilistic entity. Its risks stem not from self-interest, but from stochastic failure. Consequently, the firm (the principal) must incur a new class of agency costs to govern this agent. The extensive Human-in-the-Loop (HIL) processes and continuous verification required to manage hallucinations (Collier et al., 2025) can be framed as direct and substantial monitoring costs to control the AI agent's behavior. Simultaneously, the potential for catastrophic financial, legal, or reputational damage from an undetected AI error due to data leakage, bias, or factual inaccuracy represents a significant residual loss. Financial provisions or other investments made to mitigate the consequences of this fallibility are therefore analogous to bonding costs incurred by the principal (Florackis, 2008).

2.4. Addressing uncertainty: the case for stochastic and sensitivity analysis

Investing in an uncertain environment requires a method of evaluating investments beyond the deterministic approach. A lot of research in corporate finance and operations management has shown that random modeling is necessary for making good decisions (Kozlova et al., 2022).

Among stochastic techniques, Monte Carlo Simulation (MCS) has emerged as a dominant framework for capital budgeting under uncertainty (Pawlak, 2024). In order to provide a better picture of the risk profile of a project, MCS changes static outputs into dynamic probability distributions by sampling from the distributions of important input variables multiple times (Fiorentini et al., 2024). It is widely used, from assessing renewable energy assets with unpredictable power prices (Verstraten and Van der Weijde, 2023) to working with TCO models to make them dynamic (Cai et al., 2025). The research indicates that MCS is the benchmark for evaluating strategic investments in situations characterized by significant uncertainty.

The range of possible outcomes can be quantified using MCS, but the input variables that contribute most to the uncertainty cannot be identified. For this, a robust sensitivity analysis (SA) is required (Magni and Marchioni, 2020). Global Sensitivity Analysis (GSA) methods are more complex than basic "one-at-a-time" analyses, which do not account for interaction effects, according to the literature. Variance-based methods, such as Sobol indices, have become a benchmark, offering the ability to quantify both the direct effect of each variable and the effect of its interactions with others (Pannier et al., 2018). With its numerous stochastic and interdependent cost drivers, GenAI implementations require this more advanced GSA approach to identify the most influential parameters and guide effective risk management.

Due to the clear but incomplete image presented by the current literature, these strategies are

essential. While TCE offers a theoretical perspective on the "make-or-buy" choice, TCO models tend to be overly prescriptive. IAS 38 permits the capitalization of AI assets, resulting in agency issues. Most crucially, the GenAI literature talks about big risks, but it doesnot put them in the context of agency costs, which is the usual way to talk about them in economics.

Even though TCO, accounting standards, and agency theory offer basic ideas, there is currently no framework that financially operationalizes the distinct agency costs of probabilistic technologies. This highlights a significant theoretical and practical gap. No model integrates the stochastic nature of AI risk (λ, P) into a TCO analysis, treats the corresponding control structures (HIL) as a component of a capitalizable intangible asset under IAS 38, and thereby allows for a theoretically grounded financial comparison of "make" (OS) versus "buy" (API) strategies. This paper develops such a framework to fill this critical gap.

2.5. Synthesis and research gap

A clear but incomplete picture is painted by the literature. The TCO framework is a basic way to figure out how much technology costs. While accounting standards have general rules for intangible assets, they do not go into detail about how to capitalize and amortize a private GenAI model. A lot of new research on GenAI shows that it has both a huge potential for output and a very complicated, multi-layered risk profile that is hard to quantify. Lastly, stochastic models and GSA are well-known as the best ways to make decisions when you do not know what will happen. However, they have not been put together yet in a way that makes sense for Generative AI's economic and accounting needs.

This reveals a critical, multi-faceted gap: there is no existing model that synthesizes these four domains. No framework (1) adapts the TCO paradigm for a probabilistic technology, (2) provides a clear method for capitalizing GenAI assets, (3) quantifies human-AI collaboration's unique operational costs and risks, and (4) accounts for pervasive uncertainty with a rigorous stochastic methodology. This paper aims to fill this gap by developing and presenting such a framework.

3. Research methodology

3.1. The TCO framework for generative AI: a formal Model

The TCO framework for generative AI is formally defined in this section. The framework is composed of three pillars: (1) Variable Operational Cost, (2) Capitalized Asset Cost, and (3) Indirect Operational Costs and Risk Provisions. Each pillar is represented by a set of formulas that quantify its financial impact.

3.2. Pillar 1: Per-unit variable operational cost (C_{var})

According to Table 1, this formula calculates the effective variable cost to produce one successful unit of output using a human-AI collaborative process. It represents the core operational efficiency of the AI implementation.

$$C_{var} = \frac{\left(\frac{W}{\alpha L} + IC\right)}{p} \qquad (1)$$

Objective: A fully-loaded variable cost should be calculated per successful AI-assisted output, including human review, API costs, and AI's quality failure rate.

Table 1. Per-Unit variable operational cost (C_{var}) component breakdown.

Symbol	Name & Description	Unit
C_{var}	*Per-Unit Variable Operational Cost:* The final calculated cost for one usable output.	Currency/Output
W	*Wage Rate of Human Reviewer:* Human reviewers can produce one hour's worth of output without using artificial intelligence. This should include salary, benefits, and overhead.	Currency/Hour
L	*Baseline Human Productivity:* Without AI assistance, the number of outputs the human reviewer can create in an hour. The term $\frac{W}{\alpha L}$ represents the baseline human-only cost per output.	Outputs/Hour
α	*Human Productivity Multiplier:* A dimensionless number that shows how much more efficient it is to work with AI and humans together. It tells you how much faster an employee can check and fix an AI output than make it from scratch. For example, if an employee takes 1 hour to write a report but only 15 minutes to review an AI draft, $\alpha = 4$.	Dimensionless Ratio
IC	*Inference Cost:* It's the direct cost per request charged by the 3rd-party AI model provider (OpenAI, Anthropic). This is a pure variable cost associated with each API call.	Currency/Output
p	*AI Quality Rate (Yield):* After a standard human review, the probability that the output of an AI system will be of sufficient quality (from 0 to 1) for use. It represents the "yield" of the AI system. An output that is so poor it must be discarded contributes to a lower p.	Dimensionless Probability

Derivation and Interpretation: The numerator, $\left(\frac{W}{\alpha L} + IC\right)$, represents the total cost incurred for each *attempted* AI-assisted output. This comprises the human review cost ($\frac{W}{\alpha L}$) and the machine cost (IC). The formula divides this cost by the quality rate, p, to account for failures. In production, the cost of a good unit must include the cost of units that were thrown away, which is similar to this. Since it typically takes two tries to get a single successful output at a quality rate of 50% (0.5), the effective cost quadruples.

3.3. Pillar 2: Capitalized AI asset cost ($CAPEX_{AI}$)

This pillar explains how much money is needed to put up front to make a proprietary or improved open-source model. IAS 38 counts these costs as intangible assets and am,ortizes them over time.

Formula 2: Data asset acquisition & preparation cost (C_{data})

$$C_{data} = C_{lic} + (H_{clean} \cdot W_{label}) + C_{storage} \quad (2)$$

Objective: To quantify the total cost of sourcing and preparing the data corpus required for model training, which forms the foundational component of the intangible asset (Table 2).

Table 2. Data asset acquisition & preparation cost (C_{data}) component breakdown

Symbol	Name & Description	Unit
C_{lic}	*Data Licensing Cost:* Direct costs for purchasing or licensing external datasets.	Currency
H_{clean}	*Human Hours for Data Curation:* Total person-hours spent on data cleaning, labeling, de-duplication, and formatting.	Hours
W_{label}	*Wage Rate of Data Curators:* The fully-loaded hourly wage of employees or contractors performing data curation tasks.	Currency/Hour
$C_{storage}$	*Data Storage Cost:* Costs associated with storing the prepared dataset during the development phase.	Currency

Formula 3: Model training & fine-tuning cost (C_{train})

$$C_{train} = \left(H_{gpu} \cdot Cost_{gpu}\right) + \left(H_{eng} \cdot W_{eng}\right) \quad (3)$$

Objective: To quantify the direct development costs associated with the computational and engineering effort to train or fine-tune the AI model (Table 3).

Table 3. Model training & fine-tuning cost (C_{train}) component breakdown

Symbol	Name & Description	Unit
H_{gpu}	*Graphics Processing Unit (GPU) Compute Hours:* Total high-performance compute hours (e.g., NVIDIA H100-hours) consumed during the training process.	Hours
$Cost_{gpu}$	*Cost per GPU Hour:* The rental cost of a specialized GPU from a cloud service provider (e.g., AWS, Azure).	Currency/Hour
H_{eng}	*Machine Learning (ML) Engineer Hours:* Total person-hours from specialized machine learning engineers for setting up, monitoring, and validating the training run.	Hours
W_{eng}	*Wage Rate of ML Engineer:* The fully-loaded hourly wage of scarce, high-cost ML engineering talent.	Currency/Hour

Formula 4: Per-unit amortization cost (C_{amort})

$$C_{amort} = \frac{C_{data} + C_{train}}{T_{useful_life}} \quad (4)$$

Objective: To allocate the total capitalized cost of the AI asset ($CAPEX_{AI} = C_{data} + C_{train}$) to individual outputs over the asset's useful life, in accordance with the matching principle (Table 4).

Table 4. Per-unit amortization cost (C_{amort}) component breakdown

Symbol	Name & Description	Unit
T_{useful_life}	*Useful Life of the AI Asset:* A critical management estimate of the asset's productive life. This can be expressed in time (e.g., years) or, more appropriately for a units-of-production method, in the total expected number of outputs the model will generate before becoming obsolete.	Total Outputs or Years

3.4 Pillar 3: Indirect operational costs & risk provisions ($C_{indirect}$)

This pillar quantifies the often-hidden ongoing costs related to operational inefficiency and risk management. These are operational expenses that must be tracked and provisioned for.

Formula 5: Cost of prompt inefficiency ($C_{badprompt}$)

This formula calculates the total cost of wasted effort within a given period due to poorly constructed prompts that fail to yield a usable output.

$$C_{badprompt_period} = N_{prompts} \cdot R_{bp} \cdot \left(IC + \left(T_{reprompt} \cdot W_{user}\right)\right) \quad (5)$$

Objective: To quantify the "cost of poor quality" stemming from user inefficiency, providing a financial justification for employee training and prompt engineering standards (Table 5).

Formula 6: Provision for AI-Generated risk ($Prov_{risk}$)

This formula calculates the amount that should be provisioned per output to cover potential future costs arising from critical AI errors (e.g., legal liabilities, reputational damage, financial misstatements).

$$Prov_{risk} = \lambda \cdot P \quad (6)$$

Table 5. Cost of prompt inefficiency ($C_{badprompt}$) component breakdown

Symbol	Name & Description	Unit
$N_{prompts}$	*Total Prompts:* The total number of prompts sent to the AI model in an accounting period.	Prompts/Period
R_{bp}	*Bad Prompt Rate:* The proportion of total prompts that are deemed "bad" (i.e., they fail to elicit a useful response and must be re-engineered). This is a key operational Key Performance Indicator (KPI).	Dimensionless Ratio
IC	*Inference Cost:* The direct API cost wasted on the initial failed prompt.	Currency/Prompt
$T_{reprompt}$	*Time to Reprompt:* The average time a user spends diagnosing the failure and rewriting a bad prompt.	Hours/Bad Prompt
W_{user}	*Wage Rate of End-User:* The fully-loaded hourly wage of the general employee using the AI tool.	Currency/Hour

Objective: To apply a systematic, risk-based approach to financial provisioning, converting an unquantified risk into a managed operational expense based on expected value (Table 6).

Table 6. Provision for AI-Generated risk ($Prov_{risk}$) component breakdown

Symbol	Name & Description	Unit
λ	*Critical Error Detection Rate:* The probability that a *critical* error in an AI output will be detected by the firm's monitoring and control systems. The inverse, $1-\lambda$, represents the escape rate of critical errors. *Note: This formula can also be framed using the escape rate.*	Dimensionless Probability
P	*Cost per Critical Error:* A significant management estimate of the total financial impact if a single critical error is not detected and causes harm (e.g., legal settlement, client loss, regulatory fine). This is analogous to the "cost of failure" in risk analysis.	Currency/Error

3.5. A stochastic TCO model for generative AI strategy selection

A formal stochastic Total Cost of Ownership (TCO) model is presented here using the conceptual framework from Section 3. The model turns theoretical ideas into a computer structure that can be used to compare and analyze the two main ways that people use AI when they do not know what will happen:

API-Based Strategy: Primarily operating under an OpEx (operational expenditure) model, this approach relies on third-party generative AI APIs.

Fine-Tuned Open-Source (OS) Strategy: A CapEx (capital expenditure)-intensive model, involving the upfront investment required to develop and maintain proprietary, fine-tuned open-source models.

What makes this model different is that it does not use deterministic, point-estimate-based evaluations. Instead, it uses probabilistic distributions for important input variables. Instead, it uses probabilistic distributions for crucial input variables to make Monte Carlo simulations and Sobol sensitivity analyses realistically predict financial outcomes and hazards.

3.6. Core model structure

The TCO for each strategy is computed as the sum of its constituent cost components.

API-Based Strategy TCO is calculated as follows:

$$CO_{API} = C_{var,API} + C_{badprompt,API} + Prov_{risk,API} + \cdots \quad (7)$$

Additional amortization is factored into the total cost of ownership (TCO) for the fine-tuned operating system strategy:

$$TCO_{OS} = C_{var,OS} + C_{badprompt,OS} + Prov_{risk,OS} + C_{amort} + \cdots \quad (8)$$

We use the formulas from Section 3 to calculate each component. The principal decision-making

metric is the difference in total cost of ownership between the two strategies:

$$\Delta TCO = TCO_{OS} - TCO_{API} \quad (9)$$

A negative ΔTCO value implies a cost advantage for the OS strategy.

Table 7. Maps each conceptual parameter to its computational counterpart, describing the assumptions and distribution applied.

Category	Parameter	Symbol	Code Variable	Description	Distribution / Value
General Context	Wage, Reviewer	$W_{reviewer}$	WAGE_REVIEWER	Fully-loaded hourly wage for reviewers	Fixed: $60/00
	Wage, End-User	W_{user}	WAGE_END_USER	Fully-loaded hourly wage for end-users	Fixed: $45/00
	Baseline Productivity	L	BASELINE_HUMAN_PRODUCTIVITY	Human output rate without AI	Fixed: 2
	Project Volume	T_{useful_life}	TOTAL_PROJECTED_OUTPUTS	Total expected outputs for amortization	Fixed: 500/000
API Strategy	Quality Rate	p_{API}	api_quality_rate	Probability that an API output is usable	PERT (0/90, 0/95, 0/98)
	Productivity Multiplier	α_{API}	api_prod_multiplier	Reviewer efficiency using API	PERT (3/0, 4/0, 6/0)
	Bad Prompt Rate	$R_{bp,API}$	api_bad_prompt_rate	Fraction of failed prompts	PERT (0/10, 0/15, 0/25)
	Critical Error Rate	λ_{API}	api_critical_error_rate	Frequency of critical errors per output	PERT (5e-5, 1e-4, 5e-4)
	Inference Cost	IC_{API}	API_INFERENCE_COST	Per-call API cost	Fixed: $0/05
OS Strategy	Quality Rate	p_{OS}	os_quality_rate	Probability that an OS output is usable	PERT (0/85, 0/90, 0/94)
	Productivity Multiplier	α_{OS}	os_prod_multiplier	Reviewer efficiency using the OS model	PERT (2/5, 3/5, 5/0)
	Bad Prompt Rate	$R_{bp,OS}$	os_bad_prompt_rate	Failed prompts under OS	PERT (0/15, 0/20, 0/30)
	Critical Error Rate	λ_{OS}	os_critical_error_rate	Frequency of critical errors	PERT (1e-4, 3e-4, 8e-4)
	Inference Cost	IC_{OS}	OS_INFERENCE_COST	Per-inference compute cost	Fixed: $0/01
Universal	Cost of Critical Error	P	cost_per_critical_error	Financial impact per critical error	PERT (50/000, 75/000, 200/000)
	Time to Reprompt	$T_{reprompt}$	*implicit*	Time to revise a bad prompt	API: 2 min; OS: 3 min

Note on λ: In this operational context, λ represents the expected occurrence rate of critical errors per output, directly informing the provision cost calculation. This differs from theoretical usage, where it might represent the error detection rate.

3.7. Parameterization and stochastic inputs

According to Table 7, to accommodate the inherent uncertainty in future costs and performance, key model parameters are specified as random variables, modeled using the PERT (Program Evaluation and Review Technique) distribution. PERT is advantageous in capturing expert judgment, requiring only three intuitive values: minimum, most likely (mode), and maximum.

3.8. Capital expenditure and amortization

Model explicitly incorporates capital expenditures for the OS strategy amortized over projected output volume using the units-of-production method:

$$CapEx_{AI} = C_{data} + C_{train} \quad (10)$$

Where:

$$C_{data} = C_{lic} + (H_{clean} \cdot W_{label}) + C_{storage} \quad (11)$$

$$C_{train} = (H_{gpu} \cdot Cost_{gpu}) + (H_{eng} \cdot W_{eng}) \quad (12)$$

The budgeted project expenditures are set as fixed parameters in the model configuration.

The amortized cost per unit is then computed as:

$$C_{amort} = \frac{CapEx_{AI}}{T_{useful_life}} \quad (13)$$

3.9. Analytical Output and Sensitivity Evaluation

Running the stochastic model across multiple simulation iterations yields a probability distribution rather than a single TCO estimate. Key decision-making metrics include:

Expected Value: The mean of the ΔTCO distribution, reflecting the average financial advantage or disadvantage of the OS strategy.

Probabilistic Breakeven: Proportion of iterations where the OS strategy is more cost-effective.

Variance and Risk: Based on the spread of the distribution, each strategy's uncertainty and financial risk are quantified. Unpredictability increases with wider spreads.

A Sobol Sensitivity Analysis is also supported, which uses Saltelli sampling to estimate the contribution of each input parameter to the output variance. This analysis identifies the most influential variables, such as P, α_{API}, and p_{OS} helping to prioritize risk mitigation and data collection efforts.

4. Results

This section presents the findings from the quantitative modeling designed to evaluate the competing technology investment strategies. The results are presented in two parts. First, we report the outcomes of the Monte Carlo simulation, which provides a probabilistic assessment of the overall financial viability and risk associated with each strategy. This analysis focuses on the distribution of the Total Cost of Ownership (TCO) differential. Second, we present the results of a variance-based Sobol sensitivity analysis to decompose the sources of this financial uncertainty and identify the most influential input parameters that drive the model's outcomes.

4.1. Stochastic financial viability analysis via Monte Carlo simulation

Under uncertainty, a Monte Carlo simulation (N=5,000) was conducted to assess the financial performance and risk profile of the two competing technology strategies. The simulation modeled

the Total Cost of Ownership (TCO) per output for both the API-based and fine-tuned Open Source (OS) strategies by drawing input values from the nine specified stochastic parameters' PERT distributions. The principal outcome is the probability distribution of the TCO differential, defined as $\Delta TCO = TCO_{OS} - TCO_{API}$ in Figure 1. A positive ΔTCO indicates a cost advantage for the API-based strategy.

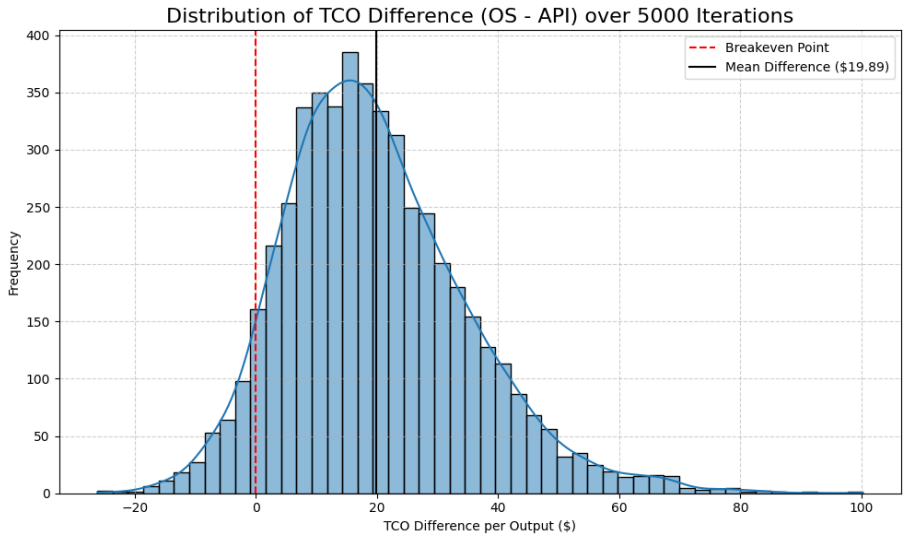


Figure 1. Distribution of TCO difference (OS - API) over 5,000 Iterations

The resulting distribution of ΔTCO, depicted in Figure 1, has a mean of $19.89. This positive anticipated value indicates that the API-based technique is, on average, the more cost-effective choice on a per-output basis. The mean shows the central tendency, but the main use of the simulation is to show how many different outcomes are possible. The distribution has a large standard deviation of $14.50, which means there is a lot of financial risk and uncertainty. The distribution also has a strong positive skewness (skewness = 1.24), which means that the OS strategy has a small chance of doing better than the API strategy (the left tail), but the danger of cost overruns is much greater than the API alternative.

The probability breakeven threshold is a very important number for making strategic decisions. The simulation indicates that the probability of ΔTCO being negative, a scenario where the OS strategy is more cost-effective, is only 6.58%. Consequently, the API-based strategy is projected to yield a lower TCO in 93.42% of the simulated scenarios. This result provides strong quantitative evidence in favour of the API-based approach. The OS plan requires a lot of money and work to put into action, and there is only a 6.58% chance that it will lead to better financial results. Real Options Theory can be used to explain this result. The lower initial investment and pay-per-use model of the API strategy protects strategic flexibility and limits downside exposure. This creates an option value that seems to be higher than the OS strategy's potential for lower marginal costs.

4.2. Variance decomposition using Sobol sensitivity analysis

Following the quantification of output uncertainty, a Sobol sensitivity analysis was conducted to decompose the variance of the model output (ΔTCO) and identify the principal drivers of this variance. By calculating the Total-Order Sobol indices (ST), which account for each parameter's individual effect and its interactions with all other parameters, we can pinpoint the most influential variables. Rather than simply identifying if a risk exists, this analysis explains why it exists, helping

to inform risk mitigation strategies. As shown in Figure 2, the results are summarized.

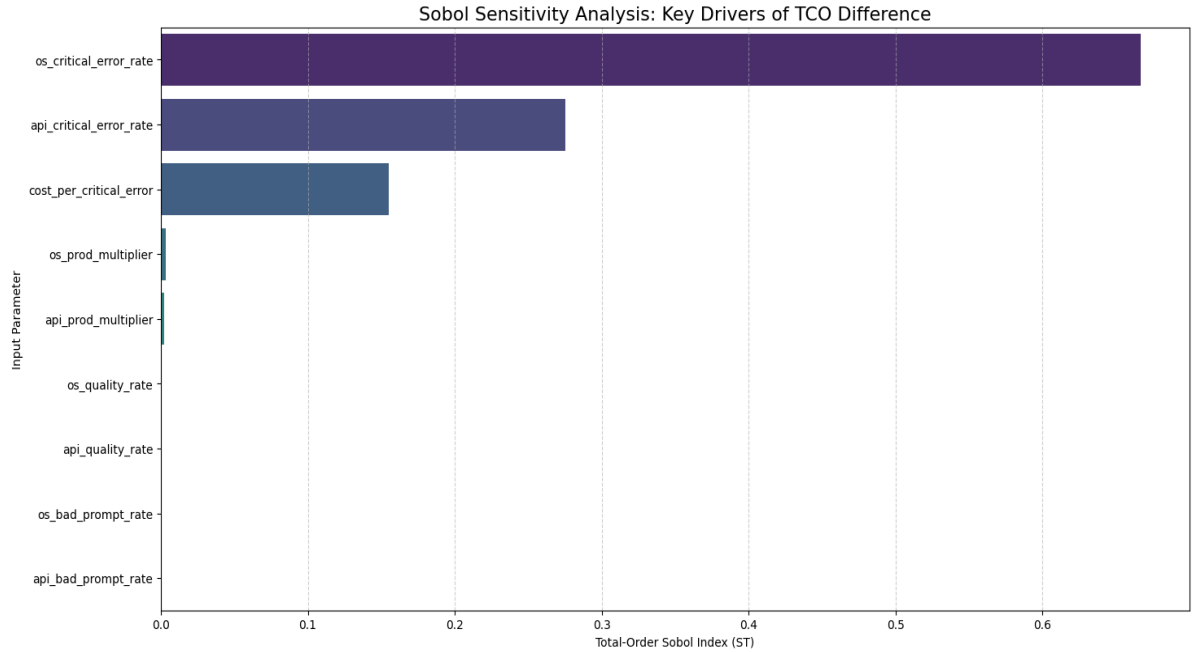


Figure 2. Sobol sensitivity analysis: key drivers of TCO difference

In the analysis, three parameters accounted for over 90% of the total variance, indicating a high concentration of variance attribution.

4.2.1. OS model critical error rate (os_critical_error_rate, ST ≈ 0.67)

The dominant source of uncertainty, contributing approximately 67% of the output variance, is the rate of critical failures in the fine-tuned OS model. This finding underscores the centrality of technical risk management in the evaluation of in-house AI solutions. The financial viability of the OS strategy is less dependent on operational efficiency metrics and more contingent upon the model's reliability and controllability. The high sensitivity is a result of the large uncertainty range and the substantial financial impact of each inaccuracy (P) for this parameter.

4.2.2. API model critical error rate (api_critical_error_rate, ST ≈ 0.28)

At 28%, the third-party API's critical error rate is the second most important variable. This highlights that the investment decision is fundamentally a *comparative risk assessment*. The financial outcome is highly sensitive to the *relative* reliability of the two platforms, shifting the focus from simply accepting a vendor's service-level agreements to actively monitoring and quantifying third-party platform risk.

4.2.3. Cost per critical error (cost_per_critical_error, ST ≈ 0.16)

The estimated financial consequence of a single critical error is the third substantive driver of variance. It's notable ST index validates the inclusion of the Prov_risk component within our TCO framework. It shows that when figuring out how much a technology investment is worth, you need to look at more than just the direct costs. You also need to make good guesses about the possible indirect costs that could come from operational failures. This is something that needs help from people in the legal, compliance, and operations areas.

One important finding is that standard measures of efficiency, like productivity multipliers and quality rates, have almost no effect (all ST < 0.01). Changes in these parameters do not have a statistically significant effect on the strategic choice within the uncertainty ranges given. This is because the risk parameters have a bigger effect. This finding goes against what most people think about evaluating IT projects, which is that they should focus on making things more efficient and saving money. Our analysis suggests that for complex AI systems, the focus of strategic financial evaluation should be reoriented from operational efficiency to a more comprehensive framework of financial risk management and model governance.

5. Discussion

Our stochastic TCO analysis quantifies two technical trajectories and reframes how generative AI investments should be evaluated. Based on our research, we propose a new paradigm that is risk-centric and is based on well-established accounting and economic theory; this paradigm shift would challenge orthodox IT value logic.

The major takeaway from this article is the complete reversal of traditional reasoning behind IT investment strategies. The Sobol sensitivity analysis (Figure 2) reached a clear conclusion: a handful of risk-related parameters (os_critical_error_rate, api_critical_error_rate, cost_per_critical_error) control the majority of the financial outcome of a strategic AI decision. These parameters account for more than 90% of the model's output variance. On the other hand, the strategic decision is not impacted by the conventional efficiency measures, including labor productivity multipliers (α) and output quality rates (p), which have been the focus of talks on IT value for many years. This proves with hard data that the outdated reasoning of calculating IT value by subtracting labor savings is seriously flawed when it comes to generative AI. It argues that the exponential cost of an uncontrolled AI-generated failure much outweighs the marginal value of making an employee progressively faster. As a result, the focus of strategic calculations should shift from the cost of speed to the cost of control.

Our approach determines the AI's critical mistake rate (λ) as the most sensitive parameter, necessitating a more profound analysis from the perspective of Agency Theory. The mistake rate is not a fixed characteristic of the AI model; rather, it is a result of its principal control mechanism—the Human-in-the-Loop (HIL) process. The high financial sensitivity to λ is really a sensitivity to the high costs of monitoring a non-human, probabilistic agent. When a company selects the OS strategy, it takes on all of this work itself, and its financial success depends directly on how well it can build an industrial-scale HIL process. The large range we see in os_critical_error_rate is the financial result of this huge operational problem.

This risk-centric paradigm finds powerful external validation in the recent strategic maneuvers within the AI industry. Meta recently signed a $14.8 billion deal with Scale AI, a company specializing in data labeling and human-led AI model refinement. According to Reuters, Scale AI now has a market valuation of nearly $14 billion. This event serves as a market-based confirmation of our central thesis. Scale AI's core business is not creating foundational models, but providing the industrial-scale HIL services required to make them safe and reliable. It is, in essence, a company that sells "error rate reduction as a service."

From the perspective of our TCO framework, the market's multi-billion-dollar valuation of this service can be understood not as speculative but as a financially rational price for certainty. Meta's cooperation acknowledges that the high cost to adopters to establish the HIL safety net is the main obstacle to these models' business viability. Within the Transaction Cost Economics (TCE) framework, these big collaborations can be thought of as complicated "make-or-buy" choices. A technology giant is paying a premium to "buy down" the single most volatile and financially

significant variable in its TCO model, the error rate, λ, by outsourcing these immense and uncertain monitoring costs.

The validation of this paradigm has profound implications. For corporate governance, it demands that the board explicitly quantify its AI risk appetite. Our framework provides a financial reporting methodology that can be justified under IAS 38 for the purpose of capitalizing AI assets that are developed internally. The building of a control apparatus is the dominating cost being capitalized, which is a critical point. This observation is based on the Resource-Based View (RBV): the real, unique asset is not the AI model, but the organizational capacity to dynamically govern it. In management accounting, new measurements are needed beyond budget variance, such as tracking the observed critical error rate (λ_obs). Finally, the consistent financial superiority of the API strategy in our model is best explained through Real Options Theory (ROT). The API method is similar to having a call option on the technology, which keeps the huge financial value of management flexibility in an uncertain environment. This value is lost when the OS investment is high-cost and permanent.

6. Conclusion

This study addressed a significant issue at the convergence of technical innovation and financial management: the lack of a comprehensive framework to assess the considerable and intricate investments necessitated by generative AI. We filled this gap by creating and testing a stochastic Total Cost of Ownership (TCO) model that goes beyond simple, certain calculations and takes into account the uncertainty and many hazards that come with this new type of technology. The research sought not only to provide a practical tool for decision-makers but also to challenge the prevailing, efficiency-focused narrative surrounding the business value of AI.

6.1. Summary of contributions

This research makes three distinct contributions to the theory and practice of technology management, accounting, and corporate strategy.

First, it extends IT investment theory for the AI era. To evaluate generative AI, we introduce the first stochastic TCO framework that incorporates probabilistic variables. By doing so, our model moves beyond static analysis to provide a risk-adjusted comparison of OpEx-heavy (API) and CapEx-heavy (OS) strategies, empirically demonstrating that for GenAI, the traditional focus on production efficiencies must be replaced by a new paradigm centered on the agency costs of monitoring and control.

Second, it contributes to the accounting literature on intangible assets. We provide a rigorous and defensible methodology for applying IAS 38 to internally generated AI assets. By explicitly modeling the costs of data acquisition, model training, and the creation of control systems, we offer a practical pathway to move the valuation of these assets from speculative to auditable, addressing a critical gap in financial reporting for the digital economy (Leitner-Hanetseder and Lehner, 2023; Moro-Visconti, 2024).

In addition, a fundamental paradigm shift is validated through the strategic management of AI adoption. Our findings provide the formal financial logic for why the "economics of speed" must give way to the "economics of trust and control." We prove that corporate governance, risk management, and the development of control-oriented dynamic capabilities—not just the pursuit of productivity—are the primary and quantifiable levers for creating sustainable value from generative AI.

6.2. Limitations of the research

As with any modeling-based research, this study has limitations that present opportunities for future work. To begin, the reliability of the model's predictions relies on the precision of the parameters used to create them. Despite our use of PERT distributions for uncertainty management, the framework's usefulness depends on an organization's capacity to provide accurate estimates for critical variables, especially the cost per critical error (P), which is not always easy to measure in advance. Second, our TCO model is, by design, focused on the cost side of the equation. It does not explicitly model potential revenue generation, strategic differentiation, or other second-order network effects that might arise from adopting one AI strategy over another. Finally, the analysis does not incorporate the complex tax implications of capitalizing and amortizing intangible assets, which would vary significantly across jurisdictions.

6.3. Avenues for future research

The constraints of this study inherently indicate numerous potential directions for subsequent research. The next stage is to test the framework in real life by doing in-depth case studies with companies that are currently working on big AI projects. This kind of research could improve the model's parameters and show that its results are useful in the real world. A second useful addition would be to include the TCO model in a larger valuation framework, like a real options analysis or a Discounted Cash Flow (DCF) model, to take into account the strategic and revenue worth of AI. Lastly, more study is needed in the fields of accounting and law to develop standard rules for how to audit, report on, and tax these new AI-based intangible assets. Our framework gives a basic vocabulary for this area.

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IJAAF; Vol. 10, No. 1, Winter 2026, Serial 34

Ferdowsi University of Mashhad

Iranian Journal of
Accounting, Auditing & Finance

Quarterly

RESEARCH ARTICLE

Ownership Structure and Value of Listed Manufacturing Companies in Nigeria Moderated by Dividend Pay-Out

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How to cite this article:
Balogun, J. Eshemokhai , Yahaya, A. Onipe and Balogun, B. Festus (2026). Ownership Structure and Value of Listed Manufacturing Companies in Nigeria Moderated by Dividend Pay-Out. Iranian Journal of Accounting, Auditing and Finance, 10(1), 21-36. doi: 10.22067/ijaaf.2026.47320.1548
https://ijaaf.um.ac.ir/article_47320.html

ARTICLE INFO

Article History
Received: 2025-02-18
Accepted: 2025-05-13
Published online: 2026-02-01

Keywords:
Managerial Ownership, Institutional Ownership, Foreign Ownership, Firm Value, Dividend Payout

Abstract

This study evaluated ownership structures on the value of listed manufacturing companies in Nigeria, with dividend payout as a moderating variable. Thus, an ex-post facto research design was used, and panel data were collected from the financial statements of the sampled listed manufacturing companies. The population of this study comprised 46 companies across four sub-sectors (agricultural, consumer goods, health, and industrial goods), of which 35 were sampled from 2012 to 2023 on the Nigerian Exchange (NGX). Data were analysed using descriptive statistics and generalised method of moments (GMM) regression. The results of the GMM showed that, although ownership structures and dividend payouts have positive impacts on firm value independently, their interactions—specifically, managerial, institutional, and foreign ownership with dividends—lower their combined effect. There was a complex relationship between ownership structure and dividend payouts in Nigeria's manufacturing sector, as evidenced by these negative coefficients. This study recommends that management cultivate the practice of regularly paying dividends, no matter how small, to institutional and foreign shareholders. Nevertheless, management should demonstrate a commitment to creating long-term value for shareholders, rather than simply paying dividends to institutional and foreign owners.

https://doi.org/10.22067/ijaaf.2026.47320.1548

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NUMBER OF REFERENCES
63

NUMBER OF FIGURES
1

NUMBER OF TABLES
4

Homepage: https://ijaaf.um.ac.ir
E-Issn: 2717-4131
P-Issn: 2588-6142

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1. Introduction

The problem of Nigerian manufacturing companies' dwindling firm value in spite of the different ownership structures is affecting investors' confidence in the Nigerian manufacturing sector. Shareholder wealth is supposed to increase as a result of businesses. This is accomplished by identifying the demands of the market, creating a system to satisfy those needs, determining the resources required, and securing funding to finance the purchase of those resources, either from angel investors or shareholders (Awen et al., 2022). Consequently, the value of a company is created by effectively and efficiently managing and utilising the resources invested by shareholders to satisfy the needs that have been recognised through increasing the company's returns.

The manufacturing industry plays a critical role in any nation's economy because it transforms raw materials into finished products. Considering the challenge of firm value decline, the federal government of Nigeria plans to inject N868.56 billion into the industrial sector through the 2021 to 2025 National Development Plan (NDP) in December 2021 to help the manufacturing sector survive in the years ahead.

The value of a company is one of the essential factors when evaluating its financial standing or market value. According to Rachmi and Heykal (2020), a company's value is the real sum per share of its common stock that would be acquired if all of its assets were to be sold for market value. The higher the stock price of a company's shares, the higher the value of the company. However, events in the capital market, starting from 2008, have further undermined investors' confidence in how the capital market functions (Adeniji, 2022). These events include the delisting of companies from the capital market, inconsistent earnings reporting, the fluctuation in firm value, the collapse of corporate bodies, inconsistent dividend payments, low capitalisation, and rising financing costs. Following the aforementioned events, shareholders have questioned the management's ability to create financial and investment strategies that can enhance a company's value.

One of the factors that encourages existing shareholders to invest more capital into a company's operations and attract potential investors is dividend payout. Investors put their money into a company in the hopes that it will grow in value, and then they want a cut of the profits. Dividends are generally paid to current shareholders as a reward for their financial investment.

Listed manufacturing businesses have institutional, foreign, ownership concentration, employee, managerial, family, state, agent, float, and individual ownership structures (Apochi et al., 2022; Tnushi et al., 2023). These ownership structures are in the form of insiders' and outsiders' ownership structures of a company.

Because of the model adopted by this study, the availability of data, and prior literature that pertains to the proxies, this study will focus on managerial ownership, institutional ownership, and foreign ownership.

Orjiakor (2022) reports that most Nigerian enterprises, which were once beneficiaries of large-scale economies, are now seeing a fall in productivity and firm value. Most Nigerian manufacturing companies are unable to attract investors due to their inability to make capital gains and pay dividends to shareholders. As a result, the value of these companies has been declining, even though there have been ongoing policy efforts to attract credit to the manufacturing sectors in Nigeria.

Evidence from past studies conducted on the concept of ownership structure and firm value of listed manufacturing companies, both in developed and emerging countries, showed that previous studies have left with mixed and contradicting results. Several of these studies have been conducted by different researchers in different countries, in different economic sectors, and using different measures of variables and data, which could explain this contradiction. The dividend payout did not serve as a moderating variable, which was an encouraging factor for attracting investors and increasing the firm's value. This study empirically analyzed the ownership structure and value of

listed industrial companies in Nigeria using dividend payout as a moderating variable.

This study explores how dividend payout moderates ownership structure and value of Nigerian listed industrial enterprises. We tested the following null hypotheses based on the study's goal:

Drawing on the study's purpose, we conducted tests to determine whether the following was true: This research will use some resources to ascertain the effect of ownership structure on the firm value of listed Nigerian manufacturing companies as a function of dividend payout. Everyone, from shareholders to market regulators to specialists to potential investors to upper-level executives, is in this category.

2. Literature review

2.1. Firm value

The value of a company is an economic concept that reflects the real amount that investors are willing to pay for a company when it is being sold. The value of a company is determined by its current managers, institutional and foreign shareholders, and potential investors. Companies that issue shares on a stock market are valued based on the value of those shares, which is determined by the market's liquidity and transparency (Rachmi and Heykal, 2020). This approach provides arguably the most detailed in-depth assessment of the company's market position and the summary of investor views on the company as a whole and its future prospects (Cristiawan and Dan, 2007).

An increase or decrease in the net worth of a company's owners can be tracked by calculating its firm value. When the value of a firm's net worth is increasing, it demonstrates to the existing shareholders the stability of the firm and forms the basis of attraction to potential investors. Akinyomi and Adebayo (2013) found that stock prices directly correlate to a rise in a company's worth. The share price of a company like the manufacturing company reflects the value of the company.

2.2. Ownership structure

Shareholders and other stakeholders own a company according to its ownership structure. The owners of a company are the primary financiers who put their resources into creating value for the operational function of the company. Several shareholders make up a company's ownership structure. Ownership structure is determined by the way the company is structured legally and financially among the shareholders. The ownership structure defines the rights, obligations, and how the net profit is distributed between the owners, the obligations of each individual involved in the company, and how the company is managed and controlled.

There are many types of ownership structures in a company, including managerial ownership, institutional ownership, foreign ownership, family ownership, government ownership, agent ownership, and individual ownership (Arthurs et al., 2008; Vintila and Gherghina, 2015; Santoso and Muda, 2020; Oyedokun et al., 2020; Bataineh, 2021; Apochi et al., 2022; Tnushi et al., 2023).

Lopez-Iturriaga and Rodriguez-Sanz (2012) proposed that ownership structure can be viewed as the fraction of shares held by the company's largest shareholders. An ownership structure is defined by the interplay among concentrated, managerial, and institutional ownership, as described by Sahut and Gharbi (2010). Further, Alipour and Amjadi (2011) stated that a company's ownership structure includes institutional and individual shareholders.

2.2.1. Managerial ownership

The term "managerial ownership" refers to the ownership stake held by a company's top executives, who also happen to play an integral role in making major business decisions. It is

possible to create a favorable business environment, encourage effective decision-making, and boost the enterprise's value when a managerial owner's interests are aligned with those of shareholders. Management shareholding is defined as the percentage of the total number of shares issued by the company that is owned by directors. CEOs, board members, and top executives are all considered members of the management team when it comes to shareholding (Andow and David, 2016). Furthermore, according to Laiho (2011), a company's management consists of the board of directors and the executive staff.

2.2.2. Institutional ownership

Companies that are held by larger entities, such as banks, insurance companies, or investment firms, are known as having institutional ownership. It is possible to create a favorable environment for business, encourage effective decision-making, and boost the enterprise's worth when a managerial owner's interests are aligned with those of shareholders. Companies in this category include insurance agencies, banks, mutual funds, pension funds, and investment firms. The first definition given by Roberts and Yuan (2006) is institutional ownership, which includes all institutional investors' stock holdings. The second definition is institutional block investors, which includes the top five or ten institutional investors' holdings. This means that the majority of a publicly listed company's stock is owned by professional financiers, who are known as institutional owners.

2.2.3. Foreign ownership

According to Gambo et al. (2019), any board member whose credentials indicate that they are a citizen of a country other than the company's home country is deemed to have foreign ownership. This study defines foreign ownership as the percentage of a company's ownership control held by non-residents. The company that receives the investment from outside is called a subsidiary, according to Malik (2015). As a result, foreign ownership occurs when multinational corporations that operate across borders make sustained investments in a foreign nation, typically through acquisitions or direct foreign investment.

2.3. Dividend payout

Dividend payout is when a corporation distributes a specified percentage of its net profit to its shareholders at the end of the fiscal year. The majority of shareholders use dividend payout to assess how well an organisation is performing in terms of an increase or decrease in value. Essentially, a dividend refers to the distribution to shareholders of the company's net profits, based on their shareholding (Al-Gharaibeh et al., 2013). The share of net profits allotted to shareholders, in accordance with the number of shares they own, is known as a dividend (Sunariyah, 2004).

2.4. Control variables

The study's control variables include leverage, profitability, and company size. Tien et al. (2013), Adiputra and Hermawan (2020), and Yahaya (2022) are just a few of the studies that supported the selection of these factors for this study due to their proven impact on company value.

2.5. Conceptual framework

Dividend payout moderating the influence of ownership structure on the value of listed manufacturing companies in Nigeria is demonstrated by the conceptual framework of this study. The study also shows the effect of leverage, profitability, and firm size on the value of a company. The conceptual model for the study is shown in Figure 1.

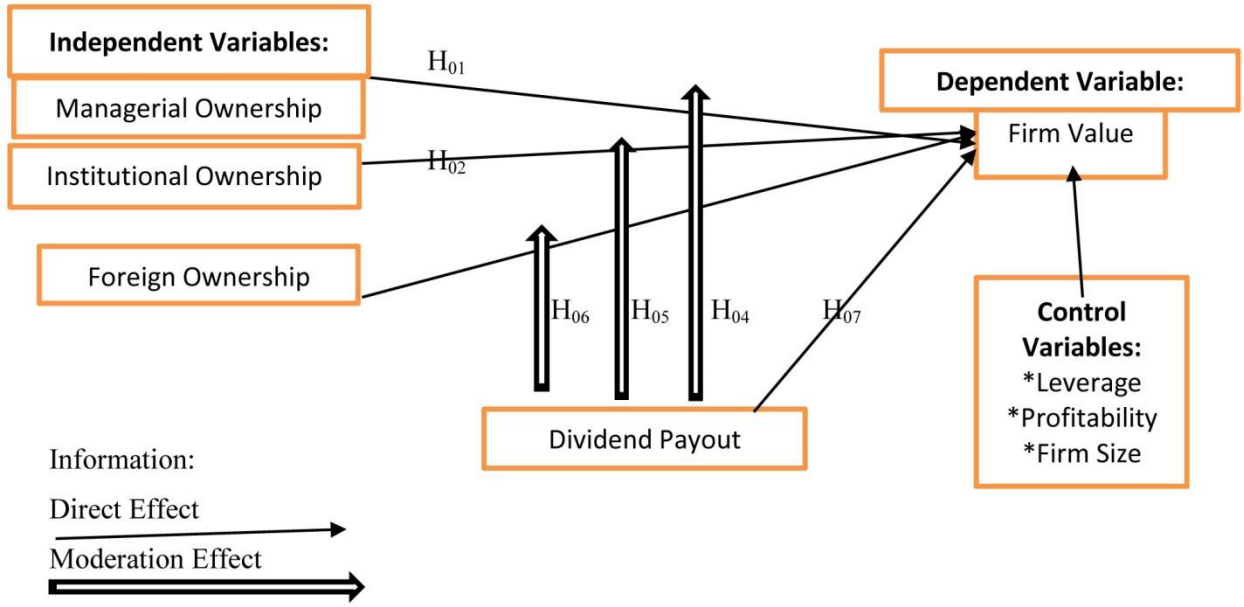


Figure 1. Conceptual framework

2.5.1. Effect of managerial ownership on the value of the company

Lintner (1956) initially put forth the bird-in-the-hand hypothesis, which states that a strong incentive to recruit new investors and promote a higher degree of corporate ownership is to pay dividends to shareholders regularly. Evada and Isnurhadi (2012), Vo and Nguyen (2014), Putranto and Kurniawan (2018), and Irdha et al. (2019) found that managerial ownership has a significant effect on the value of the firm. Managerial ownership is a form of ownership structure that can influence business management to provide an excellent outcome for the majority of shareholders. Many enterprises offer managers insider ownership of the company for managers to perform better (Connelly et al., 2010). Allowing managers to make decisions or establish policies that might boost a company's worth is one benefit of managerial ownership. Applying the theoretical basis and the above-mentioned research results, the first hypothesis is formulated as follows:

H_{01}: Managerial ownership has a significant effect on the value of listed manufacturing companies in Nigeria.

2.5.2. Effect of institutional ownership on the value of the company

Lintner (1956) The bird-in-the-hand theory emphasises that the regular payment of dividends to shareholders serves as a powerful incentive for attracting more investments and keeping existing shareholders, such as institutional owners. Clay (2001), Xiong (2016), and Doğan (2020) examined the effect of institutional ownership on the firm value of companies and found a significant relationship. However, Sari and Patrisia (2019) and Andhika and Muhyarsyah (2021) found that a negative relationship exists between institutional ownership and firm value. This result has shown conflicting results on the relationship that exists between institutional owners of a company and the firm's value.

Monks and Minow (2001) opined that institutional shareholders undertake all necessary measures to safeguard the value of a company's wealth, including watching the enterprise's management and market activities in which they have their investments. The following second hypothesis is formulated based on the theoretical basis and the research results discussed above:

H_{02}: Institutional ownership has a significant effect on the value of listed manufacturing

companies in Nigeria.

2.5.3 Effect of foreign ownership on the value of the company.

Al-Khouri et al. (2004), Rely and Arsjah (2019), and Ryu et al. (2021). However, Khasawneh and Staytieh (2017) and Rohim et al. (2019) found that foreign ownership has a significantly negative relationship with firm value. The industry in which a company operates is important, and when it comes to the impact of the services industry in particular, it is discovered that the impact of foreign ownership on firm value is always statistically significant. Based on the theoretical basis and the research results discussed, the following third hypothesis is proposed:

H_{03}: Foreign ownership has a significant effect on the value of listed manufacturing companies in Nigeria.

2.5.4. Effect of dividend payout on the value of the company

The bird-in-the-hand theory, developed by Lintner (1956), is one of the major theories on the impact of dividends on company value. This theory is one school of thought that backs up the dividend relevance. A number of studies have shown that dividends significantly impact business value. Triani and Tarmidi (2019), Morovvati Siboni and Pourali (2015), and Egbeonu Oliver et al. (2016). A company's dividend capability is a significant signal of its survival and success and the holy grail for efficient and effective operations and performance monitoring (Bhabatosh, 2015). This leads us to our fourth hypothesis, which is based on the previously mentioned study and the theoretical groundwork:

H_{04}: Dividend payout has a significant effect on the value of listed manufacturing companies in Nigeria.

The contradictory conclusions of existing research led us to explore how divided payout moderates the link between managerial, institutional, and foreign ownership of Nigerian listed manufacturing companies:

H_{05}: Dividend payout has a significant moderating effect on managerial ownership and the value of listed manufacturing companies in Nigeria.

H_{06}: Dividend payout has a significant moderating effect on institutional ownership and the value of listed manufacturing companies in Nigeria.

H_{07}: Dividend payout has a significant moderating effect on foreign ownership and the value of listed manufacturing companies in Nigeria.

2.6. Theoretical review

Due to its applicability to this study, the bird-in-the-hand theory was adopted. The bird-in-the-hand idea put forth by Lintner (1956) is one of the main frameworks that attempts to explain how dividends affect shareholder value. The dividend relevance theory has the backing of this and other theoretical traditions. Every shareholder argues that if a dividend were paid out today, it would be worth more than any potential future capital gains or share appreciation, according to the bird-in-the-hand theory. The saying "a bird in the hand is worth two in the bush" served as the foundation for the bird-in-the-hand theory.

2.7. Empirical review

According to Oyedokun et al. (2020), ownership structure and firm value in Nigeria were examined by using selected quoted consumer goods firms. A number of factors have a direct and significant impact on the value of firms, including managerial ownership, institutional ownership, and foreign ownership.

Vo and Nguyen (2014) found that managerial ownership had an inverse effect on leverage ratio and dividend policies. Xiong (2016) examined the relationship between institutional investors and firm value in Chinese listed firms. The study found that institutional investors influence corporate value.

The study by James et al. (2021) focused on the effects of managerial ownership, institutional ownership, and foreign ownership on firm value. The study found a strong correlation between managerial ownership, institutional ownership, and foreign ownership and the firm's valuation. Lucky and Uzokwe (2019) conducted research on dividend policy and firms' value, finding that all independent variables were significant with a direct impact on firms' values.

3. Methodology

To determine the connection between the ownership structure and the value of listed manufacturing companies in Nigeria, this study used the ex-post facto research approach. The moderating variable in this relationship was dividend payout. A sample of 35 manufacturing companies listed on the Nigerian Exchange Group between 2012 and 2023 was selected using judgmental sampling and filtering methods. The companies' products range from agricultural goods to consumer goods, healthcare goods, and industrial goods. Our secondary data comes from audited financial statements and accounts of selected manufacturing companies listed on the Nigerian Exchange Group (NGX).

3.1. Model specification

This study adapts Oyedokun et al.'s (2020) model. The basic model of Oyedokun et al (2020) is stated as: Tobin $Qit = \beta 0 + \beta 1INSTOit + \beta 2MGRLOit + \beta 3FORNOit + \beta 4OWCit + \beta 5FSIZEit + \mu it. \ldots . i$

Where Tobin $Q_{\beta 0}$ is Market capitalisation, INSTO presents Institutional ownership, MGRLO denotes Managerial ownership, FORNO represents Foreign ownership, OWC indicates Ownership concentration, and FSIZE shows Firm Size (Control Variable), β0 illustrates Constant/Intercepts, β_1, β_2, β_3 and β_4, present Parameters of determination, $\boldsymbol{\mu t}$ states Stochastic Variable (Error term)

In achieving the stated hypotheses 1 to 7 of this study, Oyedokun et al (2020) model was modified. The econometric form of the model is specified as follows:

$$FIRMV = \beta 0 + \beta 1MAGRIOit + \beta 2INSTUOit + \beta 3FOREINOit + \beta 4MAGRIO * DIDPit + \beta 5INSTUO * DIDPit + \beta 6FOREINO * DIDPit + \beta 7DIDPit + \beta 8LEVit + \beta 9PROFit + \beta 10FSit + eit$$

Where FIRMV is Firm Value, *MAGRIO*=Managerial ownership, *INSTUO*=Institutional ownership, *FOREINO* indicates Foreign ownership, $MAGRIO * DIDP$ presents Moderating effect of dividend payout and managerial ownership, $FOREINO * DIDP$ shows Moderating effect of dividend payout and foreign ownership, $INSTUO * DIDP$ represents Moderating effect of dividend payout and institutional ownership, *DIDP* denotes Dividend payout, LEV shows Leverage, PROF is Profitability, FS indicates Firm size, β_0 presents Constant, β_1 to β_7 shows Regression coefficients, e indicates Error term, i denotes Observation, t presents Year of observation.

4. Results and discussions

This section presents the outcome of this study based on the hypotheses formulated. The result of descriptive statistics is presented in Table 2.

Table 1. Variables definition, measurement, and sources

S/N	Variables	Proxy	Definition	Measurement	Sources
1	Dependent Variable Firm value	FIRMV	This is the economic measure reflecting the market value of a business.	Measured as the ratio of market capitalization to the book value of total assets	Oyedokun et al. (2020), and Mukaria et al. (2020)
2	Independent Variables Managerial Ownership	MAGRIO	The percentage of equity stake held by board members of the total number of shares in issue by the company	Measured as a percentage of shares held by the management of the total number of shares in issue.	Jusoh and Che-Ahmad (2014), Abdulfatah et al. (2022), and Irom et al. (2023).
3	Institution Ownership	INSTUO	Over the total number of issued shares of a Listed Company, the percentage of outstanding shares owned by huge fund managers	The percentage of shares held by institutional investors (i.e., the cumulative percentage of shares held by institutions with more than 5% of shares in issue) to total shares outstanding	Jusoh and Che-Ahmad (2014), Mukaria et al. (2020), Apochi et al. (2022) and Tnushi et al. (2023)
4	Foreign Ownership	FOREIO	Ownership control of a company held by individuals or entities who aren't citizens of the country where the company is located	Foreign ownership is measured as the cumulative percentage of shares held by foreigners of the total number of shares in issue.	Jusoh et Che-Ahmad (2014), Mukaria et al. (2020), Tnushi et al. (2023), Gambo et al. (2019).
5	Moderation Variable Dividend Payout	DIDP	Dividends distributed to shareholders, usually in cash or stock, are the company's net profit.	Measured as a percentage of the annual dividend paid to net income	Akinleye and Ademiloye (2018), Abdulfatah et al. (2022), Yahaya (2022).
6	Control Variables Leverage	LEV	The ability of a company to meet its short-term obligations of indebtedness.	Measured as a ratio of total debt to total assets	Yahaya and Awen (2020) and Yahaya (2022).
7 8	Profitability	PROF	How well a company can generate income from operational processes and ensure the continuity of the company in the future.	Measured as a ratio of net income to total assets	Rochmah and Ardianto (2020), Yahaya (2022)
	Firm Size	FS	Represent the size of the company.	Measured by the natural logarithm of total assets	Mamaro and Tjano (2019) and Usman and Yahaya (2023).

Source: Researcher's Compilation (2024)

Table 2. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
FIRMV	420	2.225	5.951	0.040	64.176
MAGRIO	420	0.102	0.150	0.000	0.647
INSTUO	420	0.389	0.294	0.000	0.948
FOREIO	420	0.153	0.276	0.000	0.843
DIDP	420	0.359	1.394	-3.078	22.171

The firm value (FIRMV) mean is found to be 2.225 with a standard deviation of 5.951. In addition, the minimum and maximum values of the sampled firms are 0.040 and 64.177, respectively. Firm values in Nigerian listed manufacturing companies are characterized by high standard deviations due to structural imbalances. The value of the companies varies greatly due to differences in market capitalisation, revenue generation, and asset base. As far as independent variables are concerned, the average managerial ownership (MAGRIO) is 0.102. This showed that managers of the sampled companies, on average, own 10.2 per cent of the shares of the companies in the pool. On average, institutional investors own 39 percent of the sampled companies, according to the Institutional Ownership (INPUT) ratio of 0.390. This means that institutional shareholders have a high presence in the sampled listed manufacturing companies in Nigeria. This result is in line with the study of Adamu and Harunal (2020), who reported that institutional shareholders have 51.3% of shareholdings using data from twenty non-financial firms' service firms. Nigerian-listed manufacturing companies with foreign investors own an average of 15.3% of shares, according to the foreign ownership (FOREIO) mean ratio of 0.153. The minimum and maximum are 0.000 and 0.844, respectively. This suggests that foreign investors have invested heavily in specific companies that are of interest to them. The mean dividend distribution (DIDP), which is the moderating variable of the study, is 0.360 in Table 2. This means that companies typically distribute 36% of their net profits to their shareholders as dividends. Some of the companies in the sample pay out dividends that are higher than their profits, while others pay out a smaller percentage of their net profit. The range is from -3.079 to 22.172, which suggests that both scenarios are possible. Olayinka and Adekola (2022) opined that the instability in dividend payments to shareholders in the trend analysis of the annual reports of some companies is a result of harsh economic situations.

4.1. Diagnostic test

The normal distribution of residues was determined by the Shapiro-Wilk W test for panel data collection. In this study, w = 0.59352 and p-value = 0.0000, suggesting that there is sufficient evidence to support a null hypothesis of normality. To prove this study hypothesis, the researchers introduce a robust estimation of standard errors using a generalised method of moments (GMM) regression model. Due to the fact that this issue violates the normality assumption, GMM is suitable to address it. The VIF was used to measure multicollinearity to consider how much of the variance of the estimated regression coefficients is due to multicollinearity. The Variance Inflator Factor (VIF) in this study ranged from 5.41 to 1.01, with an average of 2.73. As a rule of thumb, none of the variables in the VIF exceeds 10 per cent, which means that there is no sign of multicollinearity. The Breusch-Pagan heteroscedasticity test was used to verify the existence of heteroscedasticity. In this study, the t-test (chi-square) was 943.04, and the p-value was 0.0000. To adjust the regression model in this study for heteroskedasticity, the researchers introduced a reliable estimation of standard errors, i.e., a generalised method of moments (GMM) regression model, to ensure the validity of the inference.

4.1.1. GMM regression output of direct effect before moderation

Table 3. Dynamic panel-data estimation, one-step system GMM

FIRMV	Coef.	Robust (Std. Err.)	t	P>|t|__
MAGRIO	-9.502	2.315	-4.100	0.000
INSTUO	2.601	0.989	2.630	0.009
FOREIO	3.262	1.002	3.250	0.001
LEV	0.001	0.014	0.090	0.931
PROF	0.286	0.330	0.870	0.385
FS	-3.269	0.790	-4.130	0.000
/b0	11.786	3.264	3.610	0.000
Number of obs = 420		Number of groups = 35		
Number of instruments = 19		Obs per group = 12		
F (5, 34) = 3.50		Prob > F = 0.012		
GMM weight matrix: Robust				
Arellano-Bond test for AR (1) in first differences: z = -1.28 Pr > z = 0.201				
Arellano-Bond test for AR (2) in first differences: z = -0.95 Pr > z = 0.342				
Hansen test of overid. restrictions: chi2(12) = 17.05 Prob > chi2 = 0.148				
(Robust, but can be weakened by many instruments.				

The outcome in Table 3 indicates that managerial ownership (MAGRIO) exhibits a negative coefficient of -9.502 with a p-value of 0.000. This signifies that, ceteris paribus, a 1% increase in managerial ownership will lead to a -9.502-unit reduction in the firm value of the sampled listed manufacturing companies in Nigeria. This suggests that management may not always act in the interests of shareholders as the company's agent, but tends to take opportunistic actions that may result in a reduction in the company's value, and which in turn results in a conflict of interest for the company. Mokaya and Jagongo (2015) and Mukaria et al. (2020) found this to be true. It is estimated that for every 1% increase in institutional ownership among the listed manufacturing companies in the sample, firm value rises by 2.601, with a p-value of 0.009. When institutional investors have a lot of expertise with a firm, they are able to keep an eye on how it's doing and make decisions based on that information, which increases the value of the company. The outcome is consistent with what Oyedokun et al. (2020) and Mukaria et al. (2020) found. A 3.262 positive coefficient and a 0.001 p-value indicate that the foreign ownership index is statistically significant. This equates to a 3,262% rise in value for each 1% increase in foreign ownership of the companies included in the sample. This suggests that the long-term high investment and the oversight role of foreign owners help to sustain and secure the company's growing value. James et al. (2021) and Khasawneh and Staytieh (2017) both find similar results, which this investigation affirms. Firm value is not positively affected by leverage (LEV), a control variable with a positive coefficient of 0.001 and a non-statistically significant p-value of 0.931. With a p-value of 0.385 and a positive coefficient of 0.286, profitability (PROF) does not statistically substantially impact the business value. Firm size (FS) shows a negative coefficient of -3.269 and a p-value of 0.000, meaning that firm size has a significant effect on the firm value. This implies that the size of a large company does not always translate into a high value for the company, as large companies may be reluctant to make new investments in expansion before their debts are paid off, which leads to a decline in the value of the company.

4.1.2. GMM regression output with moderating variable effect

Table 4. Dynamic panel-data estimation, one-step system GMM

FIRMV	Coef.	Robust (Std. Err.)	t	P>|t|
MAGRIO	-0.865	1.009	0.860	0.005
INSTUO	1.334	0.665	2.00 0	0.045
FOREIO	1.924	0.680	2.830	0.005
DIDP	1.143	0.582	1.960	0.050
MAGRIO*DIDP	-3.131	1.492	-2.100	0.036
INSTUO*DIDP	-1.317	0.756	-1.740	0.081
FOREIO*DIDP	-1.588	0.927	-1.710	0.087
LEV	1.844	0.316	5.820	0.000
PROF	3.429	2.000	1.710	0.086
FS	-0.313	0.197	-1.580	0.001
/b0	2.315	2.105	1.100	0.001
Number of obs = 420		Number of groups = 35		
Number of instruments = 24		Obs per group = 12		
F(9, 34) = 3.06		Prob > F = 0.009		
GMM weight matrix: Robust				
Arellano-Bond test for AR(1) in first differences: z = -1.28 Pr > z = 0.199				
Arellano-Bond test for AR(2) in first differences: z = -0.94 Pr > z = 0.349				
Hansen test of overid. restrictions: chi2(12)= 15.40 Prob > chi2 = 0.220				
(Robust, but can be weakened by many instruments.)				

The results in Table 4 show that managerial ownership (MAGRIO) has a negative coefficient of -0.865 and a p-value of 0.005. This means that a 1% increase in managerial ownership will cause the value of the firm to drop by -0.865 units. This agrees with the findings of Mokaya and Jagongo (2015) and Mukaria et al. (2020). Institutional ownership (INSTUO) has a positive coefficient of 1.334 and a p-value of 0.045. This means that, everything else being equal, a 1% increase in institutional ownership is linked to a 1.334 unit rise in company value. This study's outcome aligns with the findings of Mukaria et al. (2020) and Oyedokun et al. (2020). Foreign ownership (FOREIO) has a positive coefficient of 1.924 with a p-value of 0.005; this result is in line with Khasawneh and Staytieh (2017) and James et al. (2021). A 1-unit increase in dividend payout (DIDP) increases company value by 1.143 units, according to a coefficient of 1.143 and a p-value of 0.050. Managerial ownership and dividend payout (MAGRIO*DIDP) on firm value (FIRMV) has a -3.135 beta and 0.036 p-value. Consequently, when dividend payments and managerial ownership both rise, firm value falls. The preference for reinvestment over dividend payments by managers who hold stock could be a consequence of agency conflict, which would allow them to retain control and resources. As a result, dividend payments are less advantageous in companies with a high level of managerial ownership. The entrenchment hypothesis, which holds that managers utilise company resources for personal gain if they are not adequately monitored, is consistent with this result. Institutional ownership and dividend payout (INSTUO*DIDP) on firm value (FIRMV) shows a negative coefficient of -1.317 and a p-value of 0.081. This result is not statistically significant. Foreign ownership and dividend payout (FOREIO*DIDP) on firm value (FIRMV) has a coefficient of -1.588 and a p-value of 0.087. This result is not statistically significant. Leverage (LEV) has a positive coefficient of 1.844 with a p-value of 0.000, indicating that leverage is a positive determinant for firms' value. The profitability coefficient is 3.429, with a p-value of 0.086, indicating that profitability has a positive and insignificant effect on firm value, meaning that a 1% increase in profitability is associated with a 3.429 increase in firm value. Firm size (FS) showed a negative coefficient of -0.313 and a p-value of 0.001, indicating that firm size has a significant effect on the firm value.

The findings of the GMM result show that, while ownership structures and dividend payout have a positive influence on firm value independently, only managerial ownership interacts with

dividend shows a positive relationship with firm value in Nigeria's manufacturing sector.

4.2. Diagnostic test

The Arellano-Bond test for AR (1) in first differences of this study is: z = -1.28, Pr > z = 0.199, suggesting that there is not enough evidence to suggest the presence of first-order autocorrelation.

The Arellano-Bond test for AR (2) in first differences of this study is: z = -0.94, Pr > z = 0.349, suggesting that the first-differenced GMM model is appropriately specified and there is insufficient evidence to suggest the presence of second-order autocorrelation in the first-differenced errors of the model.

To assess the validity of the instruments used in this study model, the Hansen diagnostic test of overidentifying restrictions was with $chi^2(12) = 15.40$ while the p-value = 0.220 at 5%, indicating that there is not enough evidence to suggest that the instruments used in the GMM estimation are invalid, and the model does not suffer from overidentifying restrictions.

5. Conclusion and recommendations

In conclusion, this study evaluated the dynamics of the effect of ownership structure on the value of listed manufacturing companies in Nigeria, with dividend payout as the moderating variable, including leverage, profitability, and firm size as the control variables. The study utilized descriptive statistics and the Generalised Method of Moments (GMM) regression model. It was found that management, institutional, and foreign ownership each have a significant effect on the value of a company. A significant impact on firm value was also exerted by the interacting relationship between managerial ownership and dividend payout. The overall findings suggested that the presence of dividend payout moderates the effect of ownership structure on firm value, particularly for managerial ownership. Based on the findings, this study recommends that management should cultivate the practice of regular payment of dividends, no matter how little it may be, to institutional and foreign shareholders to demonstrate the sustainability capacity of their company. Management should commit to long-term shareholder value creation beyond dividends paid to institutional and foreign shareholders by expanding the business, following best corporate governance practices, and implementing best corporate governance practices.

5.1. Suggested Areas for Further Studies

This study suggests that future researchers should investigate other variables that may affect the relationship between ownership structures and the value of a company. For example, the impact of family ownership, employee-agent ownership, organisational culture, or individual ownership can be examined on the value of listed companies.

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IJAAF; Vol. 10, No. 1, Winter 2026, Serial 34

Iranian Journal of
Accounting, Auditing & Finance

Ferdowsi University of Mashhad

Quarterly

RESEARCH ARTICLE

Corporate Citizenship Sustainability Reporting Model Based on Adherence to Stakeholder Norms in the Capital Market

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How to cite this article:
Shadman, M. , Moradi, M. and Salehi, M. (2026). Corporate Citizenship Sustainability Reporting Model Based on Adherence to Stakeholder Norms in the Capital Market. Iranian Journal of Accounting, Auditing and Finance, 10(1), 37-65. doi: 10.22067/ijaaf.2026.46718.1539
https://ijaaf.um.ac.ir/article_46718.html

ARTICLE INFO

Article History
Received: 2024-11-03
Accepted: 2025-06-15
Published online: 2026-02-01

Keywords:
Corporate citizenship Reporting, Information Normativity, Sustainability

Abstract

This study presented a corporate-citizen sustainability reporting model grounded in stakeholder collective norms in the capital market. This research adopted a mixed-methods approach. Initially, in the qualitative phase, the study employed Grounded Theory to identify the emerging aspects of the core phenomenon under investigation. Then, the Delphi method was used to ensure the reliability of the data derived from the interview tool. In the quantitative phase, fuzzy linguistic scales were used to identify the most central and explainable domains of corporate citizenship sustainability reporting within the capital market. The time period of the current study should be considered 2023 to 2024 for data collection. In the qualitative phase, 14 experts and scholars from the accounting community were selected based on their expertise and participated. Through interviews and three rounds of coding, a multidimensional model was developed for corporate citizenship sustainability reporting. In the quantitative phase, 25 financial managers and accounting heads from selected companies in the capital market participated in the fuzzy Todim process based on matrix checklist tools. The results of the qualitative section suggest that a framework for the development of corporate citizenship sustainability reporting serves as a basis for adherence to stakeholder norms in the capital market. The findings of the quantitative phase revealed that the "human resource disclosure enhancement functions" component had the most influential coefficient on adherence to information disclosure in corporate citizenship sustainability reporting, aligning with the inclusive normativity of stakeholders, especially internal stakeholders within companies. The contribution of this study was rooted in the theoretical views of accounting knowledge. This study focused on corporate sustainability reporting as a corporate citizen, seeking to streamline accounting procedures to strengthen stakeholders' perceptions of facts by making the effectiveness of disclosed information more persuasive. Given the limited attention to this matter in prior research, this study sought to expand accounting knowledge to enhance responsible accounting functions in the social context.

https://doi.org/10.22067/ijaaf.2026.46718.1539

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NUMBER OF REFERENCES
52

NUMBER OF FIGURES
10

NUMBER OF TABLES
10

Homepage: https://ijaaf.um.ac.ir
E-Issn: 2717-4131
P-Issn: 2588-6142

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1. Introduction

The quality of financial reporting is considered a tool at companies' disposal in the capital market, through which they aim to reduce the gap between shareholders and companies by providing transparent reports, particularly in the presence of agency conflicts (Wang and Hussin, 2024). In conditions marked by imbalances and conflicting interests, corporate behavior norms tend to change due to weaknesses in corporate governance. The absence of responsible and committed norms leads to increased conflicts between companies and their stakeholders, while adherence to ethical and social standards diminishes (Sunder, 2016). In such conditions, disruptions, conflicts, instability of norms, and, in some cases, normlessness intensify the pressure on companies to be accountable to social expectations and compel them to emphasize the quality of financial reporting. Quality in information disclosure can facilitate social and economic development, enabling a stable capital market free from tensions and distortions. In addition, social and economic planning and progress are enhanced in alignment with stakeholder expectations (Battiston and Gamba, 2016). Conflicts that arise from agency costs and reflect the difference between the company's approach to respecting stakeholders' rights and the priority interests of power holders (Mrabure and Abhulimhen-Iyoha, 2020). Furthermore, due to market inefficiencies, stakeholder accountability standards may be distorted, which, in turn, can lead to tension-generating behaviors such as herding (Bhutto et al., 2025).

Thus, the shift in the approach to organizational citizenship within the framework of contemporary management theories has led to a more coherent alignment between information disclosure functions and social expectations because corporate citizenship sustainability reporting, as a theory derived from the concept of organizational citizenship behavior, strengthens processes related to accountability and responsibility towards stakeholders within the company. The development of investment opportunities in the capital market is also facilitated by fostering trust (Sharif Khafari et al., 2023). In other words, corporate citizenship reporting is considered a symbol of humanitarian strategies that enhance companies' corporate social responsibility capabilities (Kazempour and Rahimian, 2018). In addition, a sustainable society, a healthy environmental ecosystem, and transparent corporate governance are established, ensuring the protection of the interests of both representative groups—i.e., the company and its stakeholders—within a framework that safeguards pluralistic (collectivist) interests (Hejazi and Abouhamzeh, 2014). An issue of concern for this study is the potential to achieve greater information balance in the capital markets of developing countries such as Iran through value-based normative frameworks that respect shareholder rights.

The corporate citizenship sustainability reporting approach offers a novel interpretation of corporate social responsibility concepts, expanding them into broader dimensions while considering the diverse interests of various stakeholder groups. This concept, which stems from the respect for shareholder rights, indicates a level of responsibility on the part of companies to reduce the agency cost gap (DesJardine et al., 2023). In a specific sense, this approach can be defined as the company's adherence to a set of behaviors intended to demonstrate greater legitimacy than competitors (Schlegelmilch et al., 2025). A review of related studies, such as Quick and Inwinkl (2020), Azizan et al. (2018), Ashesh and Thiruvengadam (2017), and Palacios (2004), highlights the importance of this research. These studies have indicated that the pressures arising from pursuing external stakeholders' rights, driven by the dysfunctional performance of companies in information disclosure and financial reporting at the capital market level, may encourage companies to meet a broader range of stakeholder expectations within their economic, legal, ethical, and discretionary responsibilities in disclosing information. As a result, greater integration and balance are fostered in the distribution of symmetrical details, elevating decision-making based on market knowledge and

insight. Consequently, the groundwork for sustainable financial reporting may be laid by addressing the dimensions of corporate citizenship reporting.

Developing sustainability reporting standards, which currently include 36 standards across four sections—fundamental concepts, economy, environment, and social issues—has been based on corporate citizenship. These standards were initially developed in advanced countries according to their political, economic, social, and cultural systems (Rahmani et al., 2023). In other words, the theoretical framework of sustainability reporting standards has been shaped around a liberal democratic system moving toward global order (Fateri et al., 2023). However, the need to develop and design a model and theoretical framework that takes these differences into account becomes increasingly apparent, as the legal, political, and social status of companies, like those of citizens, varies across countries, including in the Islamic Republic of Iran, with its distinct systems. In addition, the participants and stakeholders in civil, political, social, and economic processes vary across these countries. Liberal countries generally emphasize transparency and standardized reporting frameworks (like GRI or SASB) for corporate citizenship, often driven by stakeholder pressure and regulatory requirements. CSR disclosures in Iran, however, are less formalized, often voluntary, and may focus on philanthropic activities rather than comprehensive environmental, social, and governance (ESG) disclosures. There is also less external pressure for robust reporting in Iran compared to liberal democracies. Therefore, the design of this model further emphasizes the significance of this research.

From the perspective of the research literature, corporate citizenship is an interdisciplinary topic. Numerous articles have been published in various academic journals, including those focused on ethics, political science, management, economics, environmental studies, social responsibility, environmental sustainability, and accounting. In terms of timeline, corporate citizenship was first introduced in 1969 and became a serious discussion area after the corporate scandals of companies like Enron and WorldCom in 2004. The discussions during these years were primarily theoretical, and they laid the foundational principles and theoretical framework for sustainability reporting in the accounting field (Rostami and Kurdistani, 2020). There has been little extensive research on corporate citizenship in domestic studies, mainly in accounting. Most research has focused on descriptive studies, the topic's importance, and its various dimensions. Therefore, a significant gap exists in the investigation of corporate citizenship dimensions in sustainability reporting.

Therefore, during the interviews, a conceptual model is presented and applied to Iranian capital market companies, with the reliability of the identified axes measured through the fuzzy Delphi process. TODIM's fuzzy process is used for this purpose. The rest of the paper is outlined as shown in Figure 1.

2. Theoretical foundations

Corporate citizenship consistently evokes the idea that a business unit, like any other member of society, is a committed citizen adhering to social values (Ampofo and Barkhi, 2024). The organization promotes ethical values, thereby enhancing accountability, trust, and assurance in the community (Hejazi and Abouhamzeh, 2014). On the one hand, corporate citizenship seeks to promote ethical values within its structures through its organizational culture. On the other hand, it acts responsibly with respect to social values such as environmental protection and the safeguarding of shareholder rights (Mahmoudkhani et al., 2021). Matten et al. (2003), in their comprehensive conceptualization of corporate citizenship, emphasized the following three concepts according to Figure 2:

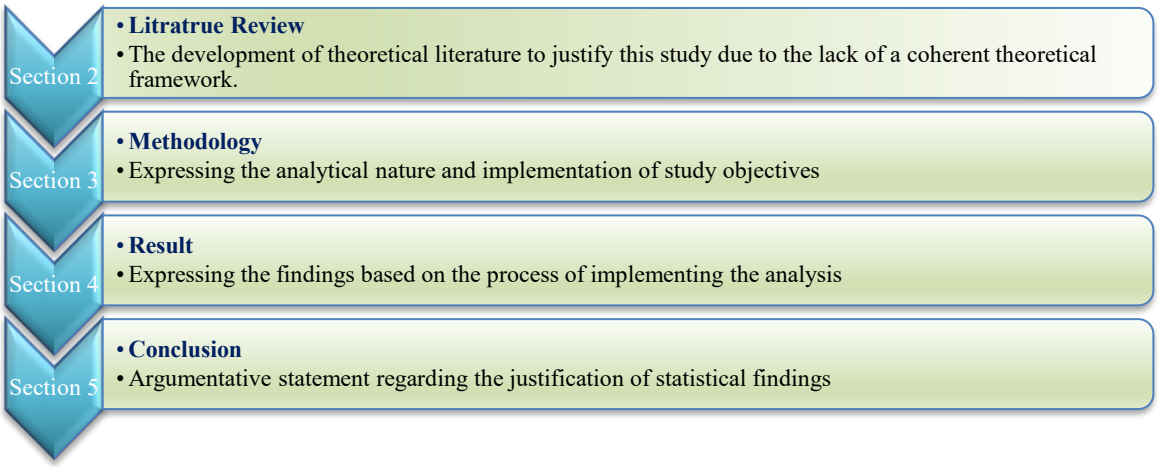


Figure 1. Outline of the paper

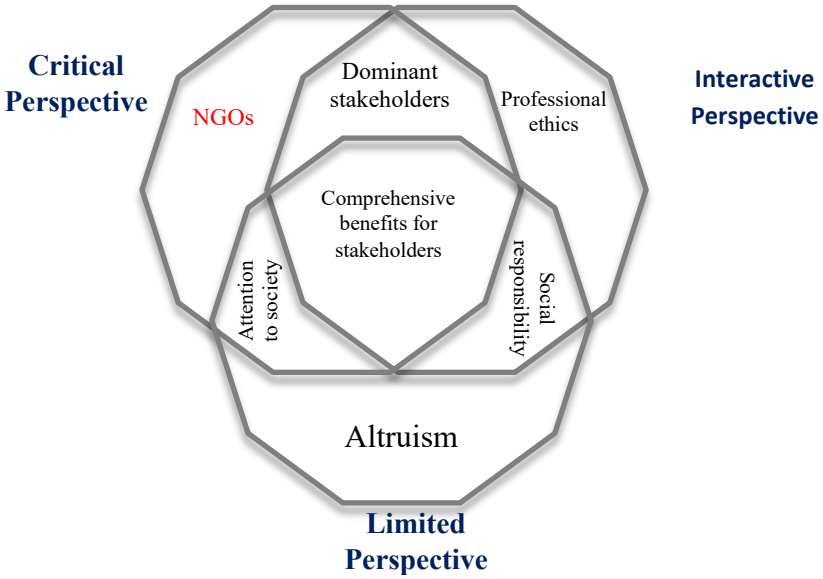


Figure 2. Dimensions of corporate citizenship

In a narrow sense, corporate citizenship refers to a company's altruism toward society, social investment, and the social responsibilities assigned to it by the community (Hejazi and Hayati, 2017). In this view, companies' role is seen merely as symbolic support for society's philanthropic and ethical values. In other words, corporate citizenship is defined based on humanitarian actions, charitable contributions, and other initiatives carried out for the benefit of society (Gulati and Diwan, 2024). Therefore, corporate citizenship is an optional activity beyond what is typically expected of a business entity (Ogola and Mària, 2020). This perspective tends to present a concept of corporate citizenship in which humanitarian activities are viewed as a strategic corporate approach (Seydabadi et al., 2025). By fostering a sustainable society, a healthy environment, and transparent political spaces, corporate citizenship can lay the groundwork for profitable business activities, thereby ensuring company benefits (Windsor, 2001).

In the balanced view, a new concept of corporate social responsibility (economic, legal, ethical, and discretionary responsibilities) is presented, emphasizing a pragmatic commitment to society's

ethical domains. In this perspective, the company merely avoids crossing social principles' boundaries and aligns itself with society's normative values (Ghorbaniyan et al., 2024). Therefore, the company seeks to implement different approaches to social responsibility based on established priorities and requirements and, on a broader scale, with a deeper understanding of stakeholder interests (Kruggel et al., 2020).

From a critical perspective, companies go beyond institutions and the potential absence of regulations, acting as critics by shaping ethical values in society. They aim to fill regulatory gaps and promote voluntary behaviors to enhance accountability towards stakeholders, building trust and confidence. According to this perspective, business entities, like all governmental institutions, must be accountable for citizens' expectations. A lack of laws should not be an excuse for indifference toward citizens' interests (Carini et al., 2021).

Understanding this concept in the corporate sector gradually led to the emergence of a functional approach to financial reporting, which emphasizes adherence to professional ethics in protecting stakeholder rights. From a critical perspective, the corporate citizenship concept does not explicitly refer to the duty of accountability and reporting (Carroll, 1998). The development of corporate citizenship reporting could play a significant role in filling the sustainability gap and protecting stakeholder and community interests (Setayesh and Mohammadian, 2011). Therefore, various theorists, such as Andersen and Johansen (2021), Carini et al. (2021), and Shinkle and Spencer (2012), have sought to make economic actors more accountable and responsible as committed citizens within society by combining political, economic, and cultural theories. The significant aspect of yjos matter is that the public sector, institutions, and the non-governmental sector, through NGOs, have not been able to develop the legal frameworks to promote the cultural values of citizenship, given the limited scope of corporate citizenship. The focus on theories derived from the core concept of corporate citizenship aims to attract stakeholder knowledge and integrate it with the company's social responsibilities for greater sustainability (Cha et al., 2023)

In other words, although the concept of corporate citizenship is significant, given the limited institutional capabilities in the upper echelons of business entities, there is a need for more significant interaction between companies and stakeholders to promote ethical behavior in financial reporting (Rego et al., 2010). Therefore, the social role of business entities in accountability, as a public benefit in society, is defined within the framework of corporate citizenship reporting. In this form of reporting, institutional pressures, aligned with stakeholder values, may lead to transparent financial reporting norms within companies. Carini et al. (2021) provided the following framework for the sustainability of corporate citizenship reporting:

According to Figure 3, the interaction between institutional pressures and stakeholder values shapes social responsibility, leading to corporate citizenship reporting. In this approach, the macrostructure of companies' social nature is reorganized to foster voluntary behaviors in information disclosure within the financial reporting framework. Within this systemic framework, the corporate citizenship approach strengthens the sustainability of companies' self-disclosure behaviors by promoting ethical values and achieving an optimal level of sustainable institutional and social norms in corporate citizenship reporting (Carroll, 2016). On the other hand, Filizöz and Fişne (2011), in another classification, divide corporate citizenship reporting into the following four dimensions:

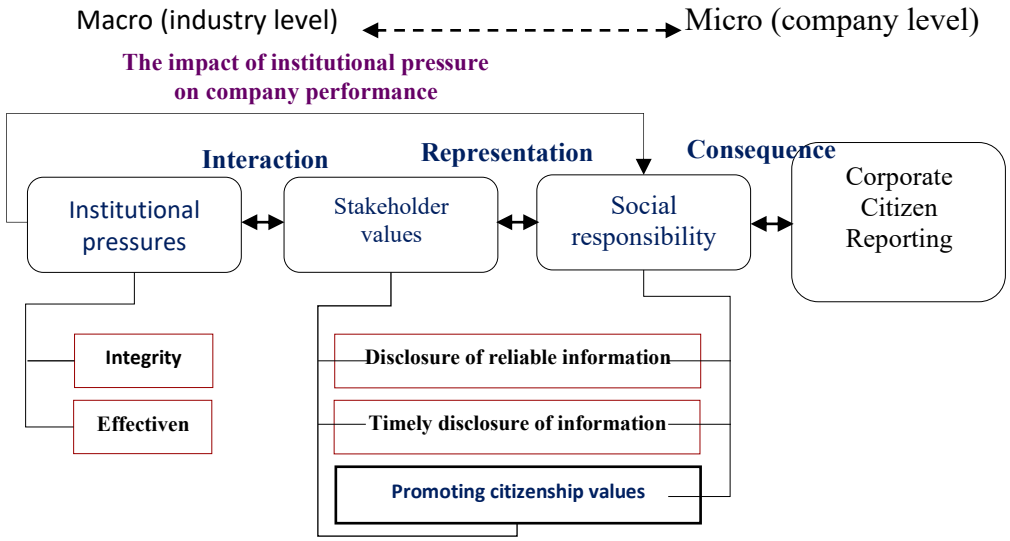


Figure 3. The proportion of institutional pressures to stakeholder pressures, like corporate citizenship reporting



Figure 4. Dimensions of corporate citizenship reporting

According to this model in Figure 4, the economic citizen, as the first dimension, refers to the role of business in generating economic benefits within society. In this role, companies should consider activities that benefit the overall economy. Therefore, in contrast to traditional theories, this approach does not focus solely on profit-making and wealth creation for owners or shareholders, but instead seeks to achieve an equal level of economic efficiency for society (Hejazi and Abouhamzeh, 2014). The legal citizen highlights that companies should comply with established laws and regulations and fulfill their legal obligations. Therefore, companies' most essential legal responsibility is to undertake economic missions mandated by law as legal citizens. Any deviation from legal responsibility can disrupt the balance of the corporate citizenship reporting approach. Although it is difficult to provide a precise definition due to the ethical citizen approach's broad conceptual scope, it encourages companies to go beyond legal obligations by

adhering to standards and addressing legal deficiencies through transparent reporting to stakeholders (Carroll, 2016). Finally, voluntary citizenship refers to companies' voluntary functions in financial reporting, often categorized as humanitarian. The reason for using the term "voluntary citizen" is the lack of obligation to fully disclose information in areas such as carbon emissions, legal issues, and other dimensions of company reporting. Adherence to these areas depends on the company's perspectives and the level of social responsibility regarding humanitarian and voluntary actions (Rego et al., 2010). In addition, these dimensions can vary depending on the objectives and social contexts in which companies operate. Focusing on the relevant practices related to companies' functions in their social environment is essential to implement them effectively (Rafay and Siddiqui, 2025).

On the other hand, Lamberton (2005), in alignment with the sustainability reporting guidelines of the *Global Reporting Initiative (GRI)*, proposed a framework based on two axes: the functions of reporting regarding focus on disclosure (vertical) and the users of information in terms of being internal or external (horizontal). This framework aims to outline justifications that could potentially assist accounting in contributing to sustainability (Figure 5).

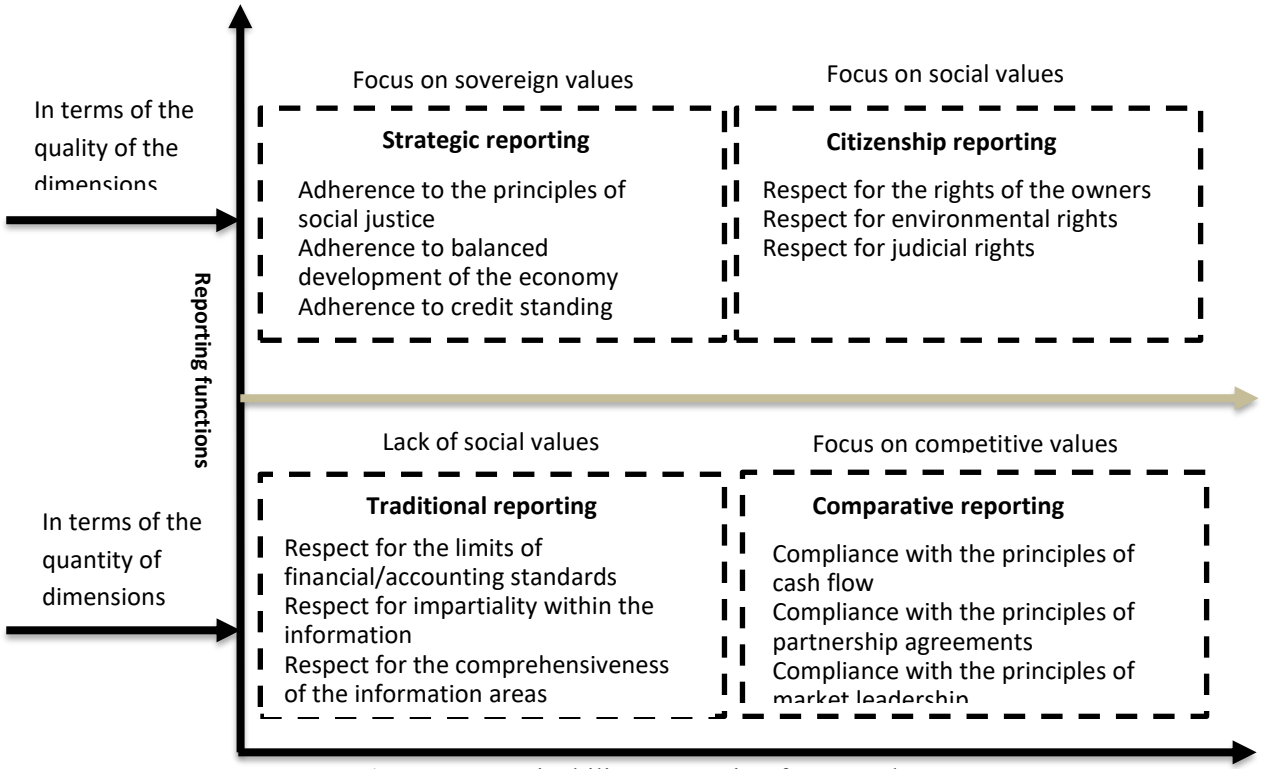


Figure 5. Sustainability accounting framework

As shown in Figure 5, the intersection of qualitative reporting functions with a focus on external users leads to the desired reporting method, which is citizenship reporting. This approach, which heralds social values, can assist accounting in achieving sustainability by upholding stakeholder, environmental, and legal rights. On the other hand, the intersection of qualitative reporting functions with a focus on internal users suggests that sustainability can be achieved through strategic reporting, adhering to strategic guidelines, and fostering balanced development while maintaining creditworthiness (Ghorbanzadeh, 2024). Additionally, the intersection of quantitative reporting functions, focusing on external users, proposes competitive reporting to achieve sustainability. Finally, the intersection of quantitative reporting functions with a focus on internal

users suggests that companies typically pursue traditional reporting methods, which generally fail to achieve sustainability values while being comprehensive and inclusive in principle (Katona, 2024).

Thus, based on the discussed theoretical foundations and identified research gap regarding the absence of a reference framework for corporate citizenship sustainability reporting, research questions can be posed in line with the study's objectives regarding methodology and analytical implementation:

- *Research Question 1:* What are the core areas of corporate citizenship sustainability reporting within the capital market?
- *Research Question 2:* What is the most significant area that can explain corporate citizenship sustainability reporting within the capital market?

The first research question is addressed through coding in Grounded Theory Analysis and Glaser's approach. In contrast, the second research question is examined in pairwise comparison and expanded evaluation matrices.

2.1. Literature review

Carini et al. (2021) completed a study entitled "Global Sustainability and Corporate Citizenship Requirements." The findings suggested that self-regulation is a criterion for assessing adherence to sustainability standards, which can strengthen strategic legitimacy and lead to outcomes such as maintaining an inclusive identity and respecting stakeholder rights, thereby laying the groundwork for corporate citizenship. Caputo et al. (2022) conducted a study entitled "Enhancing Environmental Information Transparency through Corporate Citizenship Sustainability Reporting." The findings showed that corporate governance and reporting characteristics influence environmental transparency. Moreover, the findings showed that building obstacles to environmental information disclosure can significantly influence the management of stakeholder opinions about the company's strategic decisions, while negatively influencing the relationship between businesses and stakeholders inside the corporate citizenship framework. Bracci et al. (2023) in "Understanding Citizen-Centric Financial Reporting: Evaluating the Views of Standard Setters" investigated how standard setters grasp changing values and expectations of stakeholders and are accountable for promoting corporate citizenship in financial reporting. The findings confirmed that developing citizen participation frameworks can help identify their expectations from municipal functions and provide inclusive local reports for stakeholders, particularly in disclosing financial and non-financial data. Granados-Sanchez (2023) carried out a study titled "Providing a sustainable citizenship framework: exploring a critical realist approach" to reflect the sustainable citizenship approach from the perspective of critical realism. The goal of the sustainable citizenship approach is to bridge the gap between the realities of pragmatist approaches that require societies to focus on the theoretical foundation of citizenship to achieve sustainability. Kashanipour et al. (2020) published a study titled "Foresight of Sustainability Reporting Using Scenario Writing Approach." Finally, based on the experts' opinions, four scenarios for the future of sustainability reporting were developed, with specific recommendations for each scenario. Setayesh and Mohammadian (2011) investigated "Value Creation through Corporate Citizenship Reporting in Banks." The findings revealed that corporate citizenship reporting positively and significantly impacts value creation within banks. This result indicated that the value of corporate citizenship reporting increases as banks disclose more indicators. Banks can influence their value creation, reduce capital costs, lower agency costs, increase liquidity, and improve financial performance and the quality of financial reporting by providing corporate citizenship reports and disclosing both financial and non-financial indicators. In turn, this leads to an increase in the bank's overall value and a greater market share. Abedi et al. (2025) conducted a study titled "Designing a corporate citizenship financial reporting

model to satisfy stakeholder information needs effectively." The results of the axial coding revealed causal conditions with 19 core concepts under four paradigm codes, contextual conditions with 26 core concepts under four paradigm codes, intervening conditions with 19 core concepts under four paradigm codes, strategic conditions with 35 core concepts under three paradigm codes, consequential conditions with 16 core concepts within three paradigm codes, and central conditions with 12 core concepts within three paradigm codes. These form the foundation of the model. The validation results also indicated that the developed model possesses the necessary credibility.

A review of the presented empirical literature confirms the originality of this paper, as no previous studies have focused on developing a corporate citizenship sustainability reporting model at the capital market level. This study significantly contributes to expanding the knowledge base in this area of financial reporting functions designed to meet citizens' expectations.

3. Research Methodology

Given the lack of a cohesive framework for understanding the dimensions of corporate citizenship sustainability reporting, this study can be categorized as developmental research in terms of its outcome. From a goal-oriented perspective, this study is exploratory, aiming to identify emerging aspects of the core phenomenon within the study context that were previously overlooked through interviews with active scholars in the field. Ultimately, this study should be considered a mixed-methods study, consistent with both inductive and deductive reasoning. The development of corporate citizenship sustainability reporting is implemented in the qualitative phase of the study through Grounded Theory analysis. This analysis contributes to conceptualizing the identified dimensions of the core phenomenon into a multidimensional model. The approach used in the Grounded Theory modeling is based on the emerging or unfolding approach of Glaser (1992), which involves three stages of coding: open, axial, and selective during expert interviews to identify the dimensions of corporate citizenship sustainability reporting. In the next step of the qualitative phase, the Delphi method is applied to validate the reliability of the identified core dimensions. Finally, in the quantitative phase, following a deductive approach, paired-comparison matrices are used to determine the most central dimension of corporate citizenship sustainability reporting within the context of the study.

3.1. Participants of the study

Given the nature of data collection in the qualitative section, the participants in this part of the study are academic-level accounting experts and specialists. These individuals, considered knowledgeable and experienced in accounting practices, information disclosure, and reporting, were selected through theoretical and snowball sampling. In the qualitative phase, to conduct interviews, efforts were made to consider participants' expertise based on their educational backgrounds in reporting and sustainability, as well as their research experience in these areas. The individuals who could provide a broader understanding of the phenomenon under investigation during the interviews, due to their knowledge and cognitive awareness, were invited. After the interviews began, the first three interviewees were selected, and additional participants were identified through a snowball sampling process based on the aforementioned criteria. A total of 14 interviews were conducted, as theoretical saturation was used as the basis for ending interviews in this type of research. Then, the participation of these experts (14 people) is used to verify reliability through the Delphi process. In the quantitative phase of the present study, financial managers and accounting heads of selected companies in the capital market were identified through the gatekeeper technique and invited to complete matrix checklists. The gatekeeper technique was used to select participants

who could contribute to data collection aligned with the study's objectives based on their experience and sufficient knowledge. The sample selection process focused on the nature of homogeneous sampling and the participants' availability. Based on similar research by Hasani Moghadam et al. (2023), Narkhede et al. (2017), and Mhatre et al. (2017), which determined the optimal participation range for matrix analysis processes (15-30 individuals), a total of 25 informed individuals were selected.

3.2. Data collection and analysis

In line with the methodology outlined, the qualitative phase of the study aims to identify the areas for developing corporate citizenship sustainability reporting through Grounded Theory. Because the phenomenon under investigation is relatively new in financial reporting, the open (in-depth) interview technique was used for the initial interview with experts, allowing coding at the end of each interview, categorizing the open codes, and connecting them to axial codes. The goal was to identify conceptual themes and core components, thereby clarifying the broader aspects of the phenomenon through categorization. Once the foundational categories were established through the coding process, the interviewees used the semi-structured interview technique to achieve theoretical saturation, ensuring balanced development of the themes and components. The data were collected organically within the phenomenon under study. As such, specific interview questions were not predetermined for all interviews. Instead, the questions were selected based on the interviewees' levels of expertise and their responses in real time. This approach ensured that the sentences articulated during the interviews were not left without a deep understanding by the interviewees. Thus, the research question design process followed a "Turn and Turn" approach, commonly referred to as the "U" method (Scheibelhofer, 2023). This method was adopted to ensure the flow of questions and responses that reflect the evolving understanding of the experts, contributing to a dynamic and comprehensive data collection.

Once the dimensions related to the phenomenon under investigation were identified, the fuzzy Delphi method was employed to assess the reliability of the core components identified in the qualitative phase, enabling generalization of the findings to the context of companies in the capital market. Given the nature of the quantitative analysis, which focuses on the Interpretive Ranking Process, the fuzzy Delphi process can be more effective at homogenizing data for quantitative evaluations. Due to its reliance on fuzzy linguistic scales, this process holds high validity for generalizing the identified criteria to the study context. Therefore, fuzzy analysis was employed to ensure reliability, given the potential dispersion in theoretical perceptions of the dimensions identified in the qualitative phase. In this analysis, the Triangular Fuzzy Number (TFN) scale, which incorporates linguistic criteria, was used to effectively capture variations in expert judgment.

Finally, data were collected through scoring checklists and paired comparisons after validating the reliability of the dimensions through a fuzzy Delphi analysis, and assigning specific codes to each core component confirmed in the previous stage. This process gathers the necessary data from the participants in the quantitative phase to perform the fuzzy Todim process. This analysis method, based on a Multi-Criteria Decision-Making (MCDM) framework, aims to identify the most influential decision-making criterion within a value perspective. As shown in relation (1), the goal is to determine the most significant dimension by evaluating its impact against the decision-making criteria defined in the study.

As shown in Figure 6, the value axis, which is positioned between cost-benefit considerations, acts as a vector that distinguishes the boundary between more influential and less influential criteria in a value-based process, which can be expressed in the following relationship:

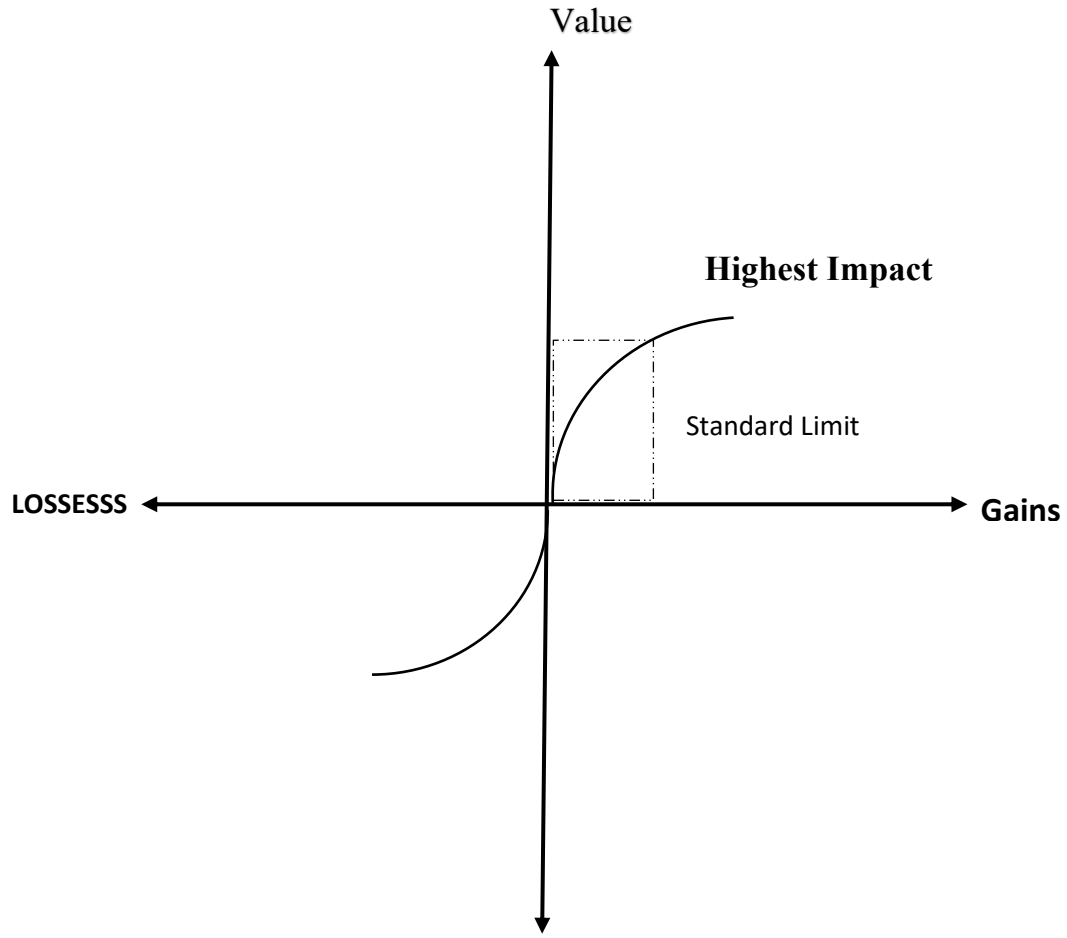


Figure 6. Multi-criteria decision-making protocol based on fuzzy implementation of Todim

$$\vartheta(x) = \begin{cases} x^{a} if x > 0 \\ -\theta(x)^{\beta} if x < 0 \end{cases} \quad (1)$$

In this context, "a" and "β" represent the parameters associated with cost (loss) and benefit (profit), respectively. The parameter "θ" indicates the characteristic of the degree of deviation toward loss relative to profit. Regarding risk aversion in the loss region, "θ < 1". Therefore, this diagram can represent a prospect value function with both convex and concave segments in the shape of an "S," which can be evaluated in a multi-criteria decision-making context. In this process, the aim is to select the criteria with the highest desirability by determining matrix weights.

4. Research findings

Through the combined data collection and analytical implementation process, the first part of the research findings, from a qualitative perspective, aimed to categorize the themes, components, and categories of the phenomenon under investigation using Glaser's approach in the Grounded Theory process. To better understand the findings in this section, the identified themes, components, and categories influencing the development of corporate citizenship sustainability reporting are presented below.

A) First category: adherence to human resource rights

Since the core phenomenon of this study is based on the corporate citizenship approach, interview questions were designed to cover aspects of sustainability reporting as perceived by experts. The results identified 84 open codes for combining themes and components within this category. Of these 84 open codes, 49 were related to the "Disclosure Functions for Human Resource Effectiveness" component, and 35 to the "Disclosure Functions for Human Resource Enhancement" component. These components are further elaborated in the sections below with their identified themes.

Disclosure functions for human resource effectiveness

This component of financial reporting emphasizes the qualitative aspects of human resource performance, seeking to identify actions taken by human resources to stimulate incentives for higher returns for the company. To determine a company's sustainability, one must identify the gap between its current state and the desired sustainable state. As mentioned, 49 open codes were identified in the formation of this component, and their conceptual themes are presented below:

- Disclosure of the ratio of company value-added to investment in human resources
- Disclosure of the ratio of innovation and inventions to total human resources
- Disclosure of the human resource productivity ratio
- Disclosure of the ratio of professional human resources to total human resources
- Disclosure of the ratio of professional human resources to company value-added

Disclosure functions for human resource enhancement

In this component, financial reporting focuses on the qualitative aspects of human resource performance and aims to disclose the practical capabilities of human resources through training and fair compensation. The goal is to examine how companies, considering the costs and benefits of human resource development, can achieve a more sustainable level of competitive performance. As mentioned, 35 open codes were identified in the formation of this component, and their conceptual themes are presented below:

- Disclosure of the ratio of human resource rewards to the reduction of unit costs
- Disclosure of the ratio of incentive allocation to the reduction of unit costs
- Disclosure of the ratio of training costs to total salary and wage costs
- Disclosure of the ratio of training costs to operational expenses
- Disclosure of the ratio of human resource rewards to human resource retention costs

Thus, the Adherence to Human Resource Rights category consists of two central components and 10 conceptual themes, as illustrated in Figure 7.

B) Second category: adherence to institutional rights

In the identification of this category, which consisted of a total of 109 open codes, the following key components emerged:

- Disclosure functions for corporate governance (39 open codes)
- Disclosure functions for the effectiveness of information systems (36 open codes)
- Disclosure functions for legal/Judicial legitimacy (34 open codes)

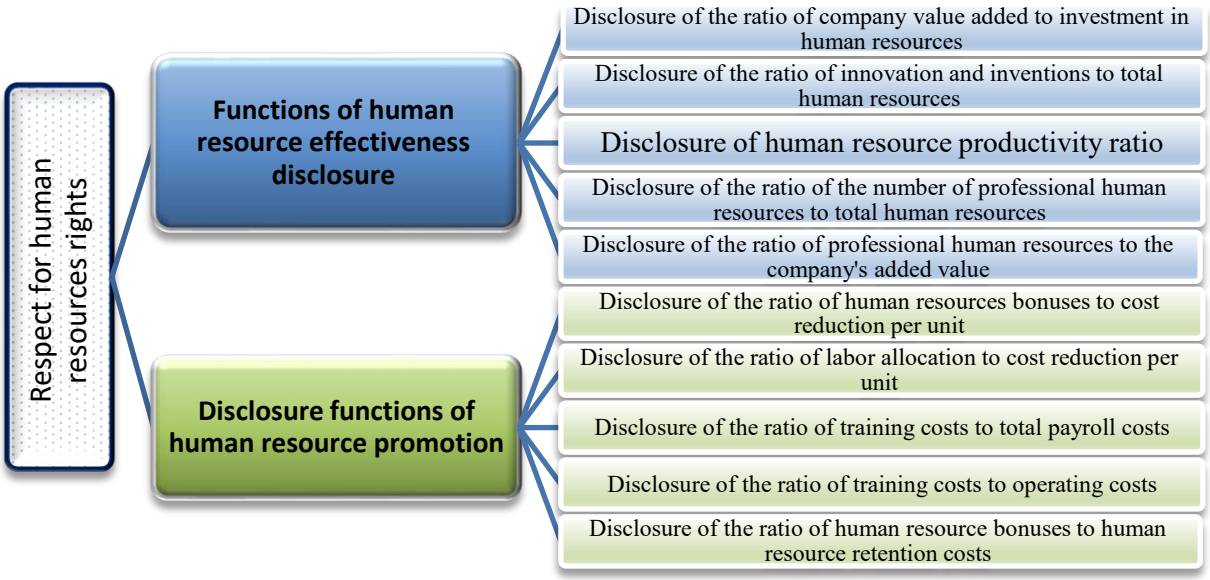


Figure 7. Dimensions related to the category of respecting human resources rights

Disclosure functions for corporate governance

In this component, financial reporting aims to disclose the composition of the board of directors and the ratios that can contribute to effective oversight of institutional rights, thereby fostering a corporate citizenship approach to achieving higher sustainability within companies. Therefore, a total of 5 conceptual themes were recognized as follows, with 39 open codes identified in this key component:

- Disclosure of the ratio of professional board members to total board members
- Disclosure of board member compensation relative to legal damages from lawsuits
- Disclosure of the ratio of non-executive board members to total board members
- Disclosure of the ratio of CEO tenure to the number of legal cases
- Disclosure of the ratio of professional executive managers to all appointed managers

Disclosure functions for the effectiveness of information systems

In this component, financial reporting focuses on disclosing the level of investment in information systems and the potential returns achievable through structural monitoring, both inside and outside the company, to enhance corporate citizenship effectiveness and achieve higher sustainability. Therefore, with 36 open codes identified in this key component, a total of 5 conceptual themes were recognized as disclosure of:

- Risk details through management accounting information systems
- Institutional guidelines for the development of information rights
- The return on operational transaction system performance in information transparency
- The return on investment in information systems relative to the shareholder opportunity cost
- Investments made in cloud accounting infrastructure development

Disclosure functions for legal/Judicial legitimacy

In this component, financial reporting aims to disclose companies' operational capacities in terms of legal claims and auditors' reports, which can serve as a basis for evaluating corporate responsibility in effectively balancing adherence to corporate citizenship values to achieve higher

sustainability for companies. Therefore, with 34 open codes identified in this key component, a total of 6 conceptual themes were recognized as disclosure of:

- The number and outcomes of the company's legal case files
- Financial misconduct reports
- The results of legal risk assessments
- Auditors' reports
- Internal control reports based on organizational health levels
- Reports related to tax exemptions

Thus, the adherence to institutional rights category consists of three key components and 16 conceptual themes (Figure 8).

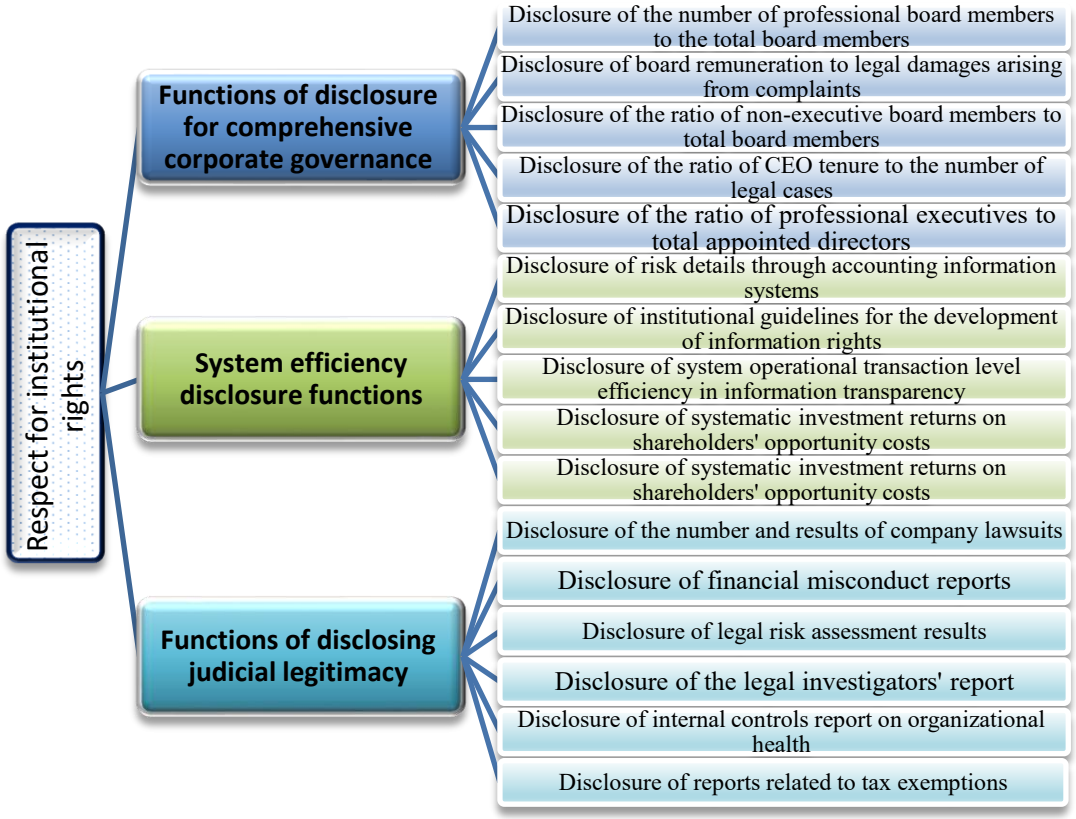


Figure 8. Dimensions related to the category of respecting institutional rights

B) Second category: adherence to social rights

In identifying this category, which consisted of a total of 94 open codes, the following central components emerged: "disclosure functions for protecting shareholders' interests" with 35 open codes; "disclosure functions for protecting environmental resources" with 34 open codes; and "disclosure functions for energy accountability" with 25 open codes.

Disclosure functions for protecting shareholders' interests

In this component, financial reporting seeks to disclose companies' operational capabilities in protecting shareholders' interests, aiming to determine how competitive mechanisms can help meet shareholders' expectations from a corporate citizenship perspective and contribute to higher company sustainability. Thus, with 35 open codes created in this central component, six conceptual

themes were identified as disclosure of:

- Transactions with related parties
- Major customers' information
- Internal control weaknesses
- Information related to managerial ownership percentage
- Executive compensation
- Percentage of free-floating shares

Disclosure functions for protecting environmental resources

In this component, financial reporting focuses on effective mechanisms for disclosing environmental information as one of the key pillars of social values in the sustainable development of companies from the perspective of corporate citizenship. Companies can gain a competitive advantage by disclosing environmental costs and other voluntary aspects. Therefore, with 34 open codes created in this central component, five conceptual themes were identified as disclosure of:

- Environmental pollution costs
- Carbon emissions from production lines
- The ratio of waste recycling to operational profit
- Results from product life cycle assessments
- The ratio of waste recycling to overhead production costs

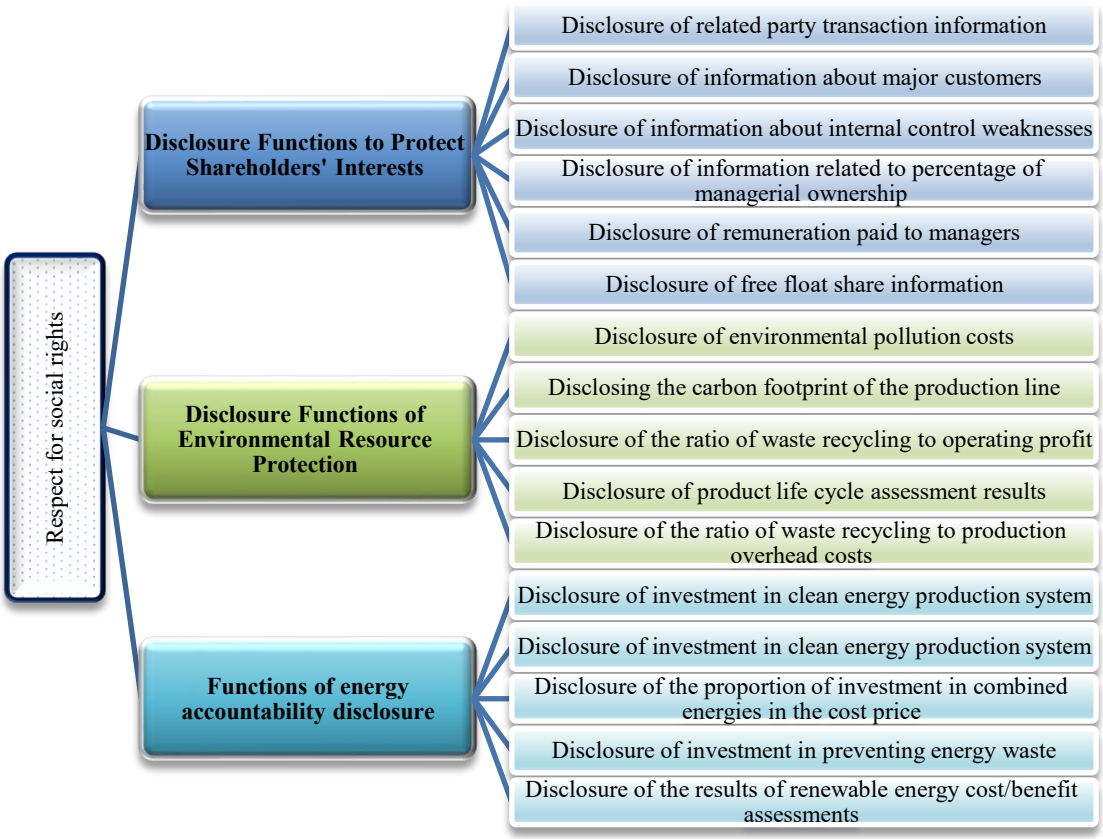


Figure 9. Dimensions related to the category of respecting social rights

Table 1. Breakdown of codes generated from conducted interviews

Identified Categories	Identified Components	Themes	Open Codes	Frequency Percentage
Adherence to Human Rights	Disclosure Functions: Human Resource Effectiveness	5	49	17.07%
	Disclosure Functions: Human Resource Promotion	5	35	12.19%
	Disclosure Functions: Comprehensive Corporate Governance	5	39	13.58%
Adherence to Institutional Rights	Disclosure Functions: Efficiency of Information Systems	5	36	12.54%
	Disclosure Functions: Legal/Judicial Legitimacy	6	34	11.84%
	Disclosure Functions: Protection of Shareholders' Interests	6	35	12.19%
Adherence to Social Rights	Disclosure Functions: Environmental Protection	5	34	11.84%
	Disclosure Functions: Energy Accountability	5	25	8.75%
Column Total	Eight Identified Components	42	287	100%

Disclosure functions for energy accountability

In this component, financial reporting seeks to disclose strategies for transitioning to renewable energy to assess the feasibility of achieving sustainable development from the corporate citizenship approach. Companies that leverage opportunities to move toward clean energy have a competitive edge in achieving sustainability. Therefore, with 25 open codes created in this central component, five conceptual themes were identified as disclosure of:

- Investments in production and assembly systems based on clean energy
- Research and development investments for utilizing renewable energy
- The ratio of investment in hybrid energy sources to the product cost price
- Investments in preventing energy wastage, such as heating systems and compressed air systems
- Results from cost/benefit evaluations of renewable energy

Thus, the category of adherence to social rights consists of three central components and 16 conceptual themes, as illustrated in Figure 9.

Based on the information presented in Table 1, among the total 287 initial open codes, corporate citizenship sustainability reporting, as an emerging phenomenon, can be examined across three categories, eight components, and 42 conceptual themes. Therefore, in the following section, Figure 10 presents the study's conceptual framework for categorizing the concepts and sub-classifications derived from the interviews.

In the following, a fuzzy Delphi analysis should be utilized to assess the reliability of the core components. Delphi analysis serves as a link between qualitative and quantitative analysis by evaluating the reliability of the model's dimensions and facilitating the conceptualization of the model’s components using the research tools used in the target population in the quantitative section. In this study, fuzzy Delphi analysis has been employed to assess the reliability of the core components of the proposed model. The triangular fuzzy number (TFN) scale, which includes a five-point linguistic scale according to Table 2, should be used to perform fuzzy Delphi analysis.



Figure 10. Theoretical framework for the development of sustainable corporate citizenship reporting

Table 2. Triangular Fuzzy Number scale

	Linguistic Scale	1	3	5	7	9
	Linguistic Phrases	Very Low	Low	Medium	High	Very High
Fuzzy Numbers	(U)	3	5	7	9	10
	(M)	1	3	5	7	7
	(L)	0	1	3	5	9

Based on the expanded fuzzy numbers, at this stage, fuzzy Delphi checklists with five options should be distributed among the experts to calculate the fuzzy average. For this purpose, the experts' opinions should be aggregated to compute the fuzzy average. The fuzzy average is calculated using the formula in Equation (2).

$$F_{AGR} = \left[min(i)\left\{\frac{\sum m}{n}\right\}, max(u)\right] \quad (2)$$

In Equation (1), n represents the aggregation of the experts' opinions; i is the minimum of the experts' opinions; m denotes the average of the experts' opinions; and u is the maximum. Then, the fuzzy defuzzification of the average expert opinions should be performed. Typically, the aggregation of triangular fuzzy numbers can be converted to a precise value of the best defuzzified fuzzy average. Therefore, according to Equations (3) to (5), the average of the triangular fuzzy

numbers is defuzzified as follows:

$$F_{AVG} = (L_{ik}, M_{ik}, U_{ik}) \quad (3)$$

$$X_m^n = \frac{(L_{ik}, M_{ik}, U_{ik})}{n} \quad (4)$$

$$Crisp\ Number = Z^* \Rightarrow (X_{max}^1, X_{max}^2, \cdots, X_{max}^k) \quad (5)$$

In these equations, k represents the number of core components, and $Z^\wedge$ is the squared value of the defuzzified average. Additionally, u^{ij}, m^{ij}, and l^{ij} refer to the maximum, most probable, and minimum evaluation values for the k-th criterion, respectively. The threshold for this analysis is set at 0.7, as determined by Sahoo and Thakur (2024). Therefore, a defuzzified value of 0.7 or higher is considered the acceptance threshold for the identified dimensions in this study. In other words, any defuzzified value greater than 0.7 is acceptable, while scores below 0.7 are deemed as rejection criteria.

Table 3. Reliability obtained from Fuzzy Delphi analysis

Result	Defuzzified Average Value	*Fuzzy mean*			Components
		l	***m***	***u***	
Confirmed	0.790	0.760	0.810	0.870	Disclosure Functions: Human Resource Effectiveness
Confirmed	0.720	0.680	0.750	0.820	Disclosure Functions: Human Resource Promotion
Confirmed	0.800	0.740	0.830	0.900	Disclosure Functions: Comprehensive Corporate Governance
Confirmed	0.770	0.740	0.790	0.850	Disclosure Functions: Information Systems Efficiency
Confirmed	0.800	0.750	0.830	0.900	Disclosure Functions: Legal/Judicial Legitimacy
Confirmed	0.820	0.750	0.840	0.910	Disclosure Functions: Protection of Shareholders' Interests
Confirmed	0.760	0.730	0.780	0.840	Disclosure Functions: Environmental Protection
Confirmed	0.810	0.780	0.830	0.890	Disclosure Functions: Energy Accountability

According to Table 3, all identified core components achieve the desired level of desirability, scoring above 0.7 in the fuzzy Delphi analysis, and can therefore be extended to matrix processes.

Next, the TODIM fuzzy analysis determines the most desirable axis of corporate citizenship sustainability reporting. Thus, pairwise comparisons are made by placing each confirmed component from the qualitative section in row i and column j to examine whether there is a direct, inverse, or mutual effect between the matrix dimensions.

Table 4. Linguistic scales based on pairwise relations

Linguistic Variables	Very High Impact	High Impact	Low Impact	Very Low Impact	No Impact
Fuzzy Values	(8, 9, 9)	(6, 7, 8)	(4, 5, 6)	(2, 3, 4)	(1, 1, 1)

In Table 4, for each research proposition, a five-point scale ranging from "Very High Impact" to "No Impact" was used in the questionnaire. For each of these, fuzzy sets with fuzzy membership functions were defined (Tesfamariam and Sadiq, 2006). Accordingly, these numbers are commonly used in fuzzy controller applications, such as decision-making, to select the best solution. Mathematical models are presented to extend the initial definitions of fuzzy numbers.

Step 1: Designing Fuzzy Linguistic Criteria

Based on the criteria established in the qualitative section, this step prioritizes the components of corporate citizenship sustainability reporting. These criteria should be organized to eliminate uncertainty according to the linguistic criteria provided in Table 4. After collecting the questionnaires, each linguistic term is assigned its corresponding value, as shown in Table 4.

Step 2: Providing matrix checklists to participants

In this step, each participant is asked to specify the impact of each dimension on the other dimensions through pairwise comparisons. The symbol $\tilde{o}_{ij} = (l_{ij} \cdot m_{iy} \cdot u_{ij})$ represents the respondent's opinion regarding the impact of the identified dimension on the others. In other words, the effect of the column dimension *i* on the row dimension *j* is examined.

Step 3: Initial decision matrix

The initial decision matrix $\tilde{o}$ is derived from the simple average of the opinions of all participants who evaluated the checklists and is calculated using Equation (6), where $\tilde{o}_{ij} = (l_{ij} \cdot m_{iy} \cdot u_{ij})$ represents the sum of the triangular fuzzy dimensions.

$$\tilde{o} = \begin{bmatrix} \tilde{o}_{11} & \cdots & \tilde{o}_{1n} \\ \vdots & \ddots & \vdots \\ \tilde{o}_{m1} & \cdots & \tilde{o}_{mn} \end{bmatrix} \cdot \tilde{o}_{ij} = \frac{1}{P} \times \sum_{P=1}^{P} \tilde{\alpha}_{ij}^{P} \quad (6)$$

Step 4: Calculating the normalized matrix (z̃)

The sum of the values of each criterion must be divided by the sum of all the components (column elements) to normalize the matrix of the identified dimensions. Therefore, Equations (7) to (9) are used to determine the normalized matrix.

$$\tilde{Z}_h = {}^{1}/_{K} \times \tilde{O}_h; \quad h = l.m.u \quad (7)$$

$$K = \max_{1 \le i \le n} \left(\sum_{j=1}^{n} U_{ij} \right) \quad (8)$$

$$\tilde{Z} = \begin{bmatrix} \tilde{Z}_{11} & \cdots & \tilde{Z}_{1n} \\ \vdots & \ddots & \vdots \\ \tilde{Z}_{m1} & \cdots & \tilde{Z}_{mn} \end{bmatrix} \quad (9)$$

Step 5: Calculating the matrix (ṽ)

Since three-component linguistic criteria and triangular fuzzy numbers are used for this analysis, the elements of each three-component item in the normalized matrix are separated to determine three matrices: $\tilde{Z}_l$, $\tilde{Z}_m$, and $\tilde{Z}_u$. Then, for each matrix, the fuzzy limits $(l''_{ij}; m''_{ij}; u''_{ij})$ are calculated using Equations (10) to (12).

$$l''_{ij} = \tilde{Z}_l \times (I - \tilde{Z}_l)^{-1} \quad (10)$$

$$m''_{ij} = \tilde{Z}_m \times (I - \tilde{Z}_m)^{-1} \quad (11)$$

$$u''_{ij} = \tilde{Z}_u \times (I - \tilde{Z}_u)^{-1} \quad (12)$$

After these relationships, each lower, middle, and upper fuzzy limit should be combined to calculate the matrix $\tilde{v}$. In other words, the elements of the matrices $(l''_{ij}; m''_{ij}; u''_{ij})$ form the first, second, and third components of the elements of the matrix $\tilde{v}$, as specified in Equation (13).

$$\tilde{v} = \begin{bmatrix} \tilde{v}_{11} & \cdots & \tilde{v}_{1n} \\ \vdots & \ddots & \vdots \\ \tilde{v}_{m1} & \cdots & \tilde{v}_{mn} \end{bmatrix} \quad (13)$$

Step 6: Converting fuzzy Numbers to non-fuzzy numbers

In this step, the fuzzy numbers should be converted to non-fuzzy numbers according to Equation (14), where *m* and *u* are each element's first, second, and third components.

$$V = \frac{(l+4_m+u)}{6} \quad (14)$$

Step 7: Assessing $D_i - R_i$ and $D_i + R_i$ for optimal utility optimization

In this step, the values of *D* and *R* for each factor are obtained by summing the rows and columns of the defuzzified matrix. Then, based on the $D_i - R_i$ and $D_i + R_i$ elements, the intensity of influence and responsiveness in each element is calculated, forming the basis for decision-making. Finally, the weight of each criterion, based on its importance in achieving optimization, is incorporated into the TODIM analysis process (Table 5). Based on the analytical sequences, the multi-criteria decision-making (MCDM) process is determined under the value model presented in Figure 1. This process uses the combination of weights through the DEMATEL technique to select the most critical criterion in the qualitative phase.

Table 5. Fuzzy TODIM Inference for Determining the Importance of Initial Criteria

F_n	$\cdots$	F_2	F_1	
W_m	$\cdots$	W_2	W_1	W_F
P_{1m}	$\cdots$	P_{12}	P_{11}	E_1
P_{2m}	$\cdots$	P_{22}	P_{21}	E_2
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$
P_{nm}	$\cdots$	P_{n2}	P_{n1}	E_n

In this matrix, *m* criteria $(F_1, \cdots F_m)$ and *n* options $(E_1, \cdots E_n)$ are available, such that P_{ij} represents the score assigned to the *i*-th option based on the *j*-th criterion ($F = 1, \cdots, m$). Additionally, W_F is the weight of the importance of criterion *F*. The fuzzy TODIM inference process can be executed in three steps, as shown in Equations (10) to (12).

Step 1: If P_{ij} and P_{ji} are the total scores assigned to the research options based on the components ($j = 1, \cdots, m$), the relative difference $(P_{ij} - P_{ji})$ of the identified criteria must first be calculated. Therefore, according to Equation (10), $\varphi_F = (E_i, E_j)$ should be calculated.

$$\varphi_F = (E_i, E_j) = \begin{cases} \sqrt{w_F \times (P_{ij} - P_{ji})}, (P_{ij} - P_{ji}) > 0 \\ 0, \quad (P_{ij} - P_{ji}) = 0 \\ \frac{-1}{\theta}\sqrt{\frac{-(P_{ij} - P_{ji})}{w_F}}, (P_{ij} - P_{ji}) < 0 \end{cases} \quad (15)$$

Therefore, θ should be considered a reduction factor.

Step 2) In this step, the degree of dominance of the option E_i over option $\delta(E_i, E_j)$ should be calculated based on Equation (16).

$$\delta(E_i, E_j) = \sum_{F=1}^{m} \varphi_F = (E_i, E_j), \forall (i, j), i \neq j \quad (16)$$

Step 3) Finally, the final weights for each identified criterion should be calculated by expanding Equation (17) in the following order.

$$w_j = \frac{\delta(E_j)}{\sum_{j=1}^{n} \delta(E_j)} \quad (17)$$

Therefore, weighting is based on the criteria for sustainable reporting to determine the most critical dimension in professional functions. As explained earlier, comparing the requirements must first be carried out using the five verbal expressions in Table 5 to form a fuzzy matrix. As observed,

the fuzzy pairwise comparison matrix for each corporate citizen's sustainable reporting dimension is determined according to Table 6. Subsequently, using the fuzzy DEMATEL algorithm, the relative difference between the rows and columns must be calculated to determine the optimization of each identified dimension. In this matrix, as previously explained, $\tilde{x}_{ij} = (l_{ij}, m_{ij}, u_{ij})$ are triangular fuzzy numbers, and $\tilde{x}_{ii} = (i = 1,2,3, \dots, n)$ is considered a fuzzy number (0,0,0). The arithmetic mean is taken from them to incorporate the opinions of all experts, according to Equation (18).

$$\tilde{z} = \frac{\tilde{x}^1 \oplus \tilde{x}^2 \oplus \tilde{x}^3 \oplus \dots \oplus x^p}{p} \quad (18)$$

In this formula, p represents the number of experts, and $\tilde{x}^1$ ،$\tilde{x}^2$،$\tilde{x}^p$ are the pairwise comparison matrices of research participants. $\tilde{z}$ is a triangular fuzzy number represented as $\tilde{z}_{ij} = (l'_{ij}, m'_{ij}, u'_{ij})$. Table 6 shows the average of the pairwise comparisons:

Table 6. Direct fuzzy matrix between dimensions

	J1			J2			J3			J4			J5			J6			J7			J7		
	l	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*
J1	0.00	0.00	0.00	0.41	0.55	0.79	0.62	0.82	0.95	0.39	0.51	0.78	0.59	0.74	0.95	0.79	0.94	1.00	0.49	0.58	0.72	0.53	0.64	0.81
J2	0.60	0.83	1.00	0.00	0.00	0.00	0.46	0.59	0.70	0.78	0.91	1.00	0.52	0.63	0.81	0.63	0.81	0.96	0.63	0.87	0.97	0.63	0.87	0.97
J3	0.62	0.82	0.95	0.36	0.52	0.68	0.00	0.00	0.00	0.59	0.74	0.95	0.77	1.00	1.00	0.72	0.89	1.00	0.75	0.97	1.00	0.53	0.64	0.78
J4	0.83	0.97	1.00	0.74	0.89	0.93	0.52	0.73	0.92	0.00	0.00	0.00	0.34	0.49	0.69	0.63	0.88	1.00	0.61	0.85	1.00	0.61	0.85	1.00
J5	0.78	0.91	0.97	0.32	0.45	0.66	0.29	0.43	0.64	0.44	0.58	0.89	0.00	0.00	0.00	0.61	0.89	1.00	0.54	0.79	0.83	0.37	0.51	0.69
J6	0.32	0.48	0.63	0.64	0.82	1.00	0.66	0.87	0.95	0.25	0.49	0.63	0.57	0.78	0.92	0.00	0.00	0.00	0.65	0.76	0.89	0.47	0.63	0.76
J7	0.69	0.86	1.00	0.33	0.48	0.66	0.36	0.50	0.68	0.47	0.61	0.78	0.31	0.46	0.61	0.38	0.59	0.87	0.00	0.00	0.00	0.55	0.76	1.00
J8	0.65	0.76	0.89	0.37	0.51	0.67	0.58	0.73	0.83	0.60	0.85	0.95	0.59	0.79	0.91	0.45	0.60	0.74	0.43	0.55	0.63	0.00	0.00	0.00

Equations (19 and (20) normalize the obtained matrix (Table 7).

$$\tilde{H}_{ij} = \frac{\tilde{z}_{ij}}{r} = \left(\frac{l'_{ij}}{r}, \frac{m'_{ij}}{r}, \frac{u'_{ij}}{r}\right) = (l''_{ij}, m''_{ij}, u''_{ij}) \quad (19)$$

Where r is obtained from the following relationship:

$$r = \max_{1 \le i \le n}\left(\sum_{j=1}^{n} u_{ij}\right) \quad (20)$$

The next step is to obtain the sum of the rows and columns of the matrix "$\tilde{T}$". The row and column sums are calculated according to relations (21) and (22).

$$\tilde{D} = (\tilde{D}_i)_{n\times 1} = [\sum_{j=1}^{n} \tilde{T}_{ij}]_{n\times 1} \quad (21)$$

$$\tilde{R} = (\tilde{R}_i)_{1\times n} = [\sum_{i=1}^{n} \tilde{T}_{ij}]_{1\times n} \quad (22)$$

$\tilde{D}$ and $\tilde{R}$ are, respectively, the $n\times 1$ and $1\times n$ matrices. The next step is determining the importance of the dimensions $(\tilde{D}_i + \tilde{R}_i)$ and the relationship between the criteria $(\tilde{D}_i - \tilde{R}_i)$. If $\tilde{D}_i -$

$\widetilde{R}_i > 0$, the corresponding criterion is considered influential, and if $\widetilde{D}_i - \widetilde{R}_i < 0$, the corresponding criterion is considered responsive. Table 8 shows $\widetilde{D}_i + \widetilde{R}_i$ and $\widetilde{D}_i - \widetilde{R}_i$.

Table 7. Normalized relationship matrix of research criteria

	J1			J2			J3			J4			J5			J6			J7			J7		
	l	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*	*l*	*m*	*u*
J1	0.00	0.00	0.00	0.041	0.097	0.110	0.094	0.102	0.120	0.101	0.108	0.133	0.075	0.092	0.113	0.045	0.094	0.10	0.073	0.118	0.126	0.089	0.113	0.128
J2	0.084	0.163	0.144	0.00	0.00	0.00	0.044	0.101	0.121	0.076	0.119	0.132	0.117	0.125	0.131	0.085	0.106	0.125	0.063	0.095	0.104	0.095	0.109	0.111
J3	0.103	0.113	0.142	0.056	0.113	0.128	0.00	0.00	0.00	0.042	0.087	0.112	0.127	0.129	0.136	0.085	0.116	0.131	0.074	0.095	0.143	0.087	0.13	0.11
J4	0.087	0.099	0.125	0.044	0.088	0.114	0.070	0.097	0.115	0.00	0.00	0.00	0.076	0.101	0.125	0.098	0.102	0.128	0.087	0.101	0.125	0.098	0.110	0.123
J5	0.060	0.090	0.100	0.055	0.096	0.105	0.103	0.115	0.136	0.083	0.098	0.118	0.00	0.00	0.00	0.112	0.134	0.155	0.074	0.103	0.134	0.103	0.111	0.112
J6	0.080	0.092	0.116	0.076	0.106	0.112	0.110	0.130	0.151	0.085	0.095	03.117	0.085	0.097	0.103	0.00	0.00	0.00	0.056	0.111	0.134	0.063	0.107	0.123
J7	0.070	0.103	0.120	0.081	0.091	0.115	0.044	0.088	0.114	0.075	0.108	0.125	0.041	0.083	0.112	0.094	0.141	0.159	0.00	0.00	0.00	0.109	0.111	0.137
J8	0.062	0.095	0.103	0.076	0.110	0.117	0.074	0.103	0.134	0.085	0.116	0.131	0.054	0.099	0.125	0.086	0.119	0.134	0.041	0.097	0.110	0.00	0.00	0.00

Table 8. Importance and impact of dimensions

		J	$\widetilde{D}$	$\widetilde{R}$	$\widetilde{D}_i + \widetilde{R}_i$	$\widetilde{D}_i - \widetilde{R}_i$	Result
Research dimensions	Disclosure of Human Resources Effectiveness	J1	4.995	5.569	10.564	-0.574	Cause
	Disclosure of Human Resources Promotion	J2	4.779	6.726	11.505	-1.947	Cause
	Disclosure of Corporate Governance	J3	4.892	3.182	8.074	1.710	Effect
	Disclosure of Information Systems Efficiency	J4	7.001	5.298	12.299	1.703	Effect
	Disclosure of Legal/ Judicial Legitimacy	J5	6.605	7.191	13.796	-0.586	Cause
	Disclosure of Shareholders' Interests Protection	J6	5.816	4.099	9.915	1.717	Effect
	Disclosure of Environmental Resource Protection	J7	5.119	3.219	8.338	1.900	Effect
	Disclosure of Energy Responsibility	J8	6.229	4.111	10.340	2.118	Effect

According to Table 8, $\widetilde{D}_i + \widetilde{R}_i$ represents the sum of the influences a factor receives from other factors and the influences it exerts on different factors. In essence, $\widetilde{D}_i + \widetilde{R}_i$ is the total of both the impact and the receptivity of each factor to others. On the other hand, $\widetilde{D}_i - \widetilde{R}_i$is the difference between the influences a factor exerts on others and the influences it receives from others. Precisely, $\widetilde{D}_i - \widetilde{R}_i$ reflects the net impact a factor has on other factors. If the net influence of a factor is positive, it is considered influential; if negative, it is considered receptive. The higher the value of

$\widetilde{D}_i + \widetilde{R}_i$, the more important the factor is considered. Based on the results, the "disclosure of human resources promotion" function is considered the essential dimension among those identified in the qualitative phase of the study. This dimension could lead to greater adherence to collective disclosure norms among stakeholders in the capital market. Following this, the fuzzy TODEM inference was applied to determine the importance of the primary criteria, as shown in Table 9, based on the participants' perspectives.

Table 9. Fuzzy TODEM inference based on research criteria

			J1	J2	J3	J4	J5	J6	J7	J8
		W_{rc}	592.0	674.0	582.0	516.0	579.0	481.0	415.0	505.0
Research dimensions	Disclosure of Human Resources Effectiveness	J1	1.000	5.809	3.271	3.176	4.093	2.143	1.382	3.001
	Disclosure of Human Resources Promotion	J2	0.645	1.000	3.767	3.345	4.003	2.365	1.222	3.155
	Disclosure of Corporate Governance	J3	0.476	0.421	1.000	3.056	4.128	2.113	1.548	2.888
	Disclosure of Information Systems Efficiency	J4	0.316	0.313	0.326	1.000	3.967	2.710	2.054	3.164
	Disclosure of Legal/ Judicial Legitimacy	J5	0.481	0.409	0.398	0.423	1.000	4.746	3.112	2.545
	Disclosure of Shareholders' Interests Protection	J6	0.308	0.311	0.305	0.346	0.341	1.000	1.643	2.328
	Disclosure of Environmental Resource Protection	J7	0.219	0.205	0.219	0.227	0.294	0.212	1.000	3.356
	Disclosure of Energy Responsibility	J8	0.449	0.389	0.351	0.339	0.291	0.301	0.194	1.000
	Rating		2nd	1st	3rd	4th	3rd	6th	7th	5th

Then, a decision matrix is formed to combine the weights of each criterion based on the results obtained from the DEMATEL algorithm (Table 10). In the above matrix, the value W_{rc} should be determined by dividing the initial weight of each criterion, as determined by DEMATEL, into the initial decision matrix Todim according to Equation (23).

$$W_{rc} = \frac{W_i}{\text{Max } W_i} \quad (23)$$

Table 10. Initial TODIM decision matrix

			J1	J2	J3	J4	J5	J6	J7	J8
		W_{rc}	592.0	674.0	582.0	516.0	579.0	481.0	415.0	505.0
Research dimensions	Disclosure of Human Resources Effectiveness	J1	00.1	061.0	056.0	042.0	055.0	033.0	023.0	039.0
	Disclosure of Human Resources Promotion	J2	031.0	00.1	059.0	048.0	59.0	043.0	029.0	040.0
	Disclosure of Corporate Governance	J3	029.0	043.0	00.1	041.0	042.0	037.0	025.0	039.0
	Disclosure of Information Systems Efficiency	J4	019.0	021.0	018.0	00.1	038.0	035.0	028.0	033.0
	Disclosure of Legal/ Judicial Legitimacy	J5	020.0	024.0	020.0	021.0	00.1	040.0	037.0	042.0
	Disclosure of Shareholders' Interests Protection	J6	030.0	027.0	033.0	021.0	036.0	00.1	038.0	040.0
	Disclosure of Environmental Resource Protection	J7	033.0	019.0	030.0	029.0	018.0	029.0	00.1	029.0
	Disclosure of Energy Responsibility	J8	019.0	021.0	016.0	012.0	016.0	011.0	009.0	00.1
	Rating		2nd	1st	3rd	4th	3rd	6th	7th	5th

The percentage weights for each identified criterion were determined during the defuzzification process of the TODIM method. The component of disclosure functions related to Human Resource Promotion ("J2") has a more influential pivotal coefficient in adhering to the disclosure of information based on corporate citizenship sustainability reporting, in line with the inclusive normativity of stakeholders, particularly internal stakeholders within companies.

5. Discussion and conclusion

This research presents a corporate citizenship sustainability reporting model based on adherence to collective stakeholder norms in the capital market. This study, grounded in the theoretical gap in corporate citizenship sustainability reporting frameworks, aimed to evaluate the normativity of collective stakeholder interests in the capital market through a qualitative grounded theory analysis and to identify core components relevant to the study. Therefore, based on the grounded theory process and interviews with scholars and experts, 287 initial open codes were analyzed, identifying three categories, eight components, and 42 conceptual themes as the grounds for developing corporate citizenship sustainability reporting. These criteria were presented as a theoretical framework to address the research question, in line with the findings from the first part of the study. Subsequently, the TODIM fuzzy process was applied in the quantitative phase of the study to address the second research question regarding the identification of the most central aspect of corporate citizenship sustainability reporting in the capital market. The eight core dimensions were evaluated through pairwise comparisons based on fuzzy linguistic scales during this analysis. The results revealed that the disclosure function component related to Human Resource Promotion emerged as the most central factor in adhering to the inclusive normativity of stakeholders, which is often overlooked in reporting practices. This factor could significantly enhance the transparency of companies' financial information disclosures.

In interpreting this result, the theory of corporate citizenship, grounded in a network of stakeholders, holds companies responsible for developing norms to preserve internal values and promote external values, thereby enabling legitimate accountability to stakeholders' needs. Human resources are prepared to enhance service quality for stakeholders through synergistic incentives within the organization, allowing the companies to develop competitive, social, and environmental values that convince direct and indirect stakeholders. Regarding financial reporting, the combination of this strategic thinking within companies is more complex than purely managerial processes based on qualitative tools because disclosing company performance in line with corporate citizenship lacks a consistent, measurable criterion and framework. In categorizing the operational pillars of such disclosure, attention must be paid to sustainable development as a mechanism that promotes the sequence of social, economic, and environmental standards. In other words, the development of corporate citizenship sustainability reporting enables companies to voluntarily disclose a wide range of financial and non-financial performance data, thereby enhancing decision-making power over financial statement comparability in the capital market. This process enables companies to maintain their operations by meeting shareholder expectations, which serves as the basis for achieving higher credit ratings and a competitive position, thus paving the way for sustainable development. In this context, the most strategic criterion for developing such a phenomenon within the capital market companies' ecosystem is the human resource promotion disclosure component. By understanding the value of human resources, this criterion suggests that companies must create equal opportunities to enhance human resource capabilities and capacities, thus improving the company’s technical performance in achieving sustainability through the integration of financial and non-financial reporting. Specifically, companies must provide fair

compensation to human resources and create opportunities based on individual and team performance evaluations. The results of these evaluations, focusing on cost reduction, should be communicated to human resources. The company's sustainability can be improved through an interactive, competitive environment enabled by training and information sharing. Such capacity to stimulate human resource perceptions will lead to effective performance outcomes, and companies that disclose the level of innovation and individual initiatives will contribute to greater dynamism in sustainability reporting. In line with the results, it is essential to note that, given the novelty of combining corporate citizenship with sustainability reporting, this study does not closely resemble previous research in its analysis and methodology. However, the results align somewhat with studies such as Granados-Sanchez (2023), Bracci et al. (2023), and Caputo et al. (2022). Therefore, in a general conclusion, the similarity of the findings obtained from the mentioned research can be considered in the functions of the human resources and judicial legitimacy areas, while the difference of these findings from the mentioned research is in the environmental approaches and the energy field as most of the past research looks at environmental and energy issues as a new part of social responsibility reports that is important.

Based on the results, it is recommended that companies move toward sustainable development through corporate citizenship reporting. There is an increasing need to strengthen the norms surrounding the accounting value of human resources. In addition to enhancing the perceived support for human resources, this area can improve companies' sustainability through financial reporting by disclosing their training-related functions and evaluating their technical outcomes, allowing higher-level institutions and even financial decision-makers to conduct more integrated assessments of companies. On the other hand, policymakers and standard-setting bodies are advised to develop standard checklists for sustainability reporting, adopting a more inclusive approach that extends beyond social, economic, and environmental issues in evaluating this matter. For example, evaluation criteria should consider human resource development to achieve a more comprehensive level of accountability to stakeholder needs in the long term.

Like research based on data collected through interviews, this study faces the intrinsic limitation of potentially not covering all aspects of the core phenomenon. Furthermore, the low number of participants in the quantitative phase of the study could be considered another limitation. Although this limited number of participants is justifiable according to the fuzzy analysis guidelines, the limitation lies in the generalizability of these analyses beyond this context. Therefore, to solve this problem in future research, by changing the nature of the quantitative phase implementation analysis method, we can move towards analyses such as partial least squares (PLS), which examines the impact of corporate citizenship reporting on the protection of shareholder rights with a larger number of participants.

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IJAAF; Vol. 10, No. 1, Winter 2026, Serial 34

Iranian Journal of
Accounting, Auditing & Finance

Ferdowsi University of Mashhad

Quarterly

RESEARCH ARTICLE

The Impact of Key Audit Matters Disclosure on Audit Report Lag: The Moderating Effect of Audit Firm Partner Gender Diversity

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How to cite this article:
Khotanlou, M. and Kazemioloum, M. (2026). The Impact of Key Audit Matters Disclosure on Audit Report Lag: The Moderating Effect of Audit Firm Partner Gender Diversity. Iranian Journal of Accounting, Auditing and Finance, 10(1), 67-89. doi: 10.22067/ijaaf.2026.47154.1571

ARTICLE INFO

Article History
Received: 2025-03-10
Accepted: 2025-08-18
Published online: 2026-02-01

Abstract

Recent changes to Auditing Standard 701 have affected audits in recent years. As per Standard 701, auditors are required to include the key audit matters (KAMs) part in the audit report. However, this section may require them to spend more time and effort, potentially delaying the issuance of the audit report. Consequently, this study examined how the disclosure of key audit matters affects the audit report lag, while simultaneously considering the moderating effects of gender diversity among audit firm partners. In this applied research, data from 124 companies listed on the Tehran Stock Exchange were collected over the period from 2018–2023. The research hypotheses were tested using panel data and multiple regression analysis. Findings showed that audit report issuance is delayed when key audit matters are disclosed. Additionally, the results suggest that gender diversity among audit firm partners moderates and weakens the relationship between key audit matters and audit report lag, aligning with the efficiency approach. The research results were further validated through a robustness test that split the research samples into two time periods: before and after the need for Auditing Standard 701. More transparency about the audit process follows from disclosing important audit matters, which prompts auditors to investigate them more thoroughly, requiring additional work and adding time to the audit reporting process. There is an increase in audit report lag because auditors need to spend more time and effort to support disclosures on important audit concerns, which are intended to reduce litigation risk and improve audit quality. The results also suggest that the personality traits and gender characteristics of audit partners, as well as differences in risk tolerance between male and female auditors, can influence the disclosure of key audit matters and, consequently, the issuance of audit reports. The findings of this study highlight the impact of Standard 701 on the audit process in the Iranian context and underscore the role of auditor gender in the composition and selection of audit engagement partners. Based on these results, the implementation of Standard 701 and the inclusion of key audit matters result in delays in the issuance of audit reports, indicating that auditors should consider this when planning the audit process and its time budget.

Keywords:
Audit Report Lag, Audit Firm Partner Gender Diversity, Key Audit Matters

https://doi.org/10.22067/ijaaf.2026.47154.1571

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NUMBER OF REFERENCES
92

NUMBER OF FIGURES
-

NUMBER OF TABLES
9

Homepage: https://ijaaf.um.ac.ir
E-Issn: 2717-4131
P-Issn: 2588-6142

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1. Introduction

Audit reports are critical for financial statement users, eliciting significant capital market reactions (Ittonen, 2012). The independent audit report, as the final output of the audit process, serves as the primary means of communication between auditors and stakeholders regarding client operations and audit procedures. Investors benefit greatly from increased openness and useful information when audit reports, including challenges, qualifications, and Key Audit Matters (KAMs), are disclosed promptly (Habib et al., 2019). According to Moradi and Molla Imeny (2019), users who lack access to the processes used to prepare financial statements tend to view a shorter audit report lag (ARL) as a sign of the dependability and quality of those statements. One qualitative feature of accounting information within the conceptual framework is its timeliness in financial reporting, which enables quicker evaluation of the reliability of financial statements.

The Audit Reporting List provides information on audit efficiency and identifies potential audit issues for auditors or clients, as a metric for audit effort. Complex interactions, such as those requiring KAM disclosures, require more work, which, in turn, increases ARL, as stated by Audit Work Theory (Abdillah et al., 2019). While maintaining credibility in financial statements, auditors must be efficient and timely while also adhering to auditing requirements. The importance of ARL in evaluating the accuracy of financial statements and the difficulties auditors encounter have prompted a plethora of research into its causes, which fall into three broad categories: those about clients, audit firms, and audit reports.

Client characteristics significantly influence ARL. Studies by Abdillah et al. (2019), Abernathy et al. (2017), Durand (2019), Habib et al. (2019), Hassan (2016), and Rusmin and Evans (2017) demonstrate that larger, more profitable companies experience shorter ARL. In contrast, high-risk firms with weak financial positions face longer delays. Increased complexity and risk necessitate thorough evaluations to mitigate professional risk, extending ARL. Delays are exacerbated by a greater risk of internal control deficiencies and reduced profitability.

However, research on client size, board characteristics, and audit committee attributes has yielded inconsistent findings (Afify, 2009). Likewise, studies on audit firm characteristics report conflicting results (Al Bhoor and Khamees, 2016; Zare Bahnamiri and Hasankhani, 2021). Regarding audit report characteristics, modified opinions or going-concern uncertainties are associated with longer ARLs (Leventis et al., 2005; Soltani, 2002). KAMs, introduced under Auditing Standard 701, aim to reduce report uniformity by providing client and audit engagement information, increasing transparency, and closing the audit expectation gap. Few studies have examined how KAM disclosure affects ARL.

The study examines whether KAM disclosure affects ARL, particularly auditor work and reporting delays. According to KAMs, the asymmetry of information between managers and owners may be reduced, but audit periods may be prolonged, based on Audit Effort Theory and Agency Theory. The asymmetry arising from conflicts of interest is highlighted by Agency Theory and addressed by KAMs, though this may necessitate more thorough audits. Due to the newness of the KAM criteria, there is a lack of consistent empirical research on how they affect ARL.

There is a lack of studies that investigate how gender diversity in audit firm partners influences the KAM-ARL relationship. The effectiveness of audits could be affected by gender diversity. In terms of efficiency, teams with female auditors may be more productive and have lower ARL because of their higher ethical behavior (Sila et al., 2016). On the flip side, they could cause setbacks due to their conservatism and fear of taking risks. Although previous research has shown a favorable correlation between KAM and ARL (e.g., Nguyen and Kend, 2021), it has failed to account for auditor traits such as gender diversity. Reid et al. (2019) also ignored developing markets such as Iran's in favor of more established ones.

This study is informed by the particular environment of Iran's capital market, which is defined by its unique regulatory frameworks and concentrated ownership. The research fills a significant void in the literature on auditing in emerging markets by studying the KAM-ARL relationship and how audit partner gender diversity moderates it using panel data from Tehran Stock Exchange companies (201-2023). It increases our understanding by looking at how gender diversity affects KAM-related delays, which could either make things faster or slower, depending on the risk profiles of auditors.

The study's contributions are threefold. First, it pioneers KAM research in Iran's capital market, enriching global auditing literature. Second, it introduces gender diversity as a moderator, addressing an overlooked auditor characteristic. Third, it offers practical recommendations for auditors, standard-setters, and investors to enhance financial reporting transparency. KAM disclosure helps investors assess risk by demonstrating the auditor's engagement with critical issues. The audit process can be streamlined if auditors and clients communicate effectively. In the subsequent sections, we will first discuss the theoretical and empirical background, followed by the research hypotheses, methodology, and findings. We will then present the conclusions, discussion, and recommendations.

2. Theoretical and empirical background and research hypotheses

2.1 Key audit matters (KAMs)

Academics and regulators have questioned the usefulness and significance of audit reports because of their uniform format (Lennox et al., 2023). The International Auditing and Assurance Standards Board (IAASB) issued International Standard on Auditing (ISA) 701, titled "Communicating Key Audit Matters in the Independent Auditor's Report," in 2016 to address this and enhance transparency and confidence in financial reporting. This standard mandates the disclosure of key audit matters (KAMs) to improve the informational value of audit reports. Because Standard 701, with the same title, is necessary from 1401 (2022), according to the Audit Organization, independent audit reports in Iran have changed in structure and content. This new type of audit reporting, according to Boonyanet and Promsen (2018), improves communication between those using financial statements and auditors. Auditors are obligated by worldwide regulators to inform investors of the audit scope, materiality thresholds, and important audit matters (Rezaee and Homayoun, 2025).

According to agency theory, which has been supported by various studies (Fama and Jensen, 1983; Jensen and Meckling, 1976; Watts and Zimmerman, 1983), independent audits help to improve financial reporting by reducing conflicts between management and shareholders. Elmarzouky et al. (2023) found that managers and shareholders could reduce conflicts of interest by disclosing important audit topics in order to improve the quality of independent audit reports. Disclosure of critical audit problems, according to Hosseini and Tanani (2025), indicates a company's market risk, according to signaling theory. According to Hussin et al. (2023), stakeholders can gain more knowledge and trust that management is looking out for their best interests when important audit topics are included in audit reports. By revealing important audit matters, Smith (2023) showed that audit reports become more understandable and transparent, which in turn provides insights into audit risks. Similarly, Li and Luo (2023) argued that the benefits of the incremental information provided by key audit matters to investors outweigh the costs of disclosure. Gambetta et al. (2023) found that key audit matters add value to financial information, with this value depending on the type of audit firm and whether the key audit matters relate to entity-level or account-level risks.

Stakeholders have been pushing for more detailed information about audit engagements and client operations, as well as greater transparency in audit reports (Litjens et al., 2015). In response, the International Accounting Standards Board (IAASB) mandated ISA 701 to improve the communicative value of independent audit reports. According to this standard, key audit matters are those issues that the auditor considers most significant based on their professional judgment when auditing the financial statements of the current period. They are selected from matters communicated to those charged with governance. Even after bringing up important audit issues, the auditor's opinion has not changed. In order to explain why these problems are important, the auditor has to explain what steps were taken to fix them. Major audit items are issues that, under ISA 705, lead to a modified audit opinion or, under ISA 570, produce significant uncertainty concerning events or conditions that may cast substantial doubt on the entity's ability to continue as a going concern, per paragraph 15 of Standard 701. Ghaemi et al. (2024) say that the optimum place to provide critical audit matters with the right subheadings is in the designated section of the audit report. In addition to the audit opinion section, a separate section is allocated for key audit matters.

The disclosure of key audit matters addresses significant audit procedures and findings (Gold and Heilman, 2019). Based on audit effort theory, prior research indicates that key audit matters require auditors to perform additional procedures, compliance training, and quality control reviews (Chalmers, 2013). However, their selection is subjective and requires significant professional judgment (Jermakowicz et al., 2018). In a study by Abdullatif and Al-Rahailah (2020), it was found that key audit issues often concern receivables, inventories, and investments. Kend and Nguyen (2020) identify revenue recognition and asset valuation as among the most significant key audit matters. In Iran, Ghaemi et al. (2024) reported that key audit matters in the audit reports primarily pertain to “related-party transactions” and “revenue recognition.” Responses obtained from a questionnaire distributed among certified public accountants in Iran by Jafari-Nasab et al. (2019) indicate that the auditor’s assessment of the fundamental assumptions underlying the recognition and disclosure of financial statement items in the audit report, the auditor’s approach to addressing various company risks, accounts with the highest risk of material misstatement (due to fraud) in the audit report, the auditor’s evaluation of significant events and transactions, and matters deemed most significant based on the auditor’s professional judgment in the audit of financial statements should be identified as key audit matters (KAMs).

2.2 Audit report lag

A company's audit report lags in issuance by a number of days after the end of its fiscal year (Durand, 2019). Auditors are under pressure to report quickly because people who use financial statements want them to. Auditors must follow certain steps and write audit reports by certain dates. Investing in emerging economies can be more challenging because there are fewer options for obtaining reliable financial information (Leventis et al., 2005). Many studies have looked into what causes audit report lag because it is an important sign of the quality of the audit and the reliability of the clients' financial records. Client characteristics, audit firm traits, and audit report form and content are the main factors affecting audit report lag, according to these studies. When looking at the types of customers, Durand (2019) discovered that audit report lag is shorter for bigger and more profitable clients. In the same way, Abernathy et al. (2017) showed that the length of time between an audit report and the size of the client is inversely related. They also said that longer audit report lags are caused by complicated client operations, bad financial conditions, or working in high-risk industries. Habib et al. (2019) also discovered that the time it takes to get an audit report is faster for clients with higher profits, concentrated ownership, and audit committee members who are good with money, but longer for clients whose financial reporting is complicated.

It is longer for clients who have complicated financial reporting. Mahdavi and Hoseininia (2015) showed that firms with higher ownership concentration provide audit reports with reduced delays. Achek and Khlif (2016) discovered that new accounting standards like IFRS may increase audit report delays. Due to its principles-based and more complicated structure, IFRS financial reporting takes longer to audit than U.S. GAAP, according to Zhou et al. (2022).

Board qualifications affect audit report latency in proportion to customer attributes, according to several studies. Chalu (2021) found that larger boards lessen audit report lags. On the other hand, Mathuva et al. (2019) and Bozorg-Asl et al. (2018) revealed that board size and audit report lag had a positive and substantial link. Mathuva et al. (2019) indicated that board independence contributes to extended audit report lags, and Afify (2009) discovered that board independence results in diminished lags.

Some studies say that the qualities of the audit firm also affect how long it takes to get an audit report, in addition to the characteristics of the client. Previous studies demonstrate that employing large audit firms, especially the Big Four, diminishes audit report latency (Rusmin and Evans, 2017). Al Bhoor and Khamees (2016) discovered that auditor industry specialization diminishes audit report latency. However, Abdillah et al. (2019) provided evidence that neither auditor industry specialization nor auditor reputation significantly reduces audit report lag.

Another factor affecting audit report lag is the audit report itself, particularly the audit opinion. The audit report lags for clients who receive going concern or modified audit opinions are longer, according to previous research (Leventis et al., 2005; Soltani, 2002). The longer lags in audit reports result from increased audit efforts. Expected increases in audit report lag could be the result of this heightened effort being directed towards resolving issues like inadequate internal control systems (Mitra et al., 2015) or drawn-out client discussions (Luo and Salterio, 2021). According to Bozorg-Asl et al. (2018), there is a positive and significant relationship between audit opinion type, reporting risk, and the number of audit report paragraphs with lags.

2.3 Key audit matters and audit report lag

This is to make things clearer, make the auditing process more trustworthy, and build trust between market participants and users. However, research on KAMs has yielded varied findings, giving rise to two distinct perspectives. Transparency is not improved by disclosing KAMs, according to the first perspective. Köhler et al. (2020) discovered that the readability and communication efficacy of KAMs are constrained for investors due to difficulties in understanding and applying this information. Marques et al. (2021) also found that audit reports with complicated KAMs are harder to read. Segal (2019) posited that KAMs are not especially beneficial for readers of financial statements. Bédard et al. (2016), Moroney et al. (2021), and Sirois et al. (2018) indicated that users may misuse KAM information.

The second perspective posits that KAM disclosures enhance transparency. According to agency theory, stakeholders expect auditors to thoroughly examine the audited entity to ensure a more reliable and credible audit opinion. Ong et al. (2022) stated that readable KAMs facilitate better understanding by stakeholders. Kipp (2017) found that KAMs, particularly when detailed, increase the credibility of financial statements. The KAMs related to information technology often lack sufficient information in annual reports, according to Sneller et al. (2017). Yoga and Dinarjito (2021) reported that KAM disclosures significantly influence investor decisions. Camacho et al. (2024) found a significant relationship between a high number of KAMs and the likelihood of financial distress. Jafari-Nasab et al. (2017) demonstrated that, from an auditor's perspective, KAM disclosures increase information value, reduce uniformity, increase auditors' professional and legal responsibilities, enhance investor decision-making, and enhance audit quality and financial

reporting.

A study by Hussin et al. (2022) found that auditors expend more time and effort on complex clients, potentially delaying audit reports. Wuttichindanon and Issarawornrawanich (2020) showed that larger audit firms and clients with subsidiaries report more KAMs, requiring more thorough examinations. Lau (2021) reported that uncertainty in accounting estimates increases the number of KAMs. In their study, Fera et al. (2022) found that clients with stronger corporate governance mechanisms received fewer KAMs. Pinto and Morais (2019) and Pinto et al. (2020) noted that the number of KAMs increases with more rigorous accounting standards. Other than in insurance, banking, and financial intermediaries, audit firm size, audit opinion type, and company complexity did not significantly affect KAMs.

Previous research has examined the correlation between KAM disclosures and audit quality, producing inconsistent outcomes. Suttipun (2021) and Zeng et al. (2021) both found that KAM disclosures make audits better by making auditors work harder. Nonetheless, Reid et al. (2019) saw no substantial rise in audit report latency or audit fees attributable to KAM disclosures. Sakin and Yildirim (2022) also found that KAM disclosures did not affect how long it took to get an audit report. Rahaman and Bhuiyan (2025) said that KAM disclosures make audit reports come out faster. Nguyen and Kend (2021) discovered that KAM disclosures require time since they must be examined by others, agreed with customers' governance authorities (such as audit committees), and be done in a way that raises audit fees and delays report delivery. Zeng et al. (2021) found that KAM disclosures in China improve the quality of audits, but they also take more time.

Abdullatif and Al-Rahailah (2020) stated that auditors require additional effort to support reported KAMs. Litigation risk and the need for high-quality audits lead to increased auditor effort, causing audit reports to be delayed. Sakin and Yildirim (2022) suggested that the requirement to disclose KAMs may lead to more thorough examinations of these matters. Although KAM disclosures do not increase audit time, client disagreements about KAM content and wording may delay audit reports, according to Reid et al. (2019). Bepari et al. (2024) observed that audit report lag increased in the period following the disclosure of key audit matters, attributing this to the increased efforts by auditors to disclose specific reasons for key audit matters. According to Alawadhi et al. (2024), audit report lag is positively correlated with the number of reported critical audit problems. They discovered that audit report latency is greatly affected by certain types of important audit matters, including investments and the implementation of new standards. Ciğer et al. (2025) found that the disclosure of key audit matters has a positive and significant impact on audit report lag. Accordingly, it can be argued that the disclosure of key audit matters, mandated to enhance the assurance role of auditing, leads to more thorough examination and evaluation, requiring greater effort from auditors, and consequently results in delayed issuance of the independent audit report. Furthermore, it is expected that audit firms will not address the reporting of key audit matters superficially, as the selection of key audit matters appears to be closely linked to the audit efforts required to address these matters. Therefore, the first hypothesis of the study is formulated as follows:

H1*:* The disclosure of Key Audit Matters has a positive and significant impact on audit report lag.

2.4 Gender diversity of audit partners and the relationship between key audit matters disclosure and audit report lag

Because of the subjective nature of the work, gender plays a role in the auditors' ability to make sound decisions. According to previous studies, gender plays a part in audit engagements, and

different genders may react differently to the updated criteria for KAMs. A more gender-balanced audit team is likely to have auditors with a wider range of life experiences and viewpoints. Auditors are expected to bring diverse perspectives and experiences to audit teams because of increased gender diversity. According to Baselga-Pascual et al. (2018), men are more likely to be task-oriented and risk-taking, whereas women are more likely to prioritize interpersonal relationships, avoid taking needless risks, and uphold a solid ethical reputation. According to research by Gul et al. (2013), women are more likely to follow financial rules, have better ethical standards, and avoid taking risks than men. Regarding the impact of women's presence in audit teams on timely audit reporting, two perspectives have been proposed. The first perspective suggests that women in supervisory roles, such as auditing, enhance transparency and reduce unwarranted delays in issuing audit reports. In contrast to this perspective, a second perspective asserts that women tend to devote more time to evaluating financial statements for compliance with generally accepted accounting principles or material misstatements.

Audits involve four steps: planning, risk assessment, evidence gathering, evaluating results, and preparing reports (Ittonen et al., 2013). Men and women differ in their approaches to planning, risk tolerance, and overconfidence. Gender can influence auditors' planning, risk aversion, and overconfidence, leading to greater caution among female audit partners when pursuing their objectives. As this is a function of audit risk, it can directly impact audit fees, audit report lag, and audit opinions (Hardies et al., 2016). The longer audit procedures performed by female audit partners can be an indication of better audit quality, according to these findings (Hao et al., 2022; Ocak and Özden, 2018). Female audit partners are more risk-averse (Hardies et al., 2016; Ittonen, 2013), cautious with audit evidence (Carrera and Mareque, 2023), and more likely to offer going concern opinions, which enhances financial reporting. Lee et al. (2019) also found that audit fees are positively associated with experienced female audit partners. This suggests that the experience of female audit partners adds value to audit processes, leading to higher audit fees. Khotanlou et al. (2024) found that the presence of female audit partners in audit engagements leads to greater disclosure of key audit matters. Ocak and Özden (2018) and Hao et al. (2022) showed that audit report latency is positively affected by female audit partners. They claim that the audit process takes longer because female audit partners spend more time on audit tasks in an effort to reduce the possibility of fraud, mistakes, and violations of financial reporting regulations. It is anticipated that female auditors, due to their high discipline and sensitivity to workplace rigor, will execute the audit process more swiftly than male auditors. This is especially true in the planning and result evaluation stages, as well as report preparation. Despite substantial evidence to the contrary, female auditors tend to conduct audits meticulously, spending more time on the audit process than male auditors. Accordingly, the second hypothesis of the study is formulated as follows:

H2*:* The gender diversity of audit firm partners moderates the relationship between the disclosure of Key Audit Matters and audit report lag.

3. Research methodology

Multiple regression analysis was used to test the research hypotheses. From 2018 to 2023, the study population consisted of companies listed on the Tehran Stock Exchange. After applying the restrictions outlined in Table 1, the sample size was reduced to 124 companies (744 firm-years). Following data extraction and variable calculation, the findings were analyzed using Microsoft Excel 2016, Stata version 14, and EViews 9.

Table 1. Screening criteria for the research population

No.	Description	Number of Companies
1	Number of companies listed on the Tehran Stock Exchange as of the end of 2018	411
2	Number of companies not active in the stock exchange during the research period	115
3	Number of companies in the financial and service industries	94
4	Firm-years with insufficient or incomplete data	78
5	Total number of companies excluded	(287)
	Number of companies included in the sample	124

3.1 Variable measurement and hypothesis testing model

To examine the impact of Key Audit Matters on audit report lag and the moderating effect of audit firm partner gender diversity on this relationship, Models (1) and (2) were used. These models are consistent with the research of Sakin and Yildirim (2022) and Abdullatif et al. (2025):

$$ARL_{i.t} = \beta_0 + \beta_1 KAM_{i.t} + \beta_2 AUDIT\ FEE_{i.t} + \beta_3 F\ SIZE_{i.t} + \beta_4 ROA_{i.t} + \beta_5 LEV_{i.t} + \beta_6 OWNER_{C\,i.t} + \beta_7 TENURE_{i.t} + \beta_8 SPEL_{i.t} + \beta_9 AUDIT\ S_{i.t} + \beta_{10} CHANGE + \varepsilon_{i.t} \quad (1)$$

$$ARL_{i.t} = \beta_0 + \beta_1 KAM_{i.t} + \beta_2 GENDER_{i.t} + \beta_3 GENDER_{\ i.t} * KAM_{i.t} + \beta_4 AUDIT\ FEE_{i.t} + \beta_5 F\ SIZE_{i.t} + \beta_6 ROA_{i.t} + \beta_7 LEV_{i.t} + \beta_8 OWNER_{C\,i.t} + + \beta_9 TENURE_{i.t} + \beta_{10} SPEL_{i.t} + \beta_{11} AUDIT\ S_{i.t} + \beta_{12} CHANGE + \varepsilon_{i.t} \quad (2)$$

3.2 Research variables measurement

3.2.1 Dependent variable

The dependent variable in this study is Audit Report Lag (ARL). It is measured as the natural logarithm of the number of days between the fiscal year-end and the issuance date of the audited financial statements (Sakin and Yildirim, 2022).

3.2.2 Independent variable

Key Audit Matters (KAMs) are the independent variable in this study. Iranian Auditing Standard No. 701 says that KAMs are the most important things that the auditor thinks are important to pay attention to during the audit of the current period's financial accounts. Paragraph 15 of the auditing standard defines a KAM as a matter that, under Standard 705, results in a modified opinion or, under Standard 570, creates material uncertainty about events or conditions that may cast significant doubt on the entity's ability to continue as a going concern.

These features allow us to classify the possible ways in which KAMs might be included in the audit report into three separate groups: 1) Noted Important Audit Matters: The audit report clearly identifies these as Important Audit Matters (KAMs). The second category is "implicit key audit matters," which includes the paragraphs that provide the groundwork for either a qualified or adverse conclusion. Thirdly, the emphasis in the topic paragraphs about material doubt relating to going concern is related to implicit key audit matters, which are material uncertainty over the company's ability to continue operations.

Due to the date of effective Auditing Standard 701 (Farvardin 1, 1401 in the Iranian calendar), the necessary information was collected for measuring this variable from published audit reports prior to and after March 21, 2022.

- Based on the three categories above, the number of explicit KAMs for the period after March 21, 2022, was gathered from the sample companies' audit reports.
- The following guidelines were used to collect implicit KAMs for sample companies before March 21, 2022:

1. In the sample company's audit report, paragraphs explaining qualifying and adverse remarks were identified as KAMs.
2. The emphasis of the matter paragraph addressing material uncertainty related to going concern in the sample company's audit report was considered equivalent to KAMs.
3. The focus of the matter paragraph in the 2021 (1400) and earlier audit reports of the sample company previously included a matter disclosed as a KAM.

After identifying the Key Audit Matters (KAMs), this study follows Pinto and Morais (2019) in using the number of KAMs disclosed in the independent auditor's report.

3.2.3 Moderating variable

Audit Firm Partner Gender Diversity (AFPGD): An independent audit report is considered independent if one of the signatories is female; otherwise, it is not.

3.2.4 Control variables

Audit Fee (AF): Imani et al. (2017) Calculated as the natural logarithm of the audit fee charged by the firm. Bamber et al. (1993) found that as firms become more complex, the likelihood of material errors increases. A positive association between audit fees and report lag has been confirmed (Vaez and Ahmadi, 2014).

Firm Size (SIZE): Measured as the natural logarithm of total assets at fiscal year-end. Larger organizations' internal control systems and abilities to pressure auditors for timely completion reduce audit report lags (Rusmin and Evans, 2017).

Return on Assets (ROA): Calculated as net income divided by total assets at fiscal year-end. Low-profitability firms delay audits to delay negative disclosures, whereas profitable firms speed up audits to promptly disclose positive news, enhancing their value perception.

Financial Leverage (LEVERAGE): Total debt split by total assets at fiscal year-end. High leverage raises audit risk, which requires more auditor time and effort, delaying the audit report (Habib and Bhuiyan, 2011).

Ownership Concentration (OWNCON): Defined as the percentage of shares held by shareholders owning at least 5% of total shares. As a result of high ownership concentration, litigation risks are reduced, which reduces the audit report lag (Abdullatif et al., 2025; Bamber et al., 1993).

Auditor Tenure (TENURE): Measured as the cumulative years of auditor engagement with the firm. It has been shown that auditors with longer tenure are more familiar with the firm's operations, which reduces the audit report lag (Habib et al., 2019; Durand, 2019).

Auditor Industry Specialization (SPEC): This is calculated by dividing the total assets of an audit firm's clients in a specific industry by the total assets of all firms in that industry. It is easier for specialized auditors to produce higher-quality reports due to their understanding of the industry (Habib and Bhuiyan, 2011).

Audit Firm Size (AFSIZE): A dummy variable that is 1 if the auditor is the Audit Organization or an Iranian Association of Certified Public Accountants Grade A member and 0 otherwise (Kazemiolum et al., 2020). Larger audit firms finish faster to protect their reputation (Rusmin and

Evans, 2017; Afify, 2009).

Auditor Change (CHAUD): Dummy variable indicating whether the firm's auditor has changed or not. Auditor changes increase audit report lag due to the need for new auditors to acquire firm-specific knowledge (Dao and Pham, 2016).

4. Research findings

4.1 Descriptive statistics of data

The descriptive statistics of the research data are presented in Tables 2 and 3. The frequency distribution of Key Audit Matters (KAMs) is shown in Table 2. In the selected sample, 446 audit reports did not contain a KAM section. Within the sample of companies with a KAM section, 107 independent audit reports contained one KAM, the highest frequency of KAMs. The maximum number of KAMs in audited reports of companies listed on the Tehran Stock Exchange was 9 items.

Table 2. Frequency of KAMs

Number of KAMs	Frequency
0	446
1	107
2	82
3	45
4	32
5	18
6	7
7	3
8	3
9	1
Total	744

Table 3. Descriptive statistics of research variables

Variable Name	Symbol	Mean	Median	SD	Min	Max
Audit Report Lag	ARL	4.391	4.418	0.401	3.178	5.193
Key Audit Matters	KAMS	0.97	0.000	1.547	0.000	9.000
Audit Fee	AUDIT-F	7.834	7.803	0.946	4.962	10.942
Firm Size	SIZE	15.554	15.330	1.724	11.361	21.571
Return on Assets	ROA	0.193	0.176	0.164	-0.562	0.699
Financial Leverage	LEVERAGE	0.509	0.505	0.214	0.025	1.345
Ownership Concentration	OWNER_C	0.499	0.510	0.193	0.070	0.940
Auditor Tenure	TENURE	4.051	2.000	2.266	1.000	23.000
Auditor Industry Specialization	SPEL	0.168	0.049	0.284	0.0006	0.591
Variable Name	Symbol	Category	Frequency		Percentage	
Audit Firm Type	AUDIT-T	1	585		78.62%	
		0	159		21.38%	
Auditor Change	CHANGE	1	199		26.74%	
		0	545		73.25%	
Gender Diversity of Audit Partners	GENDER	1	86		11.55%	
		0	658		88.45%	

Table 3 presents the descriptive statistics for the quantitative and qualitative variables used in this study, including detailed parameter values for each variable. There is a strong correlation

between the audit report lag (ARL) and its median of 4.391. As a result, the audited financial statements are issued after a natural logarithm of the number of days since the fiscal year's end. The mean number of key audit matters (KAMS) is 0.97, indicating that, on average, each company reported approximately 1 KAM, a modified opinion, or a material uncertainty related to going concern. The mean and median natural logarithms of audit fees (AUDIT-F) are 7.834 and 7.803, respectively. Firm size (SIZE) has a mean of 15.554. The mean return on assets (ROA) is 0.193, with a minimum of -0.562, reflecting losses for some firms in the sample. An average of 0.509 and a maximum of 1.345 for financial leverage (LEVERAGE) show that some companies' liabilities surpassed their assets. On average, there are 0.499 owners. The average term of auditors is about 4 years, which is in line with the maximum 4-year requirement set by the Tehran Stock Exchange. According to the Auditing Organization, the longest duration of employment is 23 years. Notably, despite reports being released under the name of the Auditing Organization, auditor independence can be maintained by allowing specialized audit boards within the organization for firms to change. On average, auditors in a given industry have a SPEL of 0.168.

For qualitative variables (dummy variables coded as 0 or 1), Table 3 reports the following: In 585 observations, audits were conducted by the Auditing Organization or Grade A quality control-rated firms accredited by the Iranian Association of Certified Public Accountants (AUDIT-T). Auditor change (CHANGE) occurred in 199 observations. Additionally, in 86 observations (11.55%), female auditors signed the independent audit report, reflecting audit firm partner gender diversity (GENDER).

4.2. Regression results analysis

In panel data studies, it is essential to conduct tests to select the appropriate model for fitting the data. Panel (pooled) research data make heteroskedasticity and serial autocorrelation tests more important for regression analysis (Aflatooni, 2015). Additionally, multicollinearity among the research variables must be examined, as it holds significant importance regardless of the data type (Aflatooni, 2022). One method to address the issue of heteroskedasticity is the use of the White (1980) corrected variance-covariance matrix approach. To account for heteroskedasticity, only standard errors and test statistics of the variables are adjusted (Aflatooni, 2015). This method does fix the problem of heteroskedasticity, but it doesn't fix the problem of serial correlation in the error terms (Petersen, 2009). Consequently, a suitable method that addresses both issues is the use of the Rogers (1993) clustered standard error estimator, which corrects for serial correlation in error terms (Aflatooni, 2022). Using clustering standard errors to reduce heteroskedasticity and serial correlation in error terms was demonstrated by Petersen (2009). When heteroskedasticity and serial correlation are present in error terms, this estimator is more unbiased than ordinary least squares and White (1980). The Rogers clustered standard error correction was used to compensate for heteroskedasticity and clustered correlation in error terms in this investigation. Regarding the examination of potential multicollinearity among the research data, the results section of the hypothesis testing includes the mean variance inflation factor (VIF) for the research variables. The mean VIF values for the independent variables in each hypothesis are below 10, indicating the absence of multicollinearity.

4.3 Model estimation and analysis of hypothesis 1 results

Table 4 presents the results of testing the first hypothesis of the study, indicating that the coefficient of the key audit matters variable is 0.0402 and statistically significant. There appears to be a direct correlation between key audit matters and audit report lag, given the positive sign of this coefficient. Therefore, the first hypothesis is not rejected. The findings of this study, which indicate

a positive and significant impact of key audit matters disclosure on audit report lag, are consistent with a substantial portion of prior empirical research (e.g., Nguyen and Kend, 2021; Alawadhi et al., 2024; Ciğer et al., 2025) and the theoretical framework (agency theory and the need for increased auditor effort). Disclosure of key audit matters requires more thorough examinations, extended negotiations with clients, and addressing complex issues, all of which require additional time and delay audit reports. However, the results contrast with some studies (e.g., Reid et al., 2019; Rahaman and Bhuiyan, 2025), indicating that the specific context of Iran and contextual factors may influence the outcomes. All things considered, the findings show that important audit matters require more work and more time, so their disclosure is not superficial or ceremonial. Additionally, understanding the factors that influence audit report lag can be useful for evaluating auditor performance. The model's F-statistic of 38.27 indicates the overall significance of the model. The coefficient of determination shows that 55% of the variation in audit report lag is explained by the explanatory variables in the study. Control variables like firm size, financial leverage, and ownership concentration also affect audit report delays.

Table 4. Results of hypothesis 1 testing

Variable Name	Symbol	Coefficient	t-Statistic	*p*-Value	VIF
Key Audit Matters	KAM	0.040	5.92	0.000	2.70
Audit Fee	AUDIT-F	-0.004	-0.24	0.807	2.50
Firm Size	SIZE	0.075	4.11	0.000	2.61
Financial Leverage	LEVERAGE	-0.227	-2.45	0.015	1.91
Return on Assets	ROA	0.047	0.71	0.478	1.88
Ownership Concentration	OWNER_C	-0.271	-2.32	0.021	1.23
Auditor Tenure	TENURE	-0.001	-0.38	0.702	2.03
Auditor Industry Specialization	SPEL	-0.037	-0.65	0.518	1.51
Audit Firm Size	AFSIZE	-0.027	-1.07	0.286	1.16
Auditor Change	CHANGE	0.009	0.58	0.564	1.28
C	-	3.152	18.32	0.000	-
Model Diagnostics		Value			
Adjusted R^2		0.553			
F Statistic		38.270			
F Statistic *p*-Value		0.000			

Note: The dependent variable is Audit Report Lag (ARL). Rogers' clustered standard errors are applied to correct for heteroscedasticity and serial correlation. Year and industry fixed effects are controlled. VIF = Variance Inflation Factor. N = 744 firms.

4.4 Model estimation and analysis of hypothesis 2 results

Table 5 presents the Hypothesis 2 testing results:

Testing the second hypothesis shows that audit firm partner gender moderates key audit matter disclosure by 0.0291 and is statistically significant. Therefore, the second hypothesis is not rejected, confirming that the gender of audit firm partners moderates the relationship between key audit matters and audit fees. Additionally, the negative coefficient of the moderating effect of gender suggests that the gender of audit firm partners weakens the positive relationship between key audit matters and audit report lags. Table 5 shows that there is no multicollinearity among the research variables, as the variance inflation factor for all variables is less than 10. This study used the clustered standard error method to deal with the problem of serial correlation in error terms. The model's F-statistic of 36.84 indicates the overall significance of the model. The coefficient of determination reveals that 56% of the variation in audit report lag is explained by the explanatory

variables in the study. The results of this study are in line with gender socialization theory and previous empirical research, like that by Hardies et al. (2016) and Ittonen et al. (2013). This is because gender diversity can make the audit process more efficient by mixing the ways that men and women act. However, the results are different from studies that show longer delays when women are present (Hao et al., 2022; Ocak and Özden, 2018). This difference can be explained by focusing on the role of gender diversity rather than the presence of women alone. This study innovates auditing literature on important audit matters and audit report latency by focusing on audit partners and gender diversity.

Table 5. Results of hypothesis 2 testing

Variable Name	Symbol	Coefficient	t-Statistic	*p*-Value	VIF
Key Audit Matters	KAM	0.051	6.84	0.000	3.100
Gender Diversity	GENDER	-0.018	-1.42	0.157	1.320
Interaction (GENDER×KAM)	GENDER× KAM	-0.029	-3.75	0.000	2.950
Audit Fee	AUDIT-F	-0.003	-0.22	0.829	2.520
Firm Size	SIZE	0.073	4.05	0.000	2.630
Financial Leverage	LEVERAG E	-0.231	-2.38	0.018	1.920
Return on Assets	ROA	0.046	0.69	0.492	1.890
Ownership Concentration	OWNER_ C	-0.269	-2.28	0.024	1.240
Auditor Tenure	TENURE	-0.0015	-0.37	0.709	2.040
Auditor Industry Specialization	SPEL	-0.036	-0.62	0.536	1.520
Audit Firm Size	AFSIZE	-0.026	-1.03	0.305	1.170
Auditor Change	CHANGE	0.009	0.59	0.555	1.290
C	-	3.184	18.47	0.000	-
Model Diagnostics	Value				
Adjusted R^2	0.568				
F Statistic	36.84				
F Statistic *p*-Value	0.000				

Note: The dependent variable is Audit Report Lag (ARL). Heteroscedasticity and serial correlation are corrected with Rogers clustered standard errors. Year and industry fixed effects are controlled. VIF = Variance Inflation Factor. N = 744 firms.

4.5 Robustness tests of the results

Dividing the six-year research period into two subgroups tested the findings for robustness by treating them as a single group. This was done to assess the stability of the results and validate the methodology. The first subgroup has 248 firm-years, which covers the years 2022 to 2023. The second subgroup has 496 firm-years, which covers the years 2018 to 2021. The models were estimated separately for each subset. The results of the additional tests of model (1) conducted for these two groups are reported in Tables 6 and 7:

By considering temporal heterogeneity, the results of the time-grouped analysis, as shown in Tables 6–9, are more robust and have a higher explanatory power (3%). This is especially true after Standard 701 was mandated in 1400 (2022). This robustness test finds small time-specific effects that might be hidden in an integrated model (2018-2023) by splitting the data into two periods (2022-2023 and 2018-2021). Important relationship directions and statistical significance in Models (1) and (2) are maintained. The robustness tests use a time-grouped strategy, which not only reduces the effects of multicollinearity but also gives a better fit to the data, allowing for a deeper understanding of how gender diversity and important audit matters affect audit report lag. These findings support the idea that temporal grouping might be a useful addition to integrated models,

especially in situations where there were major changes in regulations over the research period.

Table 6. Results of model (1) – group 1 (2022–2023)

Variable Name	Symbol	Coefficient	t-Statistic	*p*-Value	VIF
Key Audit Matters	KAM	0.045	5.320	0.000	2.650
Audit Fee	AUDIT-F	-0.003	-0.200	0.839	2.480
Firm Size	SIZE	0.071	3.950	0.000	2.580
Financial Leverage	LEVERAGE	-0.238	-2.310	0.022	1.890
Return on Assets	ROA	0.049	0.680	0.499	1.850
Ownership Concentration	OWNER_C	-0.285	-2.480	0.014	1.200
Auditor Tenure	TENURE	-0.001	-0.320	0.751	2.000
Auditor Industry Specialization	SPEL	-0.035	-0.580	0.562	1.490
Audit Firm Size	AFSIZE	-0.025	-0.990	0.324	1.140
Auditor Change	CHANGE	0.010	0.620	0.535	1.250
C	-	3.178	18.450	0.000	-
Model Diagnostics			Value		
Adjusted R^2			0.542		
F Statistic			32.18		
F Statistic *p*-Value			0.000		

Note: The dependent variable is Audit Report Lag (ARL). Rogers' clustered standard errors are applied to correct for heteroscedasticity and serial correlation. Year and industry fixed effects are controlled. VIF = Variance Inflation Factor. N = 248 firms.

Table 7. Results of model (1) – group 2 (2018–2021)

Variable Name	Symbol	Coefficient	t-Statistic	*p*-Value	VIF
Key Audit Matters	KAM	0.036	4.180	0.000	2.680
Audit Fee	AUDIT-F	-0.004	-0.270	0.787	2.470
Firm Size	SIZE	0.077	4.280	0.000	2.620
Financial Leverage	LEVERAGE	-0.219	-2.180	0.030	1.900
Return on Assets	ROA	0.046	0.630	0.529	1.860
Ownership Concentration	OWNER_C	-0.262	-2.290	0.023	1.220
Auditor Tenure	TENURE	-0.001	-0.420	0.674	2.020
Auditor Industry Specialization	SPEL	-0.039	-0.650	0.516	1.500
Audit Firm Size	AFSIZE	-0.028	-1.120	0.264	1.150
Auditor Change	CHANGE	0.009	0.550	0.582	1.270
C	-	3.138	18.180	0.000	-
Model Diagnostics			Value		
Adjusted R^2			0.531		
F Statistic			42.360		
F Statistic *p*-Value			0.000		

Note: The dependent variable is Audit Report Lag (ARL). Rogers' clustered standard errors are applied to correct for heteroscedasticity and serial correlation. Year and industry fixed effects are controlled. VIF = Variance Inflation Factor. N = 496 firms.

The results of the robustness tests for Model 2 for both groups are presented in Tables 8 and 9:

5. Conclusion and suggestions

Following the financial scandals in the early 2000s, the criticism of the auditing profession by stakeholders, and the establishment of corporate governance requirements in various countries, the demand from users for more Information from independent auditors increased. Users sought improvements in the auditor's report to enhance transparency and strengthen the assurance role of auditing. Consequently, standard-setters reviewed and made changes to the structure of the auditor's report to reduce the gap in expectations. Among these changes was the addition of a section entitled "Key Audit Matters" (KAMs) in the independent auditor's report, developed according to

International Auditing Standard 701, "Communicating Key Audit Matters." The main objective of this standard is to increase transparency and inform users of financial reports. In Iran, the Audit Organization has also mandated Standard No. 701, titled "Communicating Key Audit Matters in the Independent Auditor's Report," which has led to changes in the structure and content of the independent auditor's report. Based on this and considering the significant role of auditors in enhancing transparency, this study investigated the relationship between key audit matters and audit report lag, with the moderating effect of the gender diversity of audit firm partners.

Table 8. Results of model (2) – group 1 (2022–2023)

Variable Name	Symbol	Coefficient	t-Statistic	*p*-Value	VIF
Key Audit Matters	KAM	0.058	6.240	0.000	3.050
Gender Diversity	GENDER	-0.020	-1.480	0.140	1.300
Interaction (GENDER×KAM)	GENDER×KAM	-0.034	-4.010	0.000	2.920
Audit Fee	AUDIT-F	-0.003	-0.170	0.866	2.500
Firm Size	SIZE	0.070	3.870	0.000	2.600
Financial Leverage	LEVERAGE	-0.242	-2.340	0.020	1.900
Return on Assets	ROA	0.047	0.660	0.511	1.870
Ownership Concentration	OWNER_C	-0.283	-2.450	0.015	1.210
Auditor Tenure	TENURE	-0.001	-0.300	0.764	2.010
Auditor Industry Specialization	SPEL	-0.033	-0.560	0.578	1.500
Audit Firm Size	AFSIZE	-0.024	-0.950	0.344	1.150
Auditor Change	CHANGE	0.010	0.640	0.523	1.260
C	-	3.210	18.670	0.000	-
Model Diagnostics			Value		
Adjusted R^2			0.561		
F Statistic			30.750		
F Statistic *p*-Value			0.000		

Note: The dependent variable is Audit Report Lag (ARL). Rogers clustered standard errors are applied to correct for heteroscedasticity and serial correlation. Year and industry fixed effects are controlled. VIF = Variance Inflation Factor. N = 248 firms.

Table 9. Results of model (2) – group 2 (2018–2021)

Variable Name	Symbol	Coefficient	z-Statistic	*p*-Value	VIF
Key Audit Matters	KAM	0.046	5.010	0.000	3.080
Gender Diversity	GENDER	-0.017	-1.280	0.201	1.310
Interaction (GENDER×KAM)	GENDER×KAM	-0.025	-3.120	0.002	2.940
Audit Fee	AUDIT-F	-0.004	-0.240	0.812	2.490
Firm Size	SIZE	0.075	4.190	0.000	2.640
Financial Leverage	LEVERAGE	-0.2247	-2.220	0.027	1.910
Return on Assets	ROA	0.045	0.620	0.537	1.880
Ownership Concentration	OWNER_C	-0.260	-2.270	0.024	1.230
Auditor Tenure	TENURE	-0.001	-0.400	0.690	2.030
Auditor Industry Specialization	SPEL	-0.037	-0.620	0.534	1.510
Audit Firm Size	AFSIZE	-0.027	-1.060	0.289	1.160
Auditor Change	CHANGE	0.009	0.560	0.575	1.280
C	-	3.165	18.320	0.000	-
Model Diagnostics			Value		
Adjusted R^2			0.543		
F Statistic			40.820		
F Statistic *p*-Value			0.000		

Note: The dependent variable is Audit Report Lag (ARL). Rogers clustered standard errors are applied to correct for heteroscedasticity and serial correlation. Year and industry fixed effects are controlled. VIF = Variance Inflation Factor. N = 496 firms.

The analysis of the findings indicates that the disclosure of key audit matters has a positive and

significant effect on audit report lag. These results align with the influence of the structure and content of the independent auditor's report on audit report lag. In contrast to Abdullatif et al. (2025) and Sakin and Yildirim (2022), the findings of this study are consistent with those of Nguyen and Kend (2021) and Afkhami and Fazeli (2024). Nguyen and Kend (2021) also confirmed a positive relationship between the number of Key Audit Matters (KAMs) and audit report delay. Consistent with other empirical research, this study found that revealing key audit matters (KAMs) reduced the audit report lag. Due to the necessity for a more comprehensive study of complicated issues, the disclosure of KAMs takes more time, which increases the audit report lag, according to this alignment. However, the contradiction with some studies (such as Reid et al., 2019; Rahaman and Bhuiyan, 2025) indicates that Iran's specific environment and contextual factors can influence the results. However, this study extends existing knowledge in three key ways. First, the influence of KAMs on reporting delays can be mitigated by having women in audit teams. This is proven by looking at the moderating effect of gender diversity among audit partners. Second, this study aims to shed light on the rising market in Iran, where audits are more complicated due to concentrated ownership and regulatory structures, in contrast to studies that were carried out in developed markets, such as Reid et al. (2019). Third, there is new information about the connection between KAMs and firm-specific traits when we look at their substance rather than just their quantity. Not only do these results add to the growing body of literature on auditing in developing economies, but they also give auditors and regulators concrete recommendations for how to improve financial reporting efficiency. These results can be explained by citing the theory of gender socialization. According to this theory, women, due to their greater risk aversion and adherence to rules (Baselga-Pascual et al., 2018; Gul et al., 2013), exhibit greater accuracy and discipline in the planning and reporting stages of auditing, which can expedite processes related to key audit matters. Also, the robustness test, by dividing the research samples into two time periods before and after the requirement of Auditing Standard 701, confirmed the research results.

The results suggest that supporting what is reported in key audit matters, reducing litigation risk, and enhancing audit quality require more thorough examinations and greater effort, which leads to an increase in audit report lag. Furthermore, evidence from this study suggests that auditors, due to the reduction in legal claims and the demand for independent and high-quality auditing, may require a more precise evaluation of key audit matters in the audit engagement. Therefore, greater auditor efforts result in increased audit report lag. Examining the relationship between the disclosure of key audit matters and audit report lag provides valuable insights into the efficiency and timeliness of the audit process, which is essential for ensuring the usefulness of financial statements. Additionally, the results show that the moderating effect of gender diversity of audit firm partners weakens the positive relationship between key audit matters and audit report lag, which is consistent with an efficiency adaptation perspective.

The findings of this research are suitable for improving financial reporting transparency for auditors and accounting and auditing standard setters. Disclosure of key audit matters provides users with more Information about the audit process and the challenges encountered in preparing financial statements. A mandatory section on key audit matters in the independent auditor's report encourages auditors to pay closer attention to these matters, which improves financial reporting quality and understanding. Auditors should continually update their processes and utilize new techniques and tools to identify and report key audit matters, thereby meeting users' informational needs and reducing audit risks. It is suggested that organizations like the Audit Organization and the Society of Certified Public Accountants organize training sessions and workshops to clarify Standard No. 701. This will help auditors better understand and report important audit matters while lowering the judgmental hurdles.

The findings are also important for investors. Investing in financial information is more reliable and accurate when audit reports are transparent. By increasing transparency and providing Information on risks related to financial statements, the disclosure of key audit matters helps reduce information risk for users.

Future researchers can investigate the impact of key audit matters on audit quality and financial reporting quality. Investors should study the effects of disclosing key audit matters on companies' financial performance, stock returns, share prices, and investor reactions. The disclosure of key audit matters can be judgmental, so prospective research should examine its relationship with other auditor characteristics such as experience, partner changes, specialization, and narcissism.

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IJAAF; Vol. 10, No. 1, Winter 2026, Serial 34

Iranian Journal of
Accounting, Auditing & Finance

Ferdowsi University of Mashhad

Quarterly

RESEARCH ARTICLE

Systematic Review of the Factors Influencing Cognitive Management Control Systems: A Meta-Synthesis Approach

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How to cite this article:
Mehrabanpour, M. , Rezaei, Z. , Kashanipour, M. and Mohammadimehr, J. (2026). Systematic Review of the Factors Influencing Cognitive Management Control Systems: A Meta-Synthesis Approach. Iranian Journal of Accounting, Auditing and Finance, 10(1), 91-116. doi: 10.22067/ijaaf.2026.47004.1555
https://ijaaf.um.ac.ir/article_47004.html

ARTICLE INFO

Article History
Received: 2024-11-30
Accepted: 2025-03-18
Published online: 2026-02-01

Keywords:
Management Control System, Cognitive Science, Meta-Synthesis, Strategic Management Accounting

Abstract

During the Industrial Revolution and the era of scientific management, the primary role of management accounting focused on cost calculation and reduction. Therefore, Management Control Systems (MCS) were designed and implemented mechanically. However, with the shift to strategic management accounting, MCS has significantly evolved. In order to manage high levels of uncertainty and complex cognitive processes, cognitively-oriented MCS are required. This study aims to conduct a systematic review of prior research to identify key factors influencing cognitive MCS, employing a meta-synthesis approach. A total of 102 articles published in international journals between 2000 and 2024 were analyzed through content analysis. The findings identify six major categories influencing cognitive MCS: (1) dynamic cognitive capabilities, (2) cognitive awareness control, (3) individual-organization fit control, (4) cognitive futures research, (5) behavioral and cultural control, and (6) cognitive competencies. As a result, a comprehensive cognitive analysis is required prior to the implementation of MCS in order to understand the causal relationships between the different components of the system. Aligning the CEO's incentives with stakeholders' goals is also essential. As a result, MCS provides critical information to managers, helping them execute their responsibilities and helping organizations maintain long-term behavioral patterns. After reviewing all of the pertinent literature on MCS in strategic management accounting, the results of the meta-synthesis provide a thorough comprehension of the topic. A comprehensive framework to address the multi-dimensional view prevalent in modern management accounting systems is presented in this meta-synthesis, which can be applied to the implementation of strategic management accounting systems in dynamically changing economic conditions.

https://doi.org/10.22067/ijaaf.2026.47004.1555

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NUMBER OF REFERENCES
73

NUMBER OF FIGURES
4

NUMBER OF TABLES
5

Homepage: https://ijaaf.um.ac.ir
E-Issn: 2717-4131
P-Issn: 2588-6142

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1. Introduction

Changing markets, changing customers, and changing behaviors make businesses dynamic. Management control, as a support function of management, is also subject to continuous change. While the basic management accounting and control concepts and instruments will not lose their relevance in the future, new problems will require new solutions (Charifzadeh and Taschner, 2017).

The difficulty for organizations is to effectively explore new market prospects while also efficiently utilizing existing tactics. Concepts like strategic control, interactive control systems, and strategic foresight have drawn a lot of attention to this dichotomy in the literature on management control. Traditionally, however, research on management control systems (MCS) has primarily focused on supporting the exploitation of established strategies (Dávila et al., 2024). Management accounting systems (MASs) give managers data that they can use for planning and control, and management control is just one of many terms for the same thing: collecting, preparing, processing, analyzing, and reporting both financial and non-financial information to managers (Chenhall, 2003). Information should be relevant and designed to support decision-making within the firm (Kaplan, 1998). Based on Chenhall (2003), MASs are systems of using MA practices (e.g., budgeting and product costing) to reach a goal, and MCS include MASs together with other types of control, such as personal control. Management control takes the perspective of managers and is concerned with driving firms towards the achievement of organizational objectives. It relates to two main issues: design of the information and responsibility system of the operating activities (information issues) and the behavioral concerns of motivating managers and employees to achieve organizational goals (cognitive issues) (Zanin et al., 2017). This study aims to systematically analyze the literature on MCSs and cognitive issues to identify studies that link both fields and to provide a state of the art and a framework for the analysis and identification of future research opportunities.

In management control systems, control processes and mechanisms are employed to ensure that the organization achieves its predetermined goals and objectives (Jukka, 2023). There is substantial literature proposing various frameworks for MCSs (Bedford et al., 2016; Ferreira and Otley, 2009; Malmi and Brown, 2008). These frameworks are aimed at the study of the individual parts and characteristics of a single MCS (Jukka, 2023). Chenhall and Moers (2015), Ghodrat Abadi et al. (2022), Matsuo et al. (2021), and Lewandowski (2023) all examine management control systems in relation to the development of management accounting and the interactive and dynamic use of control mechanisms to shape individual performance. A more dynamic and open management accounting system has evolved from its traditional, cybernetic roots of controlling mechanisms within closed systems. In this way, modern systems provide a foundation for enabling innovation, while recognizing organizational complexity and promoting responsiveness.

There has been a renaissance in management control and accounting as of late, with several different theoretical frameworks being presented for MCS. Despite the substantial contributions to the literature from various published frameworks like the performance management and control framework (Ferreira and Otley, 2009) or more generalized ideas of management control systems (MCS), none of these current conceptualizations adequately address the present demands of management control by taking into account the viewpoints of the many different actors and stakeholders involved (Malmi and Brown, 2008).

Few studies have looked at what factors affect management control systems, despite the large body of literature on management accounting in the nation. However, companies need a strong management control system that can help them implement strategic management accounting programs. This system should be able to bridge the gap between strategy creation and planning. This study aims to explore and identify the key factors that influence cognitive management control systems.

It is important to note that a management control system cannot be transferred from one environment to another without careful consideration of the strategic management accounting issues involved. Each control and accounting system is designed to meet the specific strategic and operational needs of a particular company. Planning the installation of a management control system necessitates, therefore, familiarity with the selected strategic management accounting framework. Individuals in organizations, according to Simons's theory, are complex social systems that must balance their own interests with those of the organization while also contending with the influence of group norms and power dynamics. Control must balance internal contradictions like freedom versus constraints, employee autonomy versus responsibility, Learning versus control, Advice/support versus prohibitions, Motivation versus coercion, and innovation/experimentation versus efficiency (Lewandowski, 2023).

Lewandowski (2023) interprets these tensions as tensions between short- and long-term policies, as well as between top-down and bottom-up strategies (emergent strategies). An MCS is a framework used by organizations to define, monitor, and evaluate employee performance to foster a culture of optimal productivity aligned with the company's goals. According to Merchant and Van der Stede (2024, MCS places a high value on collaborative teamwork, and it ensures that all employees work cooperatively towards shared goals. These systems can be categorized based on the nature of the information they provide, namely as financial or non-financial control systems. Financial control systems, on the one hand, provide invaluable information for analyzing costs, managing cash flow, and improving a company's efficiency. In contrast, non-financial control systems are useful for identifying emerging market segments, forecasting sales, and engaging in competitor accounting.

Managers may evaluate competitive positioning differently even under comparable situations. MCS can influence their risk preferences by modifying their cognitive frameworks (Bhimani, 2012). In terms of how it thinks, acts, and designs its control systems, every company has its own logic. However, most of the previous research has ignored organizational learning, procedures, and practices in the context of cross-organizational information flows and coordination in favor of studying formal organizational structures. Adaptable methods of action are necessary for accounting, reporting, and control systems to integrate and balance various institutional logics in the face of conflicting social and instrumental demands (Agarwal et al., 2024). Management accounting is undergoing a period of transition as a result of the following factors: the ever-changing nature of information; the evolution of the concept of an organization from a "system" to an "organism" and finally to a "human being"; and the ever-changing environments in which these entities operate.

Emergent causality is replacing linear causality in strategic management accounting tools. This means that the focus is no longer solely on simple, predetermined relationships, but rather on complex, feedback-driven, and unpredictable reciprocal influences over time. Meaning-making within management control systems is based on an understanding of human behavior and thought in this new approach. This implies that control systems are no longer limited to financial numbers and data; instead, they emphasize how individuals and groups perceive, interpret, and react to organizational information and goals. This shift in perspective highlights the need for a deeper understanding of the human and cognitive dimensions in the control and management processes of today's complex organizations.

One of the key challenges impacting both financial and non-financial domains involves cognitive issues.

Management accounting techniques can be more effectively used, and value generation can be enhanced by attending to these often-intangible cognitive elements that impact MCS. The aims of the company, the management, and the employees themselves are in a constant state of dialectical

conflict, but this helps bring them into harmony. This method takes into account the fact that people's perceptions, interpretations, and processing of data have a significant bearing on the efficiency of control systems and, by extension, the accomplishment of organizational goals. Management control systems (MCS) and management accounting have both been the subject of substantial research, but most of that research has concentrated on the behavioral components of MCS. Nevertheless, there has been little research into MCS that takes a cognitive viewpoint. This work intends to fill that void by offering fresh perspectives to the field through a thorough analysis of the differences between conventional MCS and cognitively-based MCS.

In an era when management control is expected to replace direct instructions in guiding the actions of an increasing proportion of the workforce at ever lower hierarchical levels, and more remotely from top management, managers and coworkers will be expected to interact more frequently. Insufficient focus on management control systems is the main cause of this issue. These systems are crucial for making the goals of management and strategic accounting a reality. MCS are therefore operational procedures that link management accounting strategy creation and program implementation. Conducting a meta-synthesis-based systematic review of the literature on cognitively informed management control systems is the principal objective of the current work. The design and evaluation of MCS remain largely unexplored, despite the fact that previous studies have shed light on management systems and strategy. Rather than focusing on strategy formulation, many organizations struggle with strategy implementation due to the lack of adequate consideration of environmental context while implementing models in strategic management accounting. Cognitive management control systems emerge as a solution, bridging the gap between management control, strategic planning, and operational control.

Despite substantial studies in management accounting and management control systems (MCS), existing studies have predominantly concentrated on the behavioral dimensions of MCS, resulting in a lack of thorough cognitive analysis. As a result of this study, a new understanding of the differences between classic MCS and cognitively-based MCS is provided. Moreover, as MCS are progressively anticipated to direct workforce operations across diverse hierarchical tiers, supplanting direct directions, the significance of reciprocal interaction between managers and colleagues intensifies. This problem happens a lot because people do not pay enough attention to MCS, which are very important for turning management and strategic accounting goals into real actions. Therefore, MCS serve as operational tools for planning and implementing management accounting strategies. The primary aim of this study is to conduct a systematic review of the literature on cognitively informed management control systems using a meta-synthesis method.

This study is structured as follows: In the first part of the paper, we present an overview of MCS and the gap in research that exists. The second section provides the theoretical foundations of MCS and its connection to cognitive issues. Next, the research methodology is discussed, including the research question and the qualitative meta-synthesis approach employed in this study. Finally, the analysis and findings are presented in detail across six dimensions.

2. Literature review

There are many management control systems in organizations, including strategic planning, budgeting, resource allocation, performance measurement, incentive systems, and responsibility centers. Merchant and Van der Stede (2024) say that managers use MCS to make sure that their employees' actions and choices are in line with the company's goals and strategies. Specifically, MCS provides information that is useful to managers in carrying out their tasks and helps organizations develop and maintain consistent behavioral patterns (Otley, 1999).

Most of the time, MCS are described as "formal, information-based routines and procedures that

managers use to keep or change patterns in the way the organization works." A large amount of previous work in the field of management control has concentrated on determining what variables impact the implementation and development of MCS. Internal considerations can include things like the nature of the company, its focus on strategy, and its financial framework. Conversely, changes in contextual or external conditions, which are often exogenously imposed, also have significant implications for the configuration of control systems. According to Antonini and Gómez-Conde (2024), these outside forces might take many forms, such as changes in the economy, new regulations, or shifting expectations from stakeholders.

Formal processes like rules, regulations, policies, and established procedures are not sufficient to attain effective control in organizations. In many cases, actual control over employee performance and behavior is exercised through informal mechanisms such as organizational culture, shared values, behavioral norms, and human interactions. Traditional management control models and routines for protecting the company often make it hard for managers to deal with strategic issues in a good way. Instead of giving us useful information, these models often lead to long-winded SWOT studies and plans that we never follow through on. It is possible to make strategic judgments but never put them into action, showing that there is a gap between the two. Cognitivism has changed the way we look at organizations by moving us away from mechanistic approaches and toward systemic thinking. This means that we look at how different parts of a system interact and depend on each other to get a better picture of how organizations behave and develop. With the new way of thinking about systems, the whole thing was seen as a system, and its parts were seen as subsystems inside it. A system was regarded as a component of a broader supra-system, its environment. Components were no longer only added together; they worked together, which led to the realization that the whole was greater than the sum of its parts. From studying individual parts or entities, the focus shifted to studying how subsystems interact with each other, and how systems interact with each other. A fundamental aspect of this thinking is the assignment of different levels of existence to phenomena. A subsystem is seen as a subsystem of a system, a system as a subsystem of a system, and a system as a subsystem of a supra-system. The phenomenon is unique at each level and necessitates a separate form of comprehension (Stacey, 2007).

Behavioral control is the first step in establishing control inside MCS. The term "control" is used to describe a system that managers put in place to make sure employees operate in the right way. There are three main kinds of controls: behavioral, cultural, and results. The result control system focuses on rewards and sanctions, motivating employees to meet expected outcomes. Behavioral control is used to ensure consistency between employee actions and organizational expectations. Behavioral control is the fundamental building block of MCS control. By definition, a control is "a system encompassing all actions taken to ensure proper behaviors" in management. There are usually three kinds of controls: behavioral, cultural, and results. Rewards and penalties are the backbone of outcome control, which in turn motivates workers to aim for predetermined outcomes by drawing their attention to the effects of their actions. Accordingly, the central role of cognition is to support and enhance the capacity to control actions, thereby enabling the creation of integrated knowledge and consistent perceptions within cognitive systems of action and interpretation.

The first step to establishing a robust MCS is to comprehend and conceptualize its mechanisms. The first step is determining whether organizational members understand the suggestions and intentions of management accountants in the context of control systems. The second step involves assessing whether this understanding has evolved into a shared conceptualization. This shared understanding must be translated into action in the third step.



Figure 1. A pragmatist approach (Adapted from Engel et al, 2016).

Organizational programs' perceived success or failure is often attributed to employees' views of organizational difficulties. A recent study by Tessier and Otley (2012) emphasizes the need to differentiate between managerial intent and employees' perceptions of control. The goals of implementing MCS are known as managerial intent, but how such systems are perceived and experienced by employees is what makes them unique.

It is inevitable that MCS will limit individual autonomy by adopting predefined routines and processes, since one of the primary goals of MCS is to guide employee behavior (Langfield-Smith, 2006). This means that MCS could be seen by some workers as a danger to their job security. Instead of seeing MCS as a tool for support and empowerment, this perception develops when people (or groups) see them as a means for punishment, control, and restriction (Tessier & Otley, 2012).

When designed correctly, MCSs change how people act in ways that are good for the company, which makes it more likely that the company will reach its goals. So, the main job of management control is to change people's behavior in ways that are good for them. Management control makes it more likely that the organization's goals will be met (Merchant and Van der Stede, 2024).

Positively, management accounting and control are viewed as the only professions free of subjective, unjustified considerations, letting the numbers speak for themselves. A perfect "business brain" would be an accountant or controller who helps their supervisors avoid making poor or incorrect decisions.

Needless to say, both views are wrong. As much as management accounting is about numbers, it is also about human behavior. Company goals, budgets, variance analyses, or performance targets might all be expressed in numbers. However, they elicit responses from humans, such as resistance, inspiration, competition, assurance, etc. Thus, human behavior is as important as the quality and "perfection" of a plan itself in determining the success or failure of an endeavor (Charifzadeh and Taschner, 2017).

Human behavior is influenced by human perception. When managers, in collaboration with management accountants, formulate and execute a strategic plan, the success of this initiative depends on the alignment of perceptions between employees and managers.

For an organization's strategies to be put into action, management control mechanisms must be in place. Collaboration amongst employees in various roles and levels of authority is what makes up an organization. The company as a whole can have a stated objective, such as increasing profits, but employees have various priorities, such as increasing their own wealth or having more leisure time.

Management control must match firm goals with managers' and employees' personal ambitions (Charifzadeh and Taschner, 2017). Perceptual differences and misalignment between the goals of employees and managers lead to a decline in organizational performance.

Cognitive dissonance is a well-researched psychological phenomenon characterized by the conflict between two cognitive elements, such as beliefs, attitudes, or behaviors. For instance, managers frequently experience cognitive dissonance in the post-implementation stages of MCS, particularly when actual performance fails to meet their expectations, often resulting in feelings of regret. Similarly, dissonance may arise when organizational performance data conflict with a manager's "internal perceptions" (Xue and Sun, 2024). Cognitive dissonance theory has been applied to explore how employees' perceptions of MCS as a threat can lead to deviant workplace behavior and intentional ignorance. Cognitive dissonance theory is one of the most important ideas in social psychology, and it is also used a lot in economics (Dierick et al., 2019).

Contemporary cognitive science seeks to understand perception within real-world contexts. The objective of cognitive science is to explain the processes and mechanisms through which individuals recognize environmental constraints and align their perceptions with goals and situational factors (Frankish and Ramsey, 2012).

This study aims to bridge the gap between cognitive science and management control systems. Using the meta-synthesis approach, it aims to systematically review the literature on cognitively informed MCS. The research aims to enhance our understanding of how cognitive factors impact the effectiveness, perception, and implementation of control systems in organizational contexts by incorporating findings from both domains.

2.1 Domestic literature review

Hejazi and Ramesheh (2013) examined the relationships between product differentiation strategy, MCS, and innovation. They considered two dimensions of MCS: organic organizational culture and formal controls. The findings indicated a direct relationship between product differentiation and innovation, as well as both dimensions of the management control system.

Rashidi et al. (2016) investigated the relationships between business strategies, management control systems, and performance in industrial towns of Qazvin province. The findings revealed that business strategies (cost leadership and product differentiation) influence MCS, and MCS, in turn, affects organizational performance.

Abili et al. (2020) conducted a study on the application of cognitive sciences in management. Cognitive science has three main areas of application that they've identified. Firstly, it plays a role in basic managerial functions like decision-making, planning, and cognitive control. Secondly, it is used in different types of management, such as neuro-leadership, wise leadership, rational-brain leadership, and self-leadership/management. Lastly, it is used in specific domains, like cognitive knowledge management and cognitive business management.

Azizi et al. (2021), in a study on how the use of different management accounting techniques affects the efficiency of MCS, found that there are significant differences in the adoption of these techniques across companies. Moreover, not all management accounting techniques have the same impact on MCS effectiveness. Based on these findings, strategic management accounting tools should be applied dynamically, incorporating cognition and environmental factors.

Ghodrat Abadi et al. (2022) presented a two-dimensional outcome-based typology of control strategies to sustain organizational dynamism. Based on Lorange's outcome-oriented strategic control model and Simons' levers of control framework, key performance, profitability, transformation, and communication strategies were identified.

For their 2021 study, Ahmadi-Lengari and Garkaz investigated how MCS influences immoral

actions. They found that when people are praised for their fair involvement in the goal-setting process, their perceptions of procedural justice improve. But this sense of equity does not necessarily translate into pay raises for managers. Likewise, views of procedural and distributive justice are not enhanced when uncontrolled elements are ignored during performance review.

Sajjadi et al. (2023) examined the influence of innovation-oriented culture on the use of strategic management accounting techniques. The study found a positive and significant relationship between an innovation-oriented culture and the increased application of such techniques. Culture plays a role in strategic management accounting innovations, as well as in the effectiveness and efficiency of these innovations in different cultural and environmental settings. This environmental dynamism underscores the need for an MCS informed by cognitive sciences to successfully implement strategic management accounting tools.

Zeraatgari et al. (2024) studied the effect of perceived organizational justice in MCS on unethical behaviors in budgeting, emphasizing the psychological dimensions involved. The results were mixed, although there was a favorable and statistically significant correlation between financial slackiness and factors like using various performance criteria, having a hand in creating goals, and receiving high-quality feedback. In contrast, the principle of controllability did not have a significant effect on such tendencies.

Daneshmand Pour et al. (2025) conducted a study titled "The role of management accounting in individual and social behavior (grounded theory approach)." The first category of contextual conditions is related to project management and risk management. Risk management, within the realm of behavioral management accounting, lays the groundwork for its various levels. Informational and motivational impacts were part of the second group. Intervening conditions were primarily divided into two groups: basic behavioral management accounting principles and social and behavioral skills.

2.2 International literature review

Using an interview and document-based case study, Ruth (2020) investigated how MCS can facilitate or impede the uptake of integrated thinking. The study found that informal social controls, supported by senior leadership, fostered trust and collaboration, promoting outcome-oriented decision-making. Accounting profit-driven old performance measuring systems, on the other hand, served to stifle integrated thinking by serving to further isolate Business Units.

With process automation serving as a moderator, Papiorek and Hiebl (2024) investigated how the quality of management accounting information systems affected the effectiveness of management control systems (MCS). Their findings confirmed the assumed positive effect of information system quality on MCS effectiveness. Furthermore, this relationship is significantly stronger in organizations with a higher degree of process automation. Value creation issues grounded in contingency theory impact MCS efficacy beyond automation.

Ammar and Hassan (2024) conducted a quantitative study that looked at how different configurations of entrepreneurial cognition styles (ECSs) in SMEs relate to one another. They utilized a cross-sectional poll to determine that people have one of three cognitive styles: knowing (which is concerned with accuracy), planning (which is concerned with structure), and creativity (which is associated with new ideas). The findings suggest that these cognitive styles significantly influence how MCS are designed and utilized in entrepreneurial contexts.

SMEs employed five configurations of MCS simultaneously: customer focus, performance monitoring, administrative focus, strategic focus, and development focus. Three notable "constellations" or clusters of relationships between ECS and MCS were found in the study's combined analysis. These clusters were distinguished by a"cohesive integration approach" in

Cluster 1, a "revealing strategic approach" in Cluster 2, and a "multifaceted exploration" in Cluster 3.

Digital literacy, agile mindset, design thinking skills, and management control competencies were explored by Imjai et al. (2024). Design thinking abilities and control management abilities can be significantly developed with digital literacy and an agile mindset. An accountant's ability to put their digital knowledge and agile mentality to use is directly correlated to their level of digital understanding.

A separate study by Papiorek and Hiebl (2024) also confirmed the positive effects of high-quality management accounting information systems on the effectiveness of MCS.

The study by Huber et al. (2025) examined internal tensions within the components of MCS and how they affected the interaction between system elements. Their findings suggest that identifying the driving forces of individual elements is essential and that the tensions between elements should be viewed as dynamic and interactive. Strategic management accounting consists of two dimensions: academic theory development and practical trend analysis. Although prior research has explored various aspects of management accounting and strategic management accounting, limited attention has been given to the gap between planning and implementation. Addressing this research gap, the present study focuses on identifying factors that influence cognitive management control systems.

3 Methodology

3.1 Research question

Based on the systematic review of previous studies, the central research question is as follows:

Which factors influence cognitive management control systems?

3.2 Research methodology

Using a qualitative meta-synthesis approach, this study adopts a rigorous and interpretive methodology that is especially useful in research areas with uncertainty and a lack of consensus. Unlike traditional literature reviews that primarily summarize individual studies, meta-synthesis goes a step further. The results of different qualitative research can be systematically analyzed, compared, and translated using this method. Each of these individual studies might have utilized different conceptual tools, theoretical lenses, or methodological approaches. By bringing them together, meta-synthesis integrates these diverse insights into a more unified and coherent body of knowledge.

The core strength of this method lies in its ability to generate a comprehensive understanding. The comprehensive examination of all pertinent qualitative publications addressing management control systems in the framework of strategic management accounting led to this comprehension, which is not merely a summary. Our goal in going through this process is to come up with fresh and original interpretations that go beyond what individual research can cover. This allows for the identification of deeper patterns, nuanced relationships, and emergent theories that might not be apparent when examining studies in isolation. Bergdahl (2019) highlights the importance of qualitative meta-synthesis in identifying commonalities and promoting theoretical progress in the field by bringing together investigations of a certain topic.

3.3 Scope of the study

There are clear boundaries between time, space, and thematic areas in this study in order to ensure a focused and pertinent synthesis.

- Temporal Scope: The years 2000–2024 are comprehensively covered in this study. By focusing on the previous twenty years, we can monitor the development of ideas in these multidisciplinary domains and make sure that the synthesis is grounded in up-to-date research.
- Spatial Scope: Our search is specifically limited to peer-reviewed articles published in reputable academic journals. The selection of journals will primarily focus on the fields of management accounting and finance, ensuring that the included studies adhere to high scholarly standards and are directly relevant to our research domain. This exclusion of non-peer-reviewed sources, grey literature, or dissertations helps maintain the quality and academic rigor of the synthesized evidence.
- Thematic Scope: The core thematic areas guiding our meta-synthesis include strategic management accounting, management control systems, and cognitive science. This interdisciplinary focus is crucial for exploring how human cognitive processes influence the design, implementation, and effectiveness of control systems in strategic contexts. The focus of our analysis will be to unpack the interplay between these three critical elements, shedding light on the human element that is often neglected in more traditional analyses of management control. The research protocol for this meta-synthesis follows the seven-step guideline developed by Sandelowski et al. (2006), as illustrated in Figure 2.

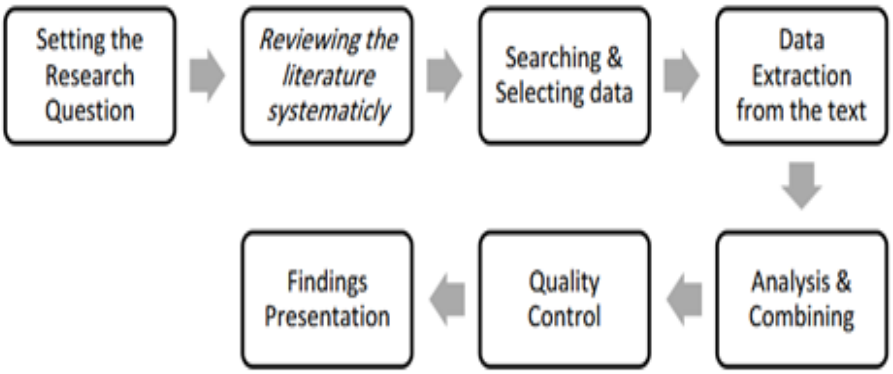


Figure 2. Research process

Step one: Formulating the research question

According to the objective, the research indicators—namely, *which population*, *what*, *when*, and *how* must be addressed. Based on this, the research questions have been organized in Table 1.

Table 1. Parameters related to formulating the research question

Key Questions	Identifying the central topic of the study is the starting point in the meta-synthesis approach. In this research, the process begins with the main research question:
What	What are the cognitive science components in management control systems?
Who	In this study, reputable international academic databases and various search engines have been examined.
When	The timeframe during which documents and records were searched and reviewed spans from 2000 to 2024. In view of the limited amount of research conducted domestically on this topic, only credible international journals have been considered.
How	The method refers to the approach used to collect studies. In this research, the secondary data analysis method has been applied. The researcher, based on specific criteria, identifies and selects appropriate articles that either enter or are excluded from the meta-synthesis process.

Step Two: systematic literature review

For this study, researchers used keywords from article titles, abstracts, and keyword sections to search Scopus and Google Scholar for English-language journal papers published between 2000 and 2024. As a result of its extensive coverage of sources, high citation metrics, access to interdisciplinary materials, and intelligent tools for systematic searching, the Scopus database was selected as the primary literature retrieval source. Additional searches were conducted using Google Scholar (Table 2).

Table 2. Keywords used in the search

English keywords
Management Control
Management Control System
Management Accounting
Strategic Management Accounting
Cognitive and Behavioral Factors in Management Accounting

Step Three: Searching and selecting relevant literature

The collected documents were reviewed in terms of the relevance of their titles, abstracts, and full texts to the research objective. Ultimately, articles were selected that either directly explained or indirectly defined the concept by examining its dimensions, components, and complexities. The screening process was conducted based on the inclusion and exclusion criteria outlined in Table 3.

Table 3. Inclusion and exclusion criteria for meta-synthesis

Factors	Inclusion Criteria	Exclusion Criteria
Geographic Scope	All studies	Conference papers
Language of Research	English	Non-English
Timeframe	2000–2024	Prior to 2000
Method Used in Document	Qualitative and quantitative methods	Non-systematic approaches
Subject Area	Related to Strategic Management, Accounting, and Management Control Systems	Unrelated topics
Type of Study	Peer-reviewed journal articles	Personal opinions, personal websites, reports, and conference proceedings

Step Four: Data extraction from selected articles

At this stage of the meta-synthesis process, the researcher continuously reviews the articles selected in Step Three to identify distinct content-related elements within which the primary studies have been conducted. These elements are regarded as initial open codes. Table 4 records the remaining references, based on the authors' names and publication dates, of this study, including the open codes that were identified and extracted.

Step Five: Analysis and integration of qualitative findings

The researcher carefully reviewed and re-examined the extracted codes in this step. Taking into account the meaning of each code, the researcher aimed to identify shared concepts and categories. Once identified, these codes were grouped into broader concepts and then categorized under thematic headings that best described the underlying ideas.

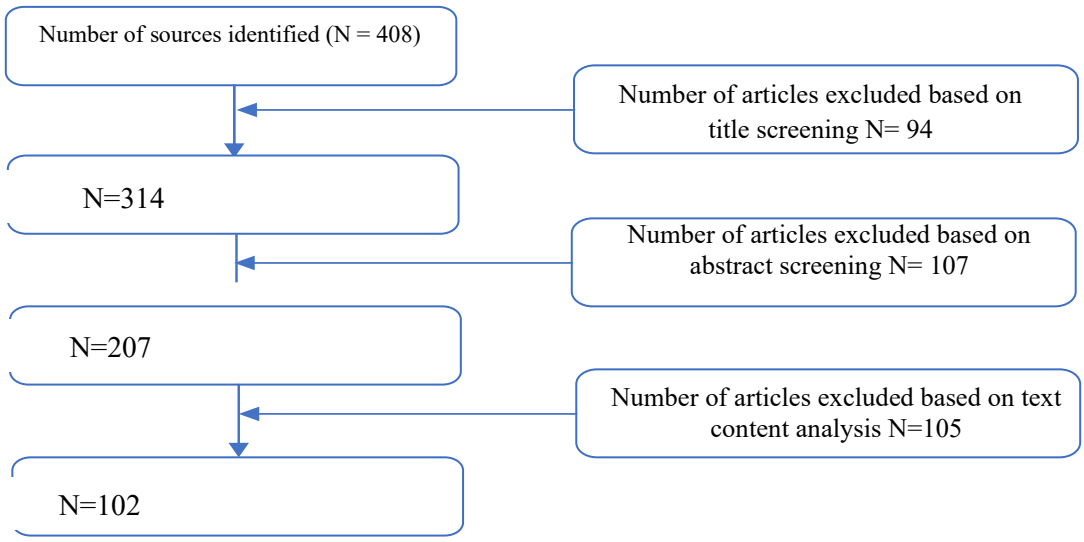


Figure 3. Search and selection of relevant articles

In this approach, based on the researcher's understanding and intuition regarding the subject matter, codes were classified into concepts, and concepts were further grouped into categories. The discovered aspects of cognitive management control systems were subsequently grouped according to certain characteristics after an analysis of the commonalities between these groups. Here is a simple, step-by-step example to help you understand the process:

- Initial Open Code (from raw text): "Managers struggle to deal with strategic issues."
- Concept (grouping similar open codes): "Challenges in strategic engagement" (This concept might also group codes like "visions not connected to reality" or "long-term plans are simply filed")
- Category (broader thematic grouping of concepts): "Cognitive Limitation" (This category could encompass concepts such as "Challenges in strategic engagement" and "Inconsistency with rational predictions").

Finally, the classification of the findings is presented in Table 4.

Table 4. The classification.

Category	Code	Concept	Author (s)/Year
Dynamic cognitive capabilities of management control	Understanding the causal relationships of the components of the management control system	Combined use of automated controls, an integrated approach in the management control system, and the role of human factors	Shields et al. (2000)
	Aligning the agent's motivations	Causal relationships of the process, interaction with the environment	Maasalo and Teittinen (2023)
	Measurement diversity	Multiple and diverse measurement criteria, feedback and updating performance measurement criteria, a range of performance criteria from detailed to holistic	Bedford et al. (2016); Langfield-Smith (2006)

	Effective management system factors	Management objectives for process, procedural goals, logic, and feedback in the control system	Chenhall (2003)
	Interdependence between management control system practices	Creating a shared understanding of the meaning and complex concepts of information, considering contingency theory	Bedford et al. (2016)
	Decision-making rules	Collected, integrated, and timely for operational decision-making	Bedford et al. (2016)
	Financial controls	Planning and forecasting, administrative controls such as structures and management processes	Akroyd (2019)
	Planning controls	Planning, effort, and the direct behavior of organizational members through setting functional area objectives and providing expected standards regarding control objectives, as well as coordinating among functional areas via goal alignment.	Malmi and Brown (2008)
	Cybernetic control	Feedback loop, performance measurement system, informational feedback on undesired variances in the system, and correction of system components.	Malmi and Brown (2008); Chenhall (2003); Ferreira and Otley (2009)
	Cultural controls	To inspire and motivate employees and guide search and discovery by transferring the company's core values.	Merchant and Van der Stede (2024); Anthony and Govindarajan (2007); Malmi and Brown (2008)
	Organizational commitment	Team members feel emotional attachment to their team. Team members feel a strong sense of belonging to their team.	Appuhami et al. (2011)
	Economic transaction cost	Encouraging goal alignment and thereby minimizing relational and performance risks.	Appuhami et al. (2011)
	System dynamics	Establishing and implementing management control systems, identifying and analyzing final results, and providing feedback to decision-makers.	Dirks and Wouters (2025)
Cognitive Awareness Control	Cognitive limitation	Human agents are constrained by knowledge limitations and cognitive biases; the complexity of processes and their limited cognitive abilities.	Bedford et al. (2016); Chenhall (2003)
	Bounded rationality	Inconsistency with predictions based on assumptions of rational economic decision-making.	Appuhami et al. (2011); Chenhall (2003)
	Individuals' mental representation	Rules of accuracy, correction, representation, and ethicality; information exchange and search; involvement of ethical standards in control.	Roberson and Stewart (2006)
	Knowledge processing problem	Uncertainty as "lack of sufficient information"; complexity as "lack of a conceptual framework to interpret information."	Lopez-Valeiras et al. (2024)

	Individual cognitive style	The tendency of individuals to use different types of information, such as opportunity costs, and the ability of managers and employees to build trust.	Chenhall (2003)
	Fair design	Fairly designing management control systems, aligning organizational goals with individual capabilities.	Janke et al. (2014)
	Procedural understanding	Allowing users to deviate from procedures, tailoring procedures to the needs of each sub-unit.	Ter Bogt and Scapens (2019)
	Cognitive frames	Maintaining a management mindset and aligning goal actions to avoid risky situations.	Chenhall and Moers (2015)
	Cognitive control	Subordinates' participation in decision-making: challenging and debating data, assumptions, and action plans.	Maasalo and Teittinen (2023)
	Cognitive flexibility	Enhancing information flow; reducing hierarchical and functional barriers; key performance indicators and other information.	Langfield-Smith (2006)
	Cognitive biases	Inertia pressures, maintaining competencies and successful past routines, bias toward past key success measures.	Bedford et al. (2016)
	Social capital	Better understanding of tribal control performance, explaining how tribal control works and its positive performance impacts, and bureaucratic controls.	Ströbele andWentges (2018)
Cultural and Behavioral Control Systems	Behavioral understanding	Understanding behavior driven by biases toward procedures; evaluating alignment of goal level and accountability.	Kim et al. (2018)
	Behavioral risk	Opportunism, bounded rationality, uncertainty, and asset specificity.	Appuhami et al. (2011)
	Results control	Controls of performance risk, performance measurement standards that are clearly defined, and minimizing performance risk.	Appuhami et al. (2011); Chenhall (2003)
	Organizational culture	Cultures of clan, bureaucracy, market; values, beliefs, assumptions; broad “fit” between personal and organizational values; informal social controls; employee socialization; alignment and self-regulation.	Merchant and Van der Stede (2024); Anthony and Govindarajan (2007)
	Meaningful work	Key drivers of individual performance: purposeful and valued goals; work engagement and individual performance.	Burghardt and Möller (2023)
	Work outcome	Managing employees' experienced meaningfulness.	Burghardt and Möller (2023)
	Learning agility	The ability to respond quickly and effectively to changes, proactively gaining insights from transformative experiences to increase customer value.	Jutidharabongse et al. (2024); Zanin et al. (2017)
	Reform management	Systematic approach to improving organizational performance, reforming processes, structures, or culture, and absorptive capacity for knowledge and adaptation to experiences.	Jutidharabongse et al. (2024)

	Behavioral focus	Controlling others' behavior and managing their performance.	Merchant and Van der Stede (2024); Pfister et al. (2023)
	Attention shift	Focusing on value-added activities, customer relationships, and customer-focused KPIs.	Janke et al. (2014) Dávila et al. (2024)
	Output control	Determining performance standards for the project, such as technical performance, quality, profitability, and market share.	Bonner (2005); Zanin et al. (2017)
Cognitive Competencies	Motivation for discussion	Facilitating organizational dialogue.	Bracci and Tallaki (2021)
	Leadership style	Transformational, dialogue-driven, flexible.	Maasalo and Teittinen (2023)
	Creative competency	Ability to generate new and novel ideas and solve problems innovatively; creative thinking and original solutions to new challenges.	Jutidharabongse et al. (2024)
	Organizational resilience	Maintaining control and performance stability; diagnostic use of controls; organizational adaptability.	Baird et al. (2023)
	Strategic decision-making	Resource allocation, risk reduction, performance evaluation for strengthening dynamic capabilities and sustainable performance; strategic mindset.	Zanin et al. (2017)
	Management control competency	Resource capacity to guide and monitor organizational activities; organizational adaptability and capacity to manage multifaceted challenges.	Jutidharabongse et al. (2024)
	Impact management	Understanding cause-and-effect relationships between employee actions and project performance, interactive use, and obtaining updated information from various stakeholders.	Burghardt and Möller (2023); Dirks and Wouters (2025)
	Control perceptions	Employees' proper perception of controls.	Tessier and Otley (2012)
	Continuous learning	Adaptability and learning from experience through more informed and data-driven decision-making.	Appuhami et al. (2011)
	Trust-based strategy	Non-opportunistic behavior, minimizing performance risk, stable social relationships, collaborative behavior, reducing transaction costs, and interdependence among stakeholders.	Appuhami et al. (2011); Zanin et al. (2017)
	Realism	Objective and factual data; decision-making based on real data.	Merchant and Van der Stede (2024)
Cognitive Foresight	Seeing the big picture	Non-financial information is provided through reports that include data such as sales forecasts, a mix of past and future data, and forward-looking approaches for future actions.	Davila et al. (2009); Zanin et al. (2017)
	Future-oriented mindset	A combination of historical information, adopting forward-looking approaches, alignment with a forward-looking mindset, and full evaluation of negative aspects.	Lopez-Valeiras et al. (2024)

	Mental models	Understanding employees and organizational processes, ensuring sustainability through informal controls.	Janke et al. (2014); López-Valeiras et al. (2024)
	Attitude change	Changing attitudes toward behavior, drivers, and variables.	Tessier and Otley (2012)
	Resilience capacity management	Cautious planning, monitoring, control processes, flexible budgeting, performance management, and how to implement them.	Bracci and Tallaki (2021)
	Coping capacities	The ability to cope with disruptions through coping actions.	Bracci and Tallaki (2021)
	Buffer capacities	Ability to absorb shocks without changing structure or performance, such as delaying investments or postponing expenses.	Bracci and Tallaki (2021)
	Cognitive capacity of open systems	Close relationship between the organization and its environment; attention to the impact of the human relations school, focusing on human behavior.	Pfister et al. (2023); Zanin et al. (2017)
	Transformational leadership	Personal attention and intellectual stimulation to inspire employees, using non-financial and forward-looking information.	Maasalo andTeittinen (2023)
	Managerial flexibility	Discretionary power for decision-making; need to deviate from rules in emergencies; convincing and supporting senior management.	Tessier and Otley (2012)
	Dynamic tension	Simultaneous and intensive use of interactive and diagnostic controls.	Bedford et al. (2016); Zanin et al. (2017)
	Critical thinking	Critical analysis, explanatory knowledge, questioning assumptions.	Rautiainen et al. (2024)
	Causality	Considering structural relationships between variables, the nature of causality between variables, and levels of analysis, descriptive knowledge is obtained.	Bracci and Tallaki (2021)
	Managerial discretion	A project manager's freedom to decide which actions are permitted and how they should be executed; autonomy and accountability.	Sakka et al. (2013); Zanin et al. (2017)
	Social controls	Controls over “emotional, irrational, and emotional elements of employees”; core values, beliefs, norms.	Einhorn et al. (2024)
	Technical controls	How tasks are performed, how people and groups are organized based on rules, procedures, and standards.	Tessier and Otley (2012); Malmi and Brown (2008)
	Delegation	Adaptability: achieving the agent and delegating decision-making authority to choose actions; selecting actions with environmental analysis.	Bedford et al. (2016); Zanin et al. (2017)
	Contingency theory	Task uncertainty and environmental uncertainty; instability of the management control system; and consideration of organizational structure.	Chenhall (2003)
person-organization fit	Competence trust	Perception of benevolence, competence, and integrity; mutual information sharing and problem-solving.	Appuhami et al. (2011)

	Fairness in the management control system	Fair design of management control system; reducing unethical behavior; fair performance indicators.	Merchant and Van der Stede (2024); Otley (1999)
	Non-conflict	Pursuing social responsibility goals, economic management based on conventional procedures.	Vuorenmaa (2024)
	Soft controls	Team control and bureaucratic formal controls.	Ströbele and Wentges (2018); Zanin et al. (2017)
	Duality of role	The dual role of controls as "positive" and "negative" or "decision-facilitating" and "decision-influencing"; limiting and facilitating elements.	Bracci and Tallaki (2021)
	Interpersonal characteristics	Belief systems, boundary controls, and interpersonal characteristics.	Abernethy et al. (2010)
	Informal controls	Individual, professional, and cultural controls; less reliance on standard operational procedures, programs, and plans.	Ferreira and Otley (2009); Burghardt and Möller (2023)
	Role ambiguity	Conflict between formal and informal management control systems.	Sakka et al. (2013)
	Executive controls	Organizing people and groups, monitoring behavior, and holding employees accountable for their behavior; the process of specifying task execution.	Malmi and Brown (2008)
	Reward and compensation control	Aligning organizational members' goals with the organization through aligning financial interests.	Malmi and Brown (2008)
	Behavioral outcomes	Job satisfaction and human resource management.	Chenhall (2003); Pfister et al. (2023)
	Knowledge sharing	Knowledge sharing within teams, team-based organizational design, tribal control, and intra-team monitoring.	Radtke et al. (2023)
	Psychological empowerment	Sense of control over work, competence, meaning, and participation in goals.	Mahmoud et al. (2022)
	Bias in employees' and managers' perceptions	There is a mismatch between managerial intentions and employees' perceptions of empowerment and limitations.	Tessier and Otley (2012)

Step 6: Quality control

To ensure reliability and quality, the documents were randomly assigned to experts. The experts, without knowledge of how the indices and concepts were integrated by the researcher, categorized the documents. After comparing the categories of the researcher with the expert, the relationships were calculated as shown in Table 5. If the codes from the two coders are close, it indicates a high level of agreement between the two coders, which reflects the reliability of the study. Cohen's Kappa index was used to evaluate the level of agreement between the two raters. The Kappa index fluctuates between zero and one. In general, the closer this measure is to one, the greater the agreement between the raters, but when it approaches zero, there is less agreement. Given that the Kappa coefficient of 0.656 indicates the validity of this measure.

4. Results

Management Accounting Systems (MASs) provide information to assist managers in planning and control. Management Accounting (MA) activities primarily involve collecting, preparing, processing, analyzing, and reporting financial and non-financial information to managers. The

information should be relevant and designed to support decision-making within the organization (Zanin et al., 2017).

Table 5. Calculation of the kappa index

Consensus observatus = 0.666		**researcher's opinion**		
		Yes	**No**	**Total**
Opinionem alterius periti	Yes	11	3	14
	No	3	1	4
	Total	14	4	18
Consensus observatus casu	0.0298	Kappa coefficient: 0.656		

A total of 102 codes were extracted, grouped into six categories related to the use of cognitive sciences in management control systems. These categories include cognitive awareness control, cognitive foresight, control over individual-organization fit, control over behavioral and cultural aspects, and review of previous studies.

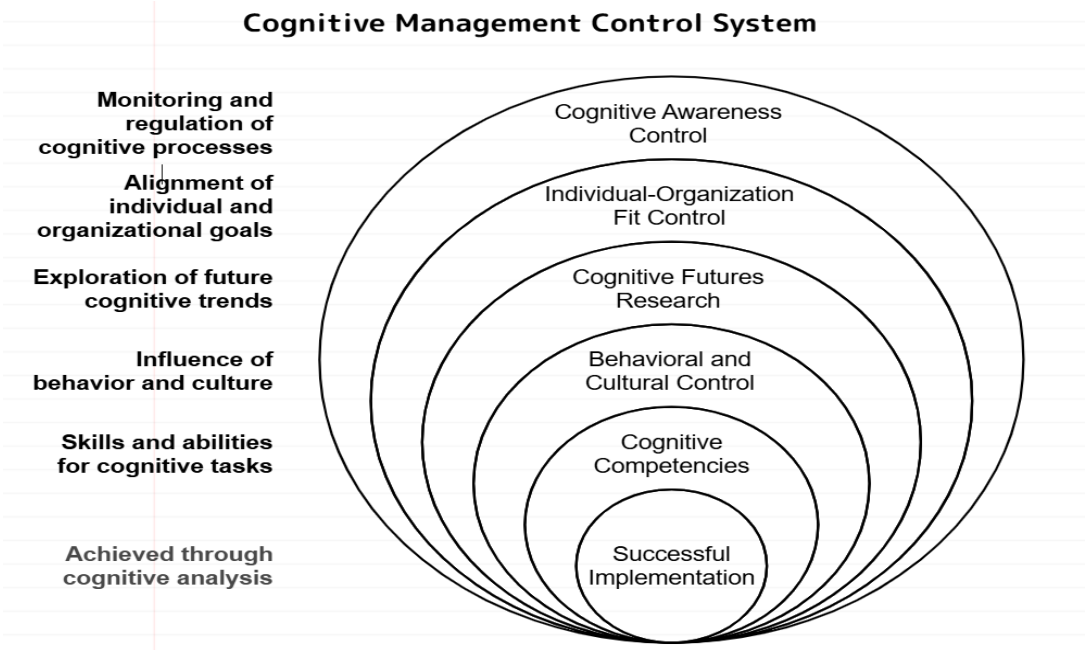


Figure 4. cognitive sciences in management control systems

4.1 Dynamic cognitive capabilities

Strategic management accounting tools are based on contingency theory, making attention to dynamic resource capabilities crucial for management control systems. An organization's capacity to coordinate its resources to carry out tasks or activities is known as its dynamic organizational capability.

According to resource-based theory, dynamic organizational capabilities generate value and drive organizational outcomes. While distinguishing between static and dynamic capabilities is often challenging, the former is often considered to be resources or competencies that enable an organization to cope with production process issues. On the other hand, dynamic organizational capabilities are viewed as strategic actions that enable organizations to adapt to environmental threats and opportunities (Nuhu et al., 2019). For the successful implementation of management control systems, organizations need causal and root-cause analyses of the dynamics of the management control system in the first stage to develop a rich understanding of the causal

relationships among its components. In the second stage, the approach of empowering the implementation of management control systems should overcome organizational complexity. In the third stage, aligning agents' motivations with management's objectives by integrating knowledge available to organizational goals and control objectives is crucial. This study's results align with those of Burghardt and Möller (2023) and Dirks and Wouters (2025), who also highlight the importance of dynamic cognitive capacities in helping firms spot opportunities and hazards during MCS implementation.

4.2 Cognitive awareness control

Cognitive awareness encompasses awareness of stimuli and environmental events, as well as cognitive phenomena such as sensation, thought, and representation.

Within the context of (MCS) and strategic management accounting, this concept is crucial for aligning individual and organizational perceptions. Awareness encompasses perceptual, non-perceptual, and self-awareness, which are associated with three types of memory: episodic, semantic, and procedural. Procedural memory, which concerns how tasks are performed, relates to the practical application of MCS. This dimension within MCS includes psychological empowerment, structural empowerment, cognitive frameworks, and cognitive flexibility, which are vital for effective implementation. For successful MCS implementation, individuals within the organization need a shared understanding of its goals and strategies. Therefore, cognitive awareness control is crucial for aligning the shared understanding among those involved in the management control system. The findings are consistent with the research of Bedford et al. (2016); Chenhall (2003); Ghodrat Abadi et al. (2022); Lopez-Valeiras et al. (2024).

4.3 Cultural and behavioral control systems

Management systems (environmental) and organizational culture are distinct constructs but interdependent. Organizational culture is embodied within the organization and, thus, determines the actual behavior of employees (Schein, 2010). The culture of every organization is either explicit, as managed by mechanisms (such as cultural controls), or implicit, as accepted by management without any attempt at change (Schein, 2010). Thus, organizational culture, as a contextual factor of management controls, has an indirect impact on individual or group behavior, while managerial controls are mechanisms that directly influence behavior to achieve organizational objectives. Cultural controls are managerial mechanisms used to interact with employees and actively manage their behavior. They can reinforce organizational culture within the company (Sageder and Feldbauer-Durstmüller, 2019). According to the research of Sajjadi et al. (2023), organizational culture is dynamic and requires deep attention for innovation in management accounting. The findings are consistent with the research of Appuhami et al. (2011); Chenhall (2003); Merchant and Van der Stede (2024); Anthony and Govindarajan (2007).

4.4 Cognitive competencies

Based on Piaget's (1997) theories of cognitive competence, individuals are able to manipulate their experiences and organize and adapt their thoughts to guide their actions. Cognitive competence involves three interrelated and dependent components: cognitive structures, cognitive processes, and overt behaviors. Among them, “cognitive processes” such as metacognition, self-regulatory cognitive styles, and cognitive skills of thinking, reasoning, problem analysis, and information processing can influence an individual’s “behaviors” such as task performance, problem-solving, and decision-making, as well as “cognitive structures” like self-schemas and goal orientations. Furthermore, individuals can alter their cognitive abilities by manipulating mental

processes and cognitive styles through the use of thinking skills, thus contributing to cognitive growth and capability. Cognitive competence fosters strategic orientation of information, internalization abilities, self-regulation, and the transfer of these cognitive skills to create knowledge and perceive a dynamic environment (Lee et al., 2012).

In cognitive competence, management control system designers require a set of skills necessary for performing tasks within a specific domain (Väisänen et al., 2021). Transparency, accountability, motivation for dialogue and discussion within organizations, resilience capabilities, and impact management are examples of cognitive competencies in management control systems. In cognitive competence, the perception of individuals regarding the goals and strategies plays a determining role in the effectiveness of the management control system.

To gain a meaningful understanding and effective feedback from the management control system, management accountants have to align their perceptions with realities and gather information from alternative and multiple sources. The findings are consistent with the research of Väisänen et al. (2021).

4.5 Cognitive foresight

In cognitive foresight, to enhance self-development, it is necessary to see a combination of the big picture and a future-oriented mindset. Hence, management control systems can be designed to manage resilience, coping, buffering, adaptability, and flexibility. Management accountants, based on the mental models of managers and the forces affecting the management control system, take the big picture into account and assess the capacity for transformation and action within the management control system. The challenge is, for instance, to question traditional assumptions because cognitive foresight explores multiple alternative futures according to contingency theory. According to Lopez-Valeiras et al. (2024) and Janke et al. (2014), the findings are consistent.

4.6 Person-organization fit control

Although human behavior can be explained by environmental or organizational factors, it can be enhanced by focusing on individuals because they bring a unique interpretation to the situation. Person-environment fit examines the extent to which individuals' demands for financial, physical, and psychological resources, as well as task-related opportunities, align with the features provided by the organization. The degree to which a person's skills match the needs of the organization for their involvement is another way of looking at fit. Trust competence, interpersonal traits, role conflict, self-control, role duality, compensation, and reward controls are all aspects of a well-fitting person with an organization. The findings are consistent with the research of Merchant and Van der Stede (2024), Otley (1999), and Malmi and Brown (2008).

5. Conclusion

During the era of the Industrial Revolution and scientific management, the role of management accounting was primarily focused on cost calculation and cost reduction. Consequently, management control systems were implemented linearly and mechanically. The degree to which a person's skills match the needs of the organization for their involvement is another way of looking at fit. Trust competence, interpersonal traits, role conflict, self-control, role duality, compensation, and reward controls are all aspects of a well-fitting person with an organization. In response to these evolving managerial needs, strategic management accounting emerged.

Strategic management accounting, by focusing on both internal and external organizational factors, aims to achieve sustainable value creation within organizations. One of the key components of strategic management accounting systems for implementing organizational strategies is the

control system. Formal control systems, due to their alignment with mechanistic organizations, can hinder employee creativity and motivation. Additionally, not all control actions can be predetermined; therefore, effective decision-making requires cognitive and behavioral considerations. The objective of the present study is to conduct a systematic review of research related to cognitive-based management control systems using a meta-synthesis method.

Cognitive competences, cognitive awareness, cognitive foresight, behavioral and cultural control, and cognitive dynamic capacities are some of the components that emerged from the meta-synthesis on cognitive management control systems. Based on contingency theory, resource dependence theory, and the person-environment fit theory, implementing a management control system necessitates an understanding of cognitive and behavioral processes. The findings suggest that in dynamic and culturally vibrant organizational environments, (MCS) must move beyond traditional mechanistic models. A cognitively-informed approach is essential to provide the necessary flexibility for implementing strategic management accounting techniques. Furthermore, achieving organizational goals through MCS requires attention to perceived fairness and justice, highlighting the importance of stakeholders' perceptions and cognitive engagement in the sensemaking processes during strategic execution.

Management control systems facilitate adaptability to environmental changes, provide performance feedback, help assess the profitability of products and customers, and enable managerial decision-making. It is recommended that to understand cognitive processes within control systems, one must also consider behavior, organizational culture, and leadership style. This understanding enables the development of outcome-based, meaningful work-oriented, and culturally aligned control systems. Additionally, it is advised that organizations first identify and design their strategic management accounting systems, recognizing the influencing factors and determining appropriate strategies. Only then should the management control system be developed. Neglecting cognitive and behavioral elements may result in divergent individual perceptions of shared objectives, thereby undermining the effectiveness of the control system.

In light of contingency and resource dependence theories, each organization's management control system must be tailored to its dynamic mechanisms. Thus, it is recommended that person-environment fit within dynamic organizational contexts be carefully considered in system implementation.

When deciding where to put the management control system in their company, executives should think about the objective, the resources available to them, and the competitive landscape. Adapting control systems to support effective decision-making under uncertain conditions requires conceptual and fundamental changes.

Future research could explore how specific characteristics of different organizational cultures influence cognitive management control systems and assess the effects of various managerial strategies on the effectiveness of these systems, potentially contributing to further advancements in this field. It could also investigate how managers' perceptions of strategic management accounting practices influence cognitive management control systems.

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IJAAF; Vol. 10, No. 1, Winter 2026, Serial 34

Iranian Journal of
Accounting, Auditing & Finance

Ferdowsi University of Mashhad

Quarterly

RESEARCH ARTICLE

Judgment and Decision-Making in Accounting and Auditing: The Perspective of the Individual, Task, and Environment

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How to cite this article:
Rahimi, K. , Mehrazin, A. , Noori Toupkanlu, Z. and Moradi, M. (2026). Judgment and Decision-Making in Accounting and Auditing: The Perspective of the Individual, Task, and Environment. Iranian Journal of Accounting, Auditing and Finance, 10(1), 117-149. doi: 10.22067/ijaaf.2026.46780.1509
https://ijaaf.um.ac.ir/article_46780.html

ARTICLE INFO

Article History
Received: 2025-01-25
Accepted: 2025-07-21
Published online: 2026-02-01

Keywords:
Judgment and Decision-making in Accounting, Judgment and Decision-making in Auditing, Individual Perspective, Task and Environment, Tehran Stock Exchange

Abstract

Considering the individual, task, and environment perspectives, this study examined judgment and decision-making in accounting and auditing. The research variables included auditor financial knowledge, auditor experience, audit environment risk, internal controls in the audit environment, time-budget pressure in auditing, and the quality of judgment and decision-making. These variables were based on a researcher-designed questionnaire and previous researchers' questionnaires, including those of Boone (1996), Bagley (2010), and Krishnan (2012), each of which has investigated these variables. A ten-year study of Tehran Stock Exchange-listed companies was conducted from 2012 to 2022. Data were collected through standardized questionnaires. The R software analyzed and fit the data to the ten research hypotheses. The results indicated a significant correlation between financial knowledge, experience, environmental risk, internal controls, and financial knowledge with the quality of judgment and decision-making by accountants. However, no significant correlation was found between work pressure and the quality of judgment and decision-making. The findings highlighted the importance of employing highly knowledgeable and skilled accountants, creating a secure environment, improving internal controls, and reducing high work pressure. Accountants can improve their judgment and decision-making by establishing such environments to improve data entry and processing accuracy.

https://doi.org/10.22067/ijaaf.2024.43077.1130

NUMBER OF REFERENCES
56

NUMBER OF FIGURES
14

NUMBER OF TABLES
21

Homepage: https://ijaaf.um.ac.ir
E-Issn: 2717-4131
P-Issn: 2588-6142

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1. Introduction

The quality of economic decisions is undoubtedly dependent on the accuracy and reliability of the information available today. Financial statements are the primary source of information for external stakeholders, especially investors, in obtaining necessary data. Among these, the income statement has attracted significant attention from investors as it provides valuable information regarding the profitability of business entities. On the other hand, the exercise of judgment by managers in preparing financial statements raises concerns about the reliability of accounting profits. If managers, through their discretion in accounting choices within financial reporting, have incentives to mislead financial statement users, the possibility of earnings manipulation or management arises (Roychowdhury, 2006). Financial markets and investment sectors play a significant role in countries' economies. Investors expect returns on their investments. The decision-making of potential and actual investors is based on the financial statements published by companies. Therefore, this information's accuracy, quality, and reliability must be confirmed by a competent authority. Independent auditors serve as trusted agents of the owners of economic entities for this purpose. Moreover, agency theory underscores the necessity of independent auditing by illustrating the conflict of interest between owners and individuals in positions of control within the company (Al-Najjar and Clarke, 2017). Laws such as the Sarbanes-Oxley Act of 2002 were enacted to restore investor confidence, emphasizing the improvement of audit committee independence, enhancing the accountability of senior management, separating accounting operations from the computational services of the company, and ensuring effective internal controls by high-quality independent auditors (Hoag et al., 2017). As a result, the quality of auditing performed is vital for companies in the modern era. The auditor's oversight of these key issues is significant to owners. Hence, the characteristics of the company's independent auditor hold considerable value.

An auditor's personal characteristics are fundamental to the quality of the audit. An independent auditor encounters issues through their assessments, where discovering and making decisions regarding these matters are related to the auditor’s traits, including skepticism, inquisitive attitude, and abilities (Gul et al., 2013). Audit quality is significantly influenced by the auditor's experience and academic knowledge (Cahan and Sun, 2015). In many studies, audit quality has been regarded as the quality of the auditor’s work (Watkins et al., 2004). Consequently, this study aims to assess the relationship between auditors' characteristics and the outcomes of the work performed by independent auditors. The subsequent section may elaborate on the research problem.

This paper examines decision-making in auditing, focusing on research that uses a psychological lens to understand, evaluate, and improve judgments, decisions, or choices within an auditing context. Much of this work employs an experimental approach; however, we also covered related studies utilizing survey and field studies. Several review articles have already covered our period of interest (Libby and Lewis, 1982; Libby and Luft, 1993; Solomon et al., 1999; Libby and Tan, 1995; Solomon and Trotman, 2003). These reviews differ in how they categorize previous research. To illustrate the role of knowledge, ability, motivation, and environment in performance, Libby and Luft (1993) arranged the literature in a certain way. Understanding the literature on multimedia judgment, bias, knowledge and memory, probabilistic judgment, environment and motivation, and policy adoption is facilitated by Solomon et al. (1999) and Solomon and Trotman (2003). In this research, the existing literature on auditing JDM (Judgment and Decision Making) is classified into three broad areas: (a) auditing tasks, (b) the auditor and their characteristics, and (c) the interaction between auditors and other stakeholders in task performance. These three characteristics—task, person, and interpersonal interaction—are integral features of the auditing setting. Auditors must perform various tasks to form an overall opinion of assurance or confirmation. So, the auditor's

skills and personality (e.g., skills) have an impact on the outcome. During this process, auditors interact with other auditors and stakeholders in the firm. Accounting and auditing are based on professional judgment (Trotman, 2006). Research opportunities in auditing programs (Bedard, 1989) and the influential report from the American Accounting Association (Committee on Human Information Processing, 1977) brought about developments in judgment and decision-making in accounting and auditing. The study of Judgment and Decision-Making (JDM) has become a significant area of research (Solomon **and** Trotman, 2003). As a research field, JDM examines the judgments and decisions made by individuals and groups (Trotman, 2006). JDM's characteristics are becoming highly accepted as important in accounting and auditing because managers, auditors, financial analysts, accountants, and standard-setters make important choices and judgments. Professional judgment is required 244 times in the International Standards on Auditing, and professionals exercise their professional judgment in accordance with IFRS. Many other studies also show how important JDM is in accounting and audits. Libby and Tan (1995), Libby and Lewis (1982), Libby and Luft (1993), Ashton and Ashton (1995), Solomon et al. (1999), Solomon and Trotman (2003), Nelson and Tan (2005), and Humphrey (2008) are some examples of monographs and reviews connected to JDM studies. These reviews each use a different method to organize earlier studies in JDM. Libby and Luft (1993) showed how literature has changed about the effect that knowledge, ability, motivation, and environment have on auditors' performance. Solomon and Trotman (2003) gathered this literature as follows: environment and motivation, policy adoption, knowledge and memory, multimedia judgment, exploration and bias, and probabilistic judgment. Nelson and Tan (2005) said that there are three main types of research about JDM auditing: the things that need to be audited, the auditor's personal traits, and how auditors deal with other people while they do their jobs. The primary focus of this study is to identify individual, environmental, and procedural factors and their impact on judgment and decision-making in accounting and auditing.

2. Literature review and hypothesis development

According to Sharaf and Mautz (1960), it is important to understand how extensive experience, a perceptual memory, controlled imagination, and an understanding of the responsibilities and functions of the profession are valuable contributions before making a judgment on a value-related issue. Personal variables refer to the decision-maker's characteristics, including knowledge, expertise, information processing ability, decision-making tools, and prior beliefs or "anchoring" (Bonner, 1999; Nelson and Tan, 2005). Accountants must continually rely on their knowledge and decision-making skills to provide the best responses to various problems across various conditions. Therefore, theoretically and practically examining the effectiveness of these characteristics is of significant interest. Decisions regarding business matters, financial statement error prediction, information recall, and fraud assessment are some of the dependent variables that may be studied in studies that take the JDM factor as a personal characteristic variable. These studies also seek to understand the effects of knowledge, expertise, information processing ability, decision aid use, and prior beliefs (anchoring). Each attribute or quality is addressed in sections of this research that concentrate on personal characteristic factors. Our next section identifies some of the shortcomings of these studies, as well as recommendations for future research in financial accounting, which has received less attention than auditing.

2.1 Auditor knowledge

Researchers have conducted substantial studies concerning auditor judgment in recent years,

which has prompted concerns regarding how audit tasks are performed and how educational and training methods can improve individual performance. Knowledge is particularly important in facilitating improved decision-making and affecting judgment processes. As Waller and Felix (1984) noted, "A professional auditor acquires a complex network of knowledge, which is difficult to acquire in a classroom." The difference in judgment between auditors and novice students is highlighted. Ashton (1991) demonstrated that judgments related to the frequency of errors are more accurate when based on direct experience rather than indirect experience, using students and auditors. No differences were found between the two groups in a public auditing task. Frederick and Libby (1986) are considered to have conducted the first study that showed how differences in knowledge impact auditors' judgments. As a result of Kahneman and Tversky (1982), this study found that auditors are aware of the relationships between control weaknesses and accounting errors, as well as the relationships between accounts, and their judgment behavior is influenced by this knowledge. In contrast, less experienced auditors only know about the relationships between accounts, which determines their judgment behavior. Frederick and Libby (1986) contributed significantly by stating that even understanding the knowledge of experts in exploratory science and their cognitive abilities requires considering their knowledge, as knowledge interacts with the ability to make judgments.

2.2 Experience and expertise

There is research in this area that examines the relationship between expertise and professional judgment. Expert knowledge is crucial for understanding how and why better performance is achieved as an individual gains more experience (Nelson and Tan, 2005).

Ashton and Kramer (1980) were the first to confirm that students behave in ways similar to auditors regarding actions such as using cues, consensus, and consistency in judgment. These findings did not show a significant difference between the judgment of students and auditors. The authors concluded that future behavioral accounting research projects should include student subjects, along with real-world topics, to assess the significance of experience, wealth, age, or other factors influencing the topic under investigation. Ashton and Kramer (1980) used students and accounting auditors as subjects, while Bedard and Biggs (1991) used 29 audit partners with varying levels of experience and demonstrated that only the consensus of material judgment and disclosure of audit partners was affected by experience level and type of firm. However, these variables did not influence the consistency of judgment or insight of the individuals themselves. In the 1990s, the literature on experience expanded to include the type of information auditors use in their decision-making. These studies have significant practical implications because they emphasize that as accountants gain more experience, they can provide better professional judgment. Bedard and Biggs (1991) examined whether this experience was general or domain-specific and found that experience related to client explanations of material findings was more strongly associated with improved professional judgment.

They conducted an experiment in which the task was complex, which could only be solved by experienced auditors. Professional judgment improved with domain-specific experience (experience in the specific area of financial statement errors), as compared to general experience (number of years of experience). This study points to the importance of developing more specific measures of experience as a substitute for expertise in auditing judgment research rather than simply using general experience as a proxy for experience. Experience as a crucial determinant of performance was examined by Frederick and Heiman-Hoffman (1994). One of their research's key questions was how auditors' knowledge base varies with individual experience level. This experiment involved 51 new audit managers with a minimum of 5 years of audit experience, 43 junior auditors with one

year of audit experience, and 41 students without audit experience. The results confirmed what was predicted: students lacked the experience necessary to classify mistakes according to their intrinsic relevance to the audit aim or the transaction cycle. On the contrary, they grouped mistakes that used identical wording together. According to Anderson et al. (1994), when audit evidence is bad, experience has a substantial role in judgment. However, when audit evidence is positive, experience has no effect. These findings enhance our understanding of the impact of experiential differences on auditing judgment tendencies, thus contributing to the general knowledge about the role of expertise in auditing. Thus, in terms of audit effectiveness, inexperienced auditors should take on more risk or be more conservative in their approach to the auditing process, which allows them to identify potential problems that might later be explored by more experienced auditors, even those without the same level of awareness. On the other hand, these findings also raise the question of whether less experienced auditors, who base their judgments on negative audit evidence, impact the effectiveness and efficiency of the audit. Asare and McDaniel (1996) expanded audit research to find the impact of experience on the effect of audit evidence, as previous studies have shown that the recent impact of audit evidence, whether positive or negative, related to a business transaction, may reduce the efficiency and effectiveness of the audit. Through experiments with auditors, Asare and McDaniel (1996) demonstrated that experience reduces the delays related to collecting accounts receivable in an audit.

2.3 Information processing

An essential issue in auditing judgment research has been how information is gathered during decision-making, specifically, whether auditors' judgment requires configuration cues (Hooper **and** Trotman, 1996). According to Nelson and Tan (2005), since the early 1970s, attention has been paid to how information is cognitively combined and processed. Throughout the 1990s, there was considerable interest in whether accountants can process information configurational or are susceptible to biases and heuristics described in psychological literature. The study of Brown and Solomon (1991) and Hooper and Trotman (1996) are examples of studies in this area. Evidence from the study by Brown and Solomon (1991) suggests that many auditors process available information in a configurational manner. Based on Brown and Solomon (1991), Hooper and Trotman (1996) examined certain conditions that may facilitate the improvement of auditors' ability to process available information configurationally. The study found that the type of compensatory form and the degree of consensus were higher for auditors who processed information configurational compared to those who did not.

2.4 Decision-making assistance

This study's personal aspect is the ability to use decision-making aids. The use of decision aids to improve professional judgment in the absence of knowledge and expertise is quite common in accounting. Decision aids can range from simple tools, such as checklists, audit programs, and other elements of auditing software embedded in professional standards, to more complex tools, like different computer models. Research on the use of decision aids helps us understand how these aids improve or bias the judgments made. In the 1980s, studies focused on the use of simple decision-making aids. For example, Butler's (1985) study demonstrated that a five-step decision aid based on a data structuring method helps auditors make more accurate decisions when accepting or rejecting reported account balances. Boritz (1985) also examined the impact of judgment in auditing from data structuring techniques as a form of aid, finding that the structure in which information is presented is a helpful tool for auditors' evaluations and plans. In a study involving 105 auditors, Bonner et al. (1992) found that checklist aids improved experienced auditors' judgment.

2.5 Prior beliefs

Psychological studies have indicated that human reasoning is susceptible to "confirmation bias," which obstructs efficient learning and subsequently affects judgment (Klayman and Ha, 1987). Kahneman and Tversky (1974) suggest that individuals use an anchoring and adjustment heuristic to establish an initial starting point (e.g., prior experience) and then adjust from this anchor based on additional data. Lord et al. (1979) demonstrated that individuals use different criteria to criticize contradictory evidence compared to supportive evidence. While most of this work regarding prior beliefs has been conducted in psychology and social psychology, some research has also been done in accounting. Early studies in the 1980s provided substantial descriptive evidence of the impact of prior knowledge on JDM. In Waller and Felix's (1984) statement, the auditor tends to prefer confirmation evidence to disconfirmation evidence. They refer to non-causal data in their decision-making processes, supporting the impact of intuitive relationships. Trotman and Sng (1989) expanded on Kida's (1984) study on the selection of information by auditors, supporting the findings that prior beliefs lead to different judgments than when there are no prior beliefs. Wright and Ashton's (1989) study contributed to the literature on prior beliefs by examining the impact of previous audit work papers (audit information about clients in past audit engagements) on audit effectiveness and efficiency. The results indicated that when auditors rely on past information about the client, it negatively affects audit efficiency, as auditors perform unnecessary audit tests. Similarly, Butt and Campbell (1989) studied the impact of prior knowledge on the importance of information order and found that the information order did not influence individuals with strong prior beliefs, whereas those with weak prior beliefs paid more attention to newly presented information. For instance, the judgment of individuals with weak prior beliefs who received negative evidence after positive proof was lower (more negative) than that of those who received negative evidence before positive proof. In this study, the authors found that negative evidence, when followed by positive evidence, has a more significant impact on judgment.

2.6 Task complexity

Considering the wide range of complexity in accounting and auditing activities, studies that focus on the effects of task complexity can shed light on how task structure impacts judgment. There are three reasons why auditors should consider work complexity (Bonner, 1994): To begin, auditor efficiency is highly sensitive to the intricacy of the work at hand. Second, decision aids and training procedures can be improved when researchers have a better grasp of task complexity. As a third benefit, knowing how complicated the work is helps auditing firm management to allocate resources more effectively. Poursoltani Zarandi et al. (2024) used an experiment to examine how structured auditing approaches affect the human resource tasks of managers in environments with varying complexities. The findings indicated that the structure of a specific auditing approach at the task level influences the level of experience required for staff to perform tasks with lower and higher complexity. Moreover, the literature on task complexity, based on psychological and marketing theories, suggests that women may make more accurate decisions than men when tasks are complex. Chong and Monroe (2015) examined the effects of gender and task complexity on the accuracy of auditing judgments, and their findings showed that when tasks were not complex, men made more accurate decisions than women. However, when tasks were more complicated, women tended to make more precise decisions. The study participants were relatively inexperienced, so the results may not be generalizable. Ng and Tan (2003), in an experiment using data collected by Tan and Kao (1999), explored the moderating role of accountability and knowledge on the relationship between task complexity and auditor performance. According to the research, accountability and knowledge used as skill mediators moderated the relationship between task complexity and

performance.

2.7 Risk

According to Kadous and Magro (2001), tax experts sort client data based on how much danger they perceive. When assessing high-risk clients, tax experts focus more on the bad consequences. When Kadous et al. (2008) looked into the possibility that high operational risk (i.e., being exposed to monetary and non-monetary costs in making wrong recommendations) mitigates the impact of client risk preferences, it added to the existing body of study on operational risk. They found that professionals make judgments that align with the client's low operational risk preference. Despite operational risk, professionals adjust their recommendations away from the client's preferred position after controlling for the effect of information search. This study contributes to accounting literature by demonstrating that professionals can overcome confirmation bias in high-risk situations via adapting to high-risk settings and conducting a more balanced information search (Kadous et al., 2008). Operational risk are conditions that affects judgment when handling risks. Phillips (1999) showed that auditors, when faced with a high risk of inconsistency, pay more attention to aggressive reporting in the financial statements than when the risk is low. This study adds to the body of research on earnings management and aggressive financial reporting by showing that the amount of focus on aggressive reporting for a financial statement account relies on whether other accounts have aggressive reporting. These results also show that auditors may be more likely to focus on aggressive financial reporting when they first review evidence for high-risk accounts before considering low-risk accounts. These results have direct effects on how to plan an audit and on other people who use financial records.

2.8 Internal control

Managing risk effectively is a function of managing corporate governance and internal control, which sets the tone for the overall control environment with a great impact on risk judgment (Boo and Sharma, 2008). Corporate governance, often regarded as a key feature of a company's internal control system, influences the extent and timing of task execution (Fama, 1980; Fama and Jensen, 1983). In the 2000s, the literature shifted from perceiving corporate governance as a supervisory role to an interest in how governance mechanisms, such as boards of directors and audit committees, impact the audit process. DeZoort and Salterio (2001) empirically examined whether the organizational governance experience of audit committee members and their financial reporting and auditing knowledge influenced their judgment in auditor-management conflicts. Among 68 audit committee members surveyed, those with more independent experience and superior auditing knowledge were more likely to provide strong support to auditors who took a "substance over form" stance when discussing problems with client management. However, when an audit committee member also served as a board director and part of the senior management team, they tended to support client management. This study supports the idea that audit committees should be entirely composed of independent directors. Auditor concerns about systemic disagreements and conflicts between auditors and management are grounded in the results, which underline differences in knowledge levels between members of the audit committee. Cohen et al. (2002) showed that senior managers and audit partners use corporate governance information. They reported that auditors may also place greater trust in the audit committee when there is an increased delegation of responsibility regarding financial reporting processes. Anderson et al. (1994) added to the literature by examining board characteristics affecting the integrity of financial reporting and its consequences on debt cost. Using a sample of 500 firms, they found that debt costs were lower for firms with boards monitored by independent directors than those with insider boards. Creditors are

sensitive to board characteristics that affect the legitimacy of financial reporting. Creditors also consider audit committees and their characteristics crucial to decision-making. These findings suggested that debt costs are lower for firms with fully independent audit committees compared to those with insiders on the audit committee.

Based on the literature review and previous research background, the following hypotheses were proposed:

H1: There is a significant relationship between financial knowledge and the quality of judgment and decision-making of accountants.

H2: There is a significant relationship between experience and the quality of judgment and decision-making of accountants.

H3: There is a significant relationship between environmental risk and the quality of judgment and decision-making of accountants.

H4: There is a significant relationship between internal controls in the environment and accountants' quality of judgment and decision-making.

H5: There is a significant relationship between work pressure and the quality of judgment and decision-making of accountants.

H6: There is a significant relationship between financial knowledge and the quality of judgment and decision-making of auditors.

H7: There is a significant relationship between experience and the quality of judgment and decision-making of auditors.

H8: There is a significant relationship between environmental risk and the quality of judgment and decision-making of auditors.

H9: There is a significant relationship between internal controls in the environment and auditors' quality of judgment and decision-making.

H10: There is a significant relationship between work pressure and the quality of judgment and decision-making of auditors.

3. Research methodology

3.1 Measurement of research variables

In this study, the variables include financial knowledge among auditors, audit experience among auditors, audit environment risk, internal controls within the audit environment, and the quality of judgment and decision-making among auditors. These variables are measured using a researcher-designed questionnaire, which is based on the questionnaires of previous researchers such as Boone (1996), Bagley (2010), Krishnan (2012), and others who have studied each of these variables. The research variables are calculated as follows:

Financial Knowledge: This relates to the degree to which auditors and accountants have studied economics, financial management, accounting, and other fields intimately connected to the financial sector. There are three levels of financial knowledge: Bachelor's level, Master's level, and Doctoral level.

Work Experience: In the accounting or auditing field, the work experience of accountants and auditors is the total years spent in either linked financial professions or the accounting or auditing sector. A value of one indicates that the work experience is less than five years; a value of two indicates that the work experience is between five and ten years; a value of three indicates that the work experience is between ten and fifteen years; and a value of four indicates that the work experience is over fifteen years.

Audit Environment Risk: An audit environment risk refers to the risks that arise from various factors within the audit environment. In a standardized questionnaire, audit environment risk is measured and reported according to specific criteria.

A company's internal control system's strength or weakness is measured by its internal controls in the audit environment. This variable is examined through specific criteria, including task segregation, periodic supervision, and inspection.

Work Pressure Resulting from the Audit Time Budget: Work pressure resulting from the audit time budget refers to factors such as the company's asset size, the time the auditor has to submit the audit report, and the restrictions placed on auditors by the employer.

Quality of Judgment and Decision-Making: The judgment and decision-making quality of accountants and auditors is assessed using the questionnaires of previous researchers, including Boone (1996), Bagley (2010), Krishnan (2012), and others.

4. Research Findings

4.1 Descriptive statistics of the research variables

The description of the research variables in terms of indicators such as minimum, maximum, mean, and standard deviation is shown in Tables 1 and 2, which present the checking of the normality of the distribution of research variables.

Table 1. Descriptive statistics of the research variables

Specialty	Variable	Min	Max	Mean	SD
Accountants	Age	26.000	51.000	39.110	3.120
	Audit Experience	3.000	15.000	8.910	3.670
Auditors	Age	31.000	49.000	33.120	3.450
	Audit Experience	4.000	15.000	9.670	4.210
	Risk Environment	2.390	4.710	3.650	0.870
Accountants	Internal Controls Environment	2.010	4.970	2.710	1.140
	Work Pressure	1.970	4.810	3.780	1.110
	Financial Knowledge	2.310	4.980	2.890	1.130
	Experience	1.060	4.510	3.520	0.980
	Quality of Judgment and Decision Making	2.230	3.980	3.040	1.210
	Risk Environment	1.970	4.560	3.970	0.940
	Internal Controls Environment	2.250	4.670	3.340	1.450
	Work Pressure	1.670	3.990	3.210	1.240
Auditors	Financial Knowledge	2.150	4.560	3.670	1.120
	Experience	1.980	4.410	3.110	0.780
	Quality of Judgment and Decision Making	2.030	4.610	3.870	1.140

4.2 Correlation of research variables

As shown in Tables 2 and 3, the Pearson correlation coefficient is used to examine the relationships between variables in the research.

Table 2. Checking the normality of the distribution of research variables

Variable	Specialty	Kolmogorov-Smirnov			Shapiro-Wilk		
		Test statistic	Degree of freedom	P-value	Test statistic	Degree of freedom	P-value
Accountants	Environmental risk	0.039	320	0.219	0.993	320	0.168
	Environmental internal controls	0.026	320	0.205	0.997	320	0.794
	Work pressure	0.025	320	0.205	0.997	320	0.905
	Financial knowledge	0.024	320	0.204	0.997	320	0.802
	Experience	0.028	320	0.208	0.996	320	0.579
	Quality of judgment and decision-making	0.035	320	0.215	0.993	320	0.171
Auditors	Environmental risk	0.026	320	0.206	0.996	320	0..578
	Environmental internal controls	0.035	320	0.215	0.993	320	0.129
	Work pressure	0.023	320	0.203	0.998	320	0.929
	Financial knowledge	0.038	320	0.218	0.995	320	0.441
	Experience	0.033	320	0.213	0.997	320	0.751
	Quality of judgment and decision-making	0.040	320	0.220	0.994	320	0.205

Table 3. Pearson correlation coefficient between research variables

	Variable	Internal environmental controls	Working pressure	Financial knowledge	Experience	Quality of judgment and decision-making
Accountants	Risk Environment	R=0.002 P =0.972	R=0.065 P =0.248	R=0.077 P =0.171	R=0.074 P =0.189	R=0.191** P =0.001
	Internal Controls Environment		R=0.018 P =0.749	R=0.034 P =0.542	R=0.061 P =0.279	R=0.342** P<0.001
	Work Pressure			R=-0.006 P =0.919	R=0.038 P =0.500	R=0.017 P =0.762
	Financial Literacy				R=-0.116** P =0.037	R=0.140** P =0.012
	Experience					R=0.347** P<0.001
Auditors	Risk Environment	R=-0.029 P =0.604	R=0.050 P =0.376	R=0.100* P =0.074	R=0.050 P =0.375	R=0.146** P =0.009
	Internal Controls Environment		R=0.013 P =0.816	R=0.084 P =0.135	R=0.001 P =0.987	R=0.261** P<0.001
	Work Pressure			R=-0.017 P =0.762	R=0.020 P =0.723	R=-0.032 P =0.563
	Financial Literacy				R=-0.094* P =0.092	R=0.406** P<0.001
	Experience					R=0.084 P =0.136

R: Spearman's correlation coefficient value; P: P-value; * Significant correlation at the 0.1 level; ** Significant correlation at the 0.05 level

4.3 Inferential statistics

4.3.1 Model fit and factor loadings evaluation

The purpose of fitting the measurement model is to determine whether the number of factors and the measured variables associated with them align with what is expected from the theoretical framework, essentially verifying whether the proposed model fits the data. In other words, the measurement model checks whether the relevant questions or items adequately assess performance evaluation. Generally, factor loadings with a standardized estimate greater than 0.5 are considered suitable, indicating that the examined item significantly impacts measuring the associated construct. Therefore, items with factor loadings lower than 0.5 will be removed from the analysis process.

In this section, the environmental risk construct measurement model is fitted for accountants and auditors separately.

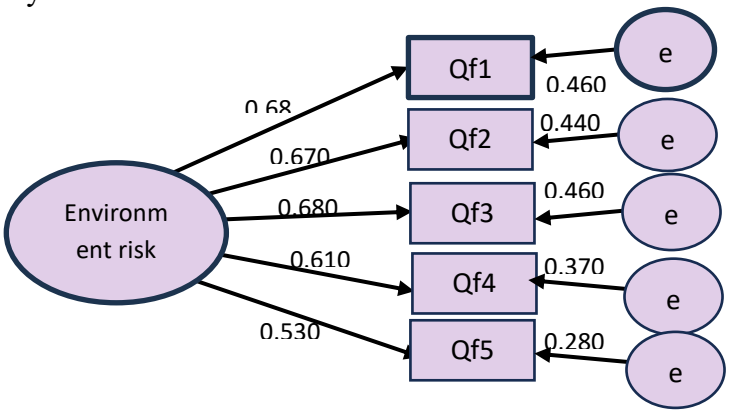


Figure 1. Fitting the environmental risk measurement model for accountants

Table 4. Examining the appropriateness of factor loadings of the environmental risk measurement model for accountants

Path			Non-standard coefficient	Test statistic	P-value		Standard coefficient
qf5	<---	Risk	1.000				0.532
qf4	<---	Risk	1.274	0.174	7.321	<0.001	0.606
qf3	<---	Risk	1.374	0.178	7.738	<0.001	0.675
qf2	<---	Risk	1.379	0.179	7.694	<0.001	0.667
qf1	<---	Risk	1.474	0.190	7.748	<0.001	0.677

In Figure 1 and Table 4, when fitting the environmental risk model for accountants, the factor loadings of all five items were greater than 0.5, indicating the significant effect of these items in measuring environmental risk for accountants. In Figure 2, the environmental risk measurement model for auditors has been fitted.

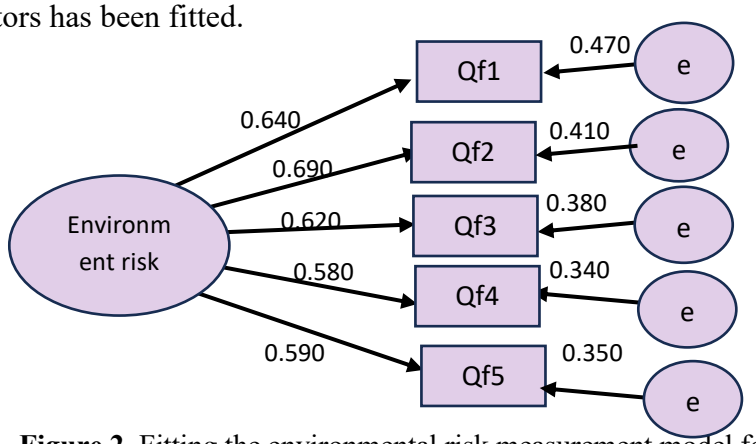


Figure 2. Fitting the environmental risk measurement model for auditors

Table 5. Auditor's assessment of factor loadings for the environmental risk measurement model

Path			Non-standard coefficient	SD	Test statistic	P-value	Standard coefficient
qf5	<---	Risk	1.000				0.594
qf4	<---	Risk	1.015	0.111	9.143	<0.001	0.58
qf3	<---	Risk	0.912	0.101	9.052	<0.001	0.62
qf2	<---	Risk	0.892	0.099	9.003	<0.001	0.689
qf1	<---	Risk	0.828	0.093	8.91	<0.001	0.639

In Figure 2 and Table 5, the factor loadings of all five items were greater than 0.5 when fitting the environmental risk model for auditors. This indicates the significant impact of these items on measuring environmental risk.

Figure 3 shows the measurement model for accountants' internal controls in the audit environment.

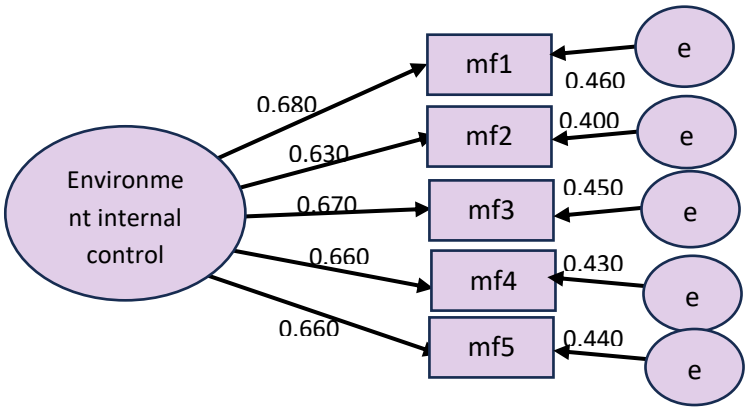


Figure 3. Fitting the internal controls measurement model for accountants

Table 6. Examining the Fit of the factor loadings of the internal controls measurement model for accountants

Path			Non-standard coefficient	SD	Test statistic	P-value	Standard coefficient
mf5	<---	Kontrol	1.000				0.664
mf4	<---	Kontrol	0.867	0.093	9.313	<0.001	0.658
mf3	<---	Kontrol	1.002	0.106	9.457	<0.001	0.672
mf2	<---	Kontrol	1.038	0.115	9.058	<0.001	0.633
mf1	<---	Kontrol	1.046	0.110	9.516	<0.001	0.678

In Figure 3 and Table 6, when fitting the internal controls in the audit environment model for accountants, the factor loadings of all five items were greater than 0.5, indicating the significant impact of these items in measuring internal controls in the audit environment for accountants.

Figure 4 shows the measurement model for auditors' internal controls in the audit environment.

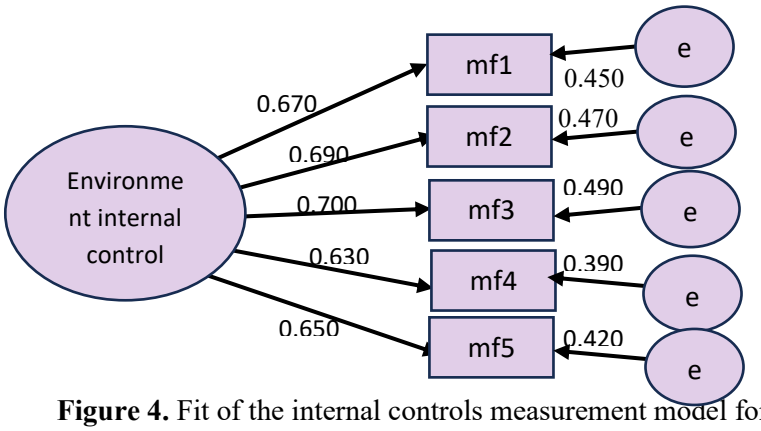


Figure 4. Fit of the internal controls measurement model for auditors

Table 7. Examination of the fit of the factor loadings of the internal controls measurement model for auditors

Path			Non-standard coefficient	SD	Test statistic	P-value	Standard coefficient
mf5	<---	Kontrol	1.000				0.647
mf4	<---	Kontrol	0.918	0.103	8.879	<0.001	0.625
mf3	<---	Kontrol	1.109	0.115	9.627	<0.001	0.702
mf2	<---	Kontrol	1.115	0.117	9.512	<0.001	0.689
mf1	<---	Kontrol	1.088	0.117	9.311	<0.001	0.668

In Figure 4 and Table 7, when fitting the internal controls in the audit environment model for auditors, the factor loadings of all five items were greater than 0.5, indicating the significant impact of these items in measuring internal controls in the audit environment for auditors.

Figure 5 shows the measurement model for work pressure for accountants.

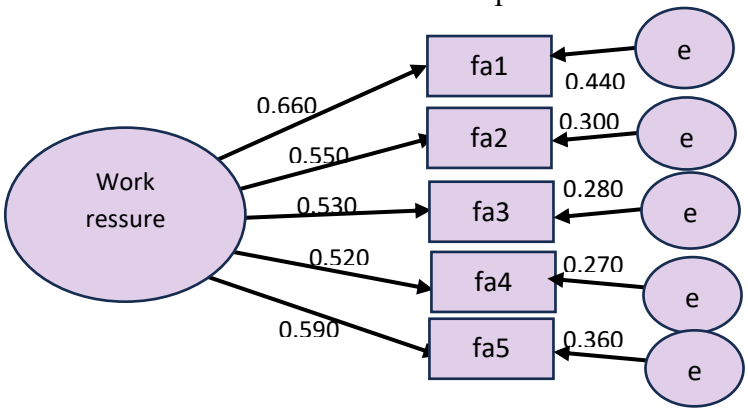


Figure 5. Fitting the work stress measurement model for accountants

Table 8. Examining the fit of factor loadings of the work stress measurement model for accountants

Path			Non-standard coefficient	SD	Test statistic	P-value	Standard coefficient
fa5	<---	Feshar	1.000				0.588
fa4	<---	Feshar	0.922	0.14	6.576	<0.001	0.523
fa3	<---	Feshar	0.849	0.129	6.605	<0.001	0.526
fa2	<---	Feshar	1.000	0.147	6.788	<0.001	0.549
fa1	<---	Feshar	1.166	0.157	7.421	<0.001	0.663

Figure 5 and Table 8 show that when fitting the work pressure model for accountants, the factor loadings of all five items were greater than 0.5, indicating the significant impact of these items in measuring work pressure for accountants.

Figure 6 shows the measurement model for work pressure for auditors.

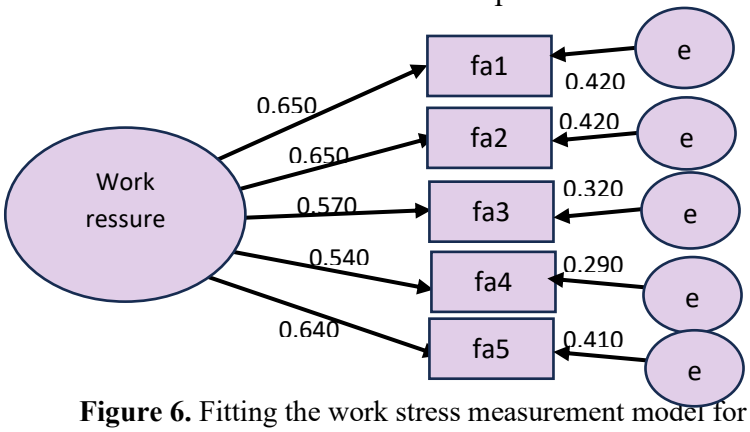


Figure 6. Fitting the work stress measurement model for auditors

Table 9. Examining the fit of the factor loadings of the work stress measurement model for auditors

Path			Non-standard coefficient	SD	Test statistic	P-value	Standard coefficient
fa5	<---	Feshar	1.000				0.640
fa4	<---	Feshar	0.837	0.114	7.361	<0.001	0.538
fa3	<---	Feshar	0.903	0.118	7.643	<0.001	0.567
fa2	<---	Feshar	1.090	0.131	8.334	<0.001	0.648
fa1	<---	Feshar	1.102	0.133	8.317	<0.001	0.646

Figure 6 and Table 9 show that when fitting the work pressure model for auditors, the factor loadings of all five items were greater than 0.5, indicating the significant impact of these items in measuring work pressure for auditors.

Figure 7 shows the measurement model for financial knowledge for accountants.

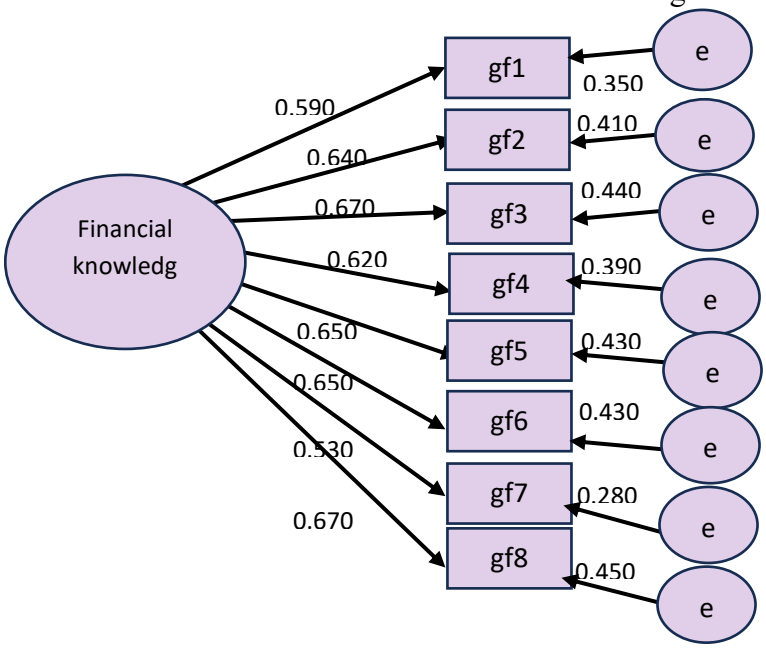


Figure 7. Fitting the financial knowledge measurement model for accountants

Table 10. Examining the appropriateness of the factor loadings of the financial knowledge measurement model for accountants

Path			Non-standard coefficient	SD	Test statistic	P-value	Standard coefficient
gf8	<---	Danesh	1.000				0.674
gf7	<---	Danesh	0.801	0.096	8.339	<0.001	0.534
gf6	<---	Danesh	1.035	0.104	9.979	<0.001	0.655
gf5	<---	Danesh	1.020	0.102	9.962	<0.001	0.653
gf4	<---	Danesh	0.979	0.102	9.566	<0.001	0.623
gf3	<---	Danesh	1.120	0.111	10.125	<0.001	0.666
gf2	<---	Danesh	1.018	0.104	9.754	<0.001	0.637
gf1	<---	Danesh	0.921	0.101	9.087	<0.001	0.588

Figure 7 and Table 10 demonstrate that the factor loadings for all eight items, when fitted to the financial knowledge model for accountants, exceeded 0.5, meaning that they significantly influence financial knowledge measurement.

Figure 8 shows the measurement model for auditors' financial knowledge.

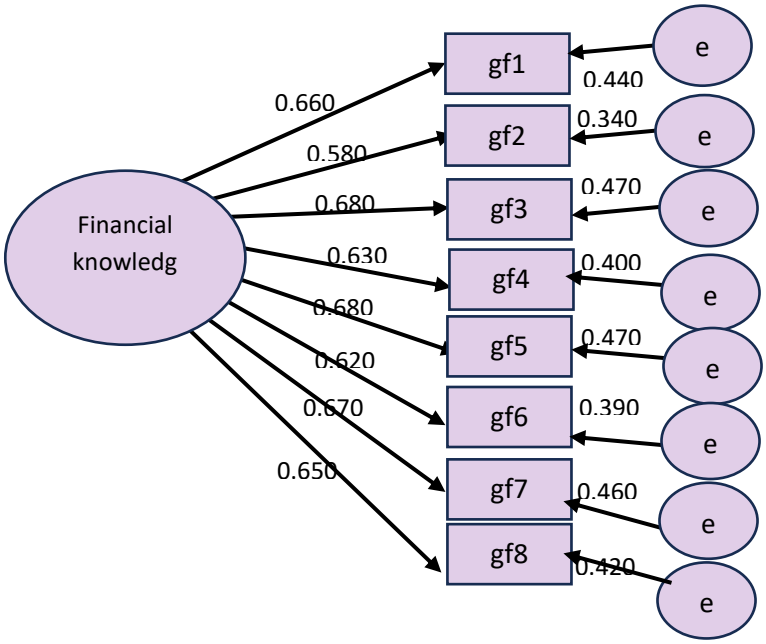


Figure 8. Fitting the financial knowledge measurement model for auditors

Table 11. Analyzing the goodness of fit of the financial knowledge measurement model for auditors

Path			Non-standard coefficient	SD	Test statistic	P-value	Standard coefficient
gf8	<---	Danesh	1.000				0.652
gf7	<---	Danesh	0.892	0.097	9.18	<0.001	0.675
gf6	<---	Danesh	1.012	0.106	9.538	<0.001	0.625
gf5	<---	Danesh	0.775	0.092	8.441	<0.001	0.682
gf4	<---	Danesh	0.880	0.098	8.954	<0.001	0.631
gf3	<---	Danesh	0.913	0.097	9.395	<0.001	0.682
gf2	<---	Danesh	1.022	0.108	9.493	<0.001	0.583
gf1	<---	Danesh	0.961	0.103	9.369	<0.001	0.662

In Figure 8 and Table 11, the factor loadings of all eight items in the financial knowledge model for auditors are greater than 0.5, indicating a significant impact of these items.

Figure 9 shows the measurement model for accountants' experience.

Table 12. An examination of the appropriate factor loadings for the accountant experience measurement model

Path			Non-standard coefficient	SD	Test statistic	P-value	Standard coefficient
sa14	<---	Tajrobe	1.000				0.672
sa13	<---	Tajrobe	0.756	0.082	9.248	<0.001	0.559
sa12	<---	Tajrobe	0.952	0.089	10.741	<0.001	0.658
sa11	<---	Tajrobe	0.861	0.083	10.383	<0.001	0.634
sa10	<---	Tajrobe	0.868	0.082	10.523	<0.001	0.643
sa9	<---	Tajrobe	1.140	0.095	12.043	<0.001	0.748
sa8	<---	Tajrobe	1.136	0.098	11.544	<0.001	0.713
sa7	<---	Tajrobe	1.196	0.099	12.081	<0.001	0.751
sa6	<---	Tajrobe	0.884	0.085	10.394	<0.001	0.634
sa5	<---	Tajrobe	0.866	0.085	10.185	<0.001	0.620
sa4	<---	Tajrobe	0.878	0.082	10.717	<0.001	0.656
sa3	<---	Tajrobe	1.025	0.091	11.229	<0.001	0.691
sa2	<---	Tajrobe	1.078	0.093	11.621	<0.001	0.718
sa1	<---	Tajrobe	1.145	0.098	11.653	<0.001	0.721

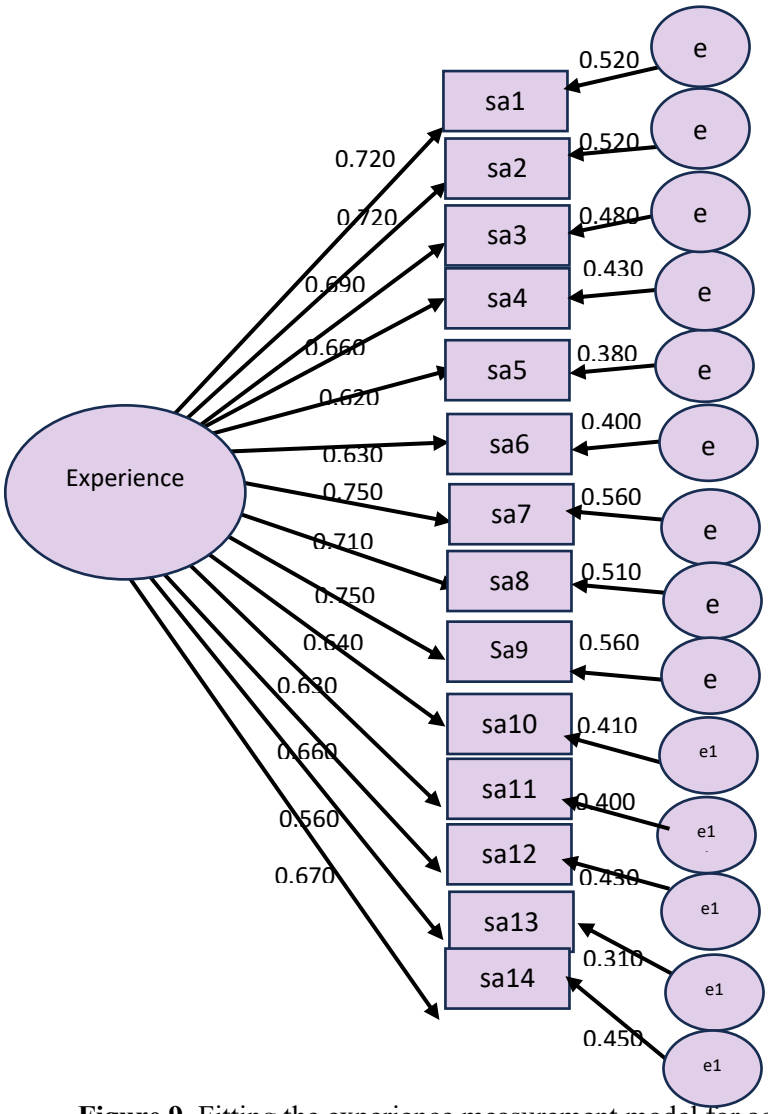


Figure 9. Fitting the experience measurement model for accountants

Using Table 12 and Figure 9, the factor loadings for all 14 items were greater than 0.5 when fitting the experience model for accountants, indicating that these items have a significant impact.

Figure 10 shows the measurement model for the auditors' experience.

Table 13. Analyzing the factor loadings of the auditor experience measurement model

Path			Non-standard coefficient	SD	Test statistic	P-value	Standard coefficient
sa14	<---	Tajrobe	1.000				0.645
sa13	<---	Tajrobe	0.937	0.091	10.276	<0.001	0.657
sa12	<---	Tajrobe	0.952	0.097	9.810	<0.001	0.622
sa11	<---	Tajrobe	0.998	0.096	10.448	<0.001	0.670
sa10	<---	Tajrobe	0.694	0.085	8.124	<0.001	0.502
sa9	<---	Tajrobe	1.068	0.101	10.526	<0.001	0.676
sa8	<---	Tajrobe	1.183	0.108	10.958	<0.001	0.710
sa7	<---	Tajrobe	1.060	0.103	10.307	<0.001	0.659
sa6	<---	Tajrobe	0.809	0.088	9.188	<0.001	0.576
sa5	<---	Tajrobe	0.870	0.092	9.466	<0.001	0.597
sa4	<---	Tajrobe	0.875	0.093	9.458	<0.001	0.596
sa3	<---	Tajrobe	1.026	0.097	10.583	<0.001	0.681
sa2	<---	Tajrobe	1.204	0.106	11.386	<0.001	0.745
sa1	<---	Tajrobe	1.142	0.109	10.509	<0.001	0.675

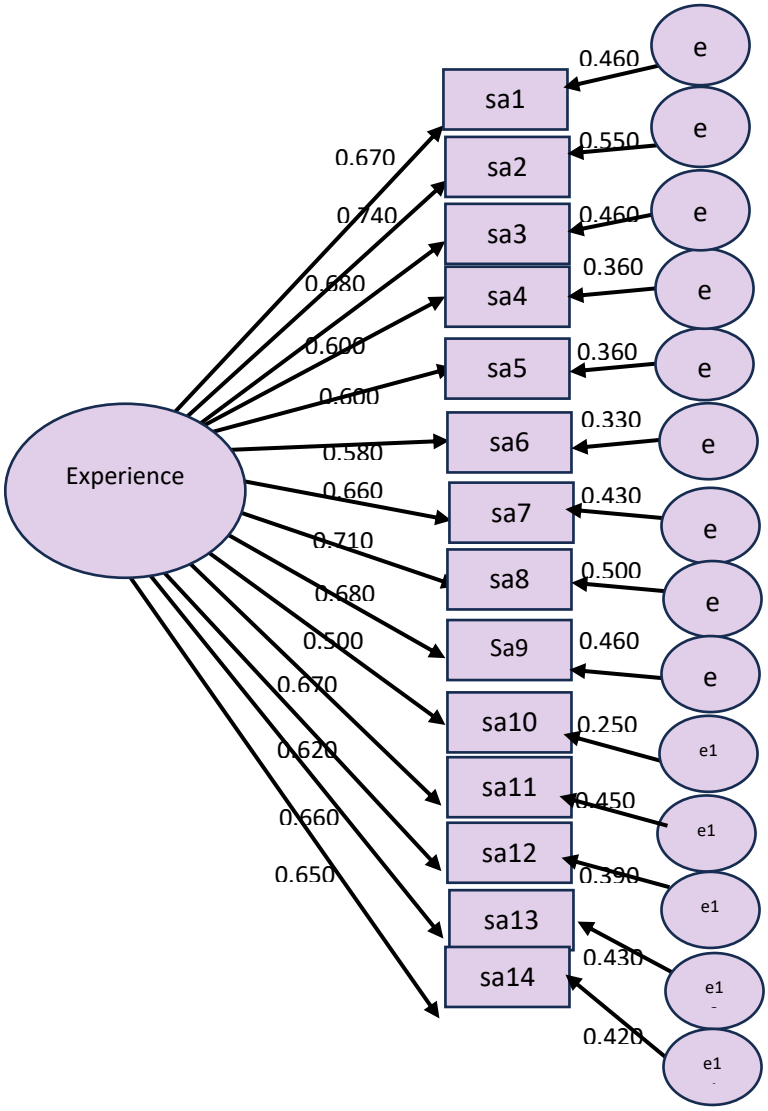


Figure 10. Fitting the experience measurement model for auditors

Figure 10 and Table 13 show that when fitting the experience model for auditors, the factor loadings of all 14 items were greater than 0.5, indicating the significant impact of these items in measuring experience for auditors.

Figure 11 shows the measurement model for accountants' judgment and decision-making quality.

In Figure 11 and Table 14, when fitting the judgment and decision-making quality model for accountants, the factor loadings of all 14 items were greater than 0.5, indicating the significant impact of these items in measuring judgment and decision-making quality for accountants.

Figure 12 shows the measurement model for auditors' judgment and decision-making quality.

Figure 12 and Table 15 show that when fitting the judgment and decision-making quality model for auditors, the factor loadings of all 14 items were greater than 0.5, indicating the significant impact of these items in measuring judgment and decision-making quality for auditors.

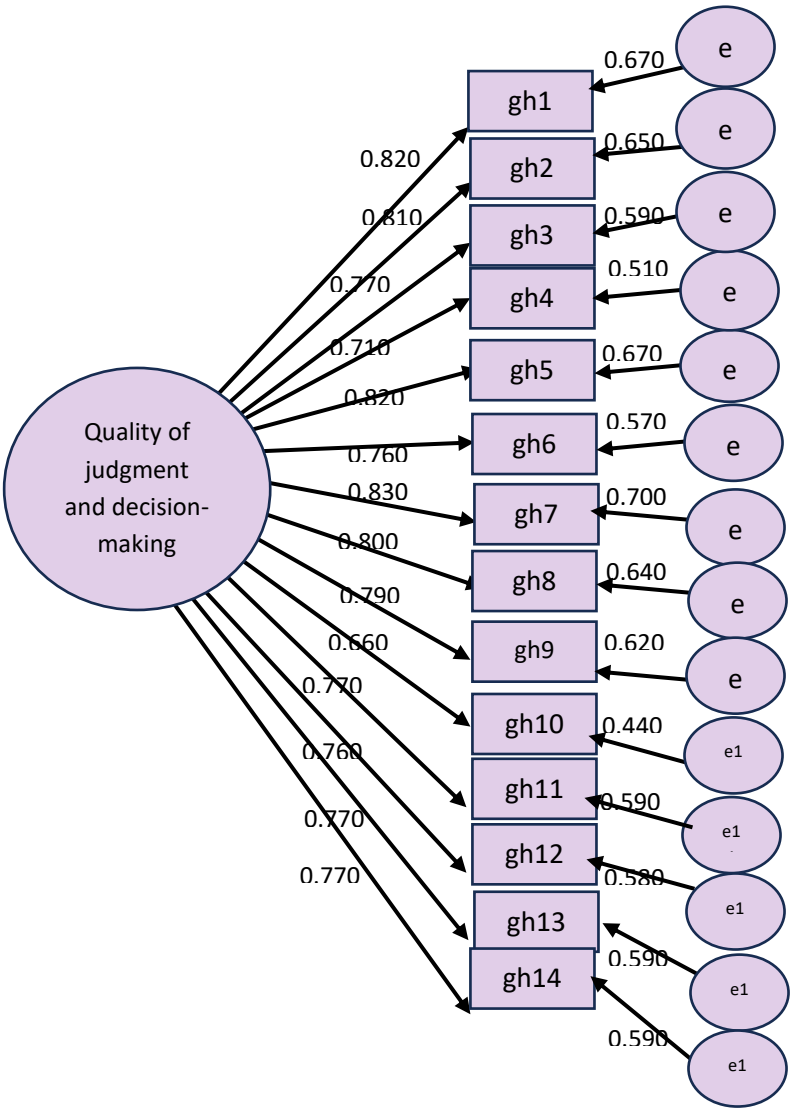


Figure 11. Fitting the model for measuring the quality of judgment and decision-making for accountants

Table 14. Analyzing the factor loadings of the model for measuring accountants' judgment and decision-making

Path			Non-standard coefficient	SD	Test statistic	P-value	Standard coefficient
gh14	<---	Ghezavat	1.000				0.766
gh13	<---	Ghezavat	0.931	0.063	14.703	<0.001	0.767
gh12	<---	Ghezavat	1.010	0.069	14.605	<0.001	0.763
gh11	<---	Ghezavat	0.982	0.067	14.667	<0.001	0.766
gh10	<---	Ghezavat	0.722	0.059	12.342	<0.001	0.661
gh9	<---	Ghezavat	1.082	0.071	15.223	<0.001	0.789
gh8	<---	Ghezavat	1.155	0.075	15.447	<0.001	0.799
gh7	<---	Ghezavat	1.177	0.072	16.299	<0.001	0.834
gh6	<---	Ghezavat	0.936	0.065	14.456	<0.001	0.756
gh5	<---	Ghezavat	1.207	0.076	15.931	<0.001	0.819
gh4	<---	Ghezavat	0.835	0.062	13.486	<0.001	0.713
gh3	<---	Ghezavat	0.966	0.066	14.703	<0.001	0.767
gh2	<---	Ghezavat	1.144	0.073	15.613	<0.001	0.806
gh1	<---	Ghezavat	1.174	0.074	15.902	<0.001	0.818

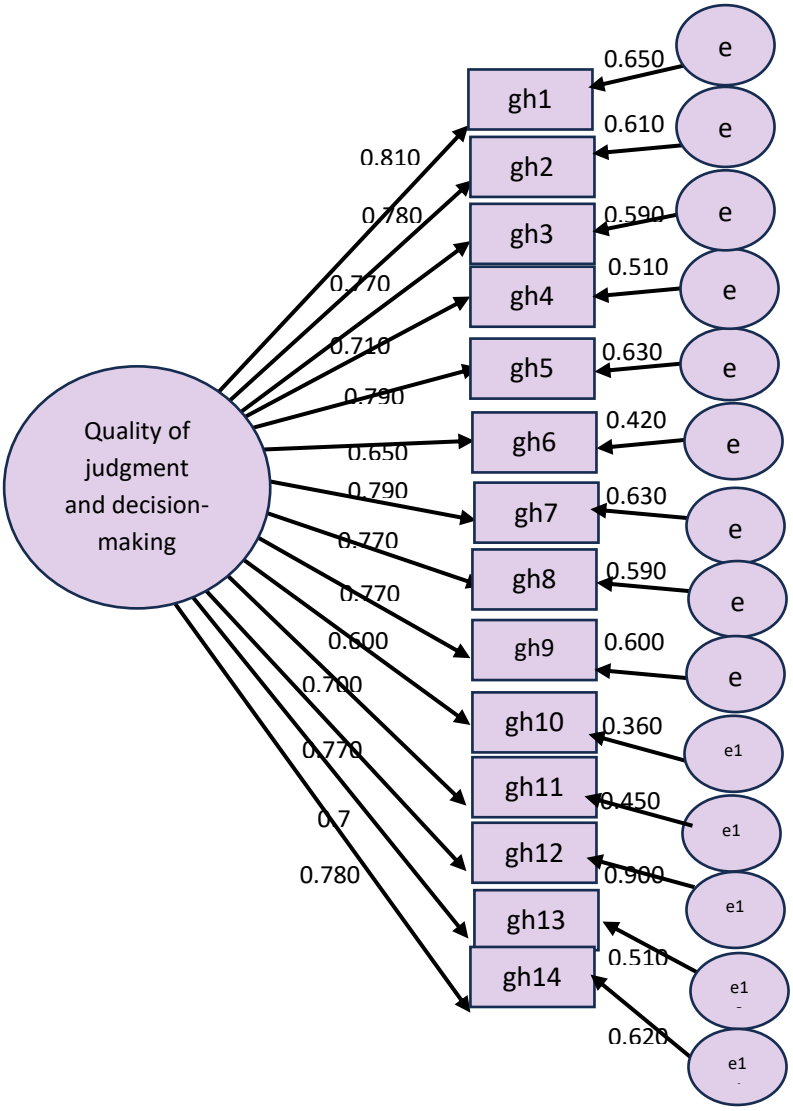


Figure 12. Fitting the model for measuring the quality of judgment and decision-making for auditors

Table 15. Examining the appropriateness of the factor loadings of the model for measuring the quality of judgment and decision-making for auditors

Path			Non-standard coefficient	SD	Test statistic	P-value	Standard coefficient
gh14	<---	Ghezavat	1.000				0.785
gh13	<---	Ghezavat	0.846	0.061	13.813	<0.001	0.716
gh12	<---	Ghezavat	1.000	0.066	15.204	<0.001	0.773
gh11	<---	Ghezavat	0.812	0.061	13.362	<0.001	0.697
gh10	<---	Ghezavat	0.669	0.059	11.287	<0.001	0.604
gh9	<---	Ghezavat	0.938	0.062	15.170	<0.001	0.772
gh8	<---	Ghezavat	0.971	0.064	15.149	<0.001	0.771
gh7	<---	Ghezavat	1.095	0.07	15.694	<0.001	0.793
gh6	<---	Ghezavat	0.733	0.06	12.208	<0.001	0.646
gh5	<---	Ghezavat	1.045	0.067	15.655	<0.001	0.791
gh4	<---	Ghezavat	0.851	0.062	13.725	<0.001	0.712
gh3	<---	Ghezavat	0.961	0.064	15.002	<0.001	0.765
gh2	<---	Ghezavat	1.064	0.069	15.423	<0.001	0.782
gh1	<---	Ghezavat	1.087	0.068	16.073	<0.001	0.807

4.3.2 Goodness-of-Fit Indices

Researchers use goodness-of-fit indices to evaluate the overall fit of the hypothesized model with the observed data. The most common index is the Chi-square statistic, which measures the difference between the covariance matrix of the fitted model and the covariance matrix from the observed sample. In this case, the null hypothesis suggests no difference between the fitted model and the sample covariance matrix, which is influenced by the sample size. Therefore, a small difference will indicate a good fit when the sample size is large. For this reason, some modified indices, such as the Chi-square over degrees of freedom, are used in conjunction with other goodness-of-fit indices, including Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Comparative Fit Index (CFI), Root Mean Square Residual (RMR), and Root Mean Square Error of Approximation (RMSEA) (where values less than 0.08 indicate reasonable approximation errors for the population). The goodness-of-fit indices for the measurement models are reported in Table 16.

Table 16. Fit indices of measurement models

Specialty	Symbol	Environment risk	Internal controls of the environment	Work pressure	Financial knowledge	Experience	Quality of judgment and decision-making
Accountants	χ^2	2.270	5.940	2.064	13.154	48.469	63.786
	$\chi 2/df$	0.568	1.188	0.413	0.658	0.655	0.874
	GFI	0.997	0.993	0.997	0.990	0.979	0.972
	AGFI	0.990	0.979	0.992	0.982	0.970	0.960
	RMR	0.021	0.036	0.020	0.032	0.038	0.044
	CFI	0.999	0.997	0.999	0.999	0.999	0.999
	RMSEA	0.001	0.024	0.001	0.001	0.001	0.001
Auditors	χ^2	3.712	20.437	6.116	14.165	87.926	63.427
	$\chi 2/df$	0.742	4.087	1.223	0.708	1.142	0.824
	GFI	0.995	0.978	0.992	0.989	0.962	0.973
	AGFI	0.986	0.934	0.976	0.980	0.948	0.963
	RMR	0.027	0.059	0.032	0.037	0.050	0.041
	CFI	0.999	0.965	0.996	0.999	0.993	0.999
	RMSEA	0.001	0.098	0.026	0.001	0.021	0.001

Based on the obtained indices, all the indices are within an acceptable range. Therefore, the results from the model can be considered reliable.

4.3.3 Validity and reliability assessment

Composite Reliability (CR) and Average Variance Extracted (AVE) indices help evaluate every concept's validity and dependability. Every construct is deemed legitimate if the AVE value for each one exceeds 0.4. Furthermore, the CR value should be higher than 0.6 if the build is reliable. Table 17 lists the validity and reliability values for every measuring methodology.

Based on the results, the constructs meet the acceptable criteria for convergent validity and reliability.

4.3.4 Structural equation model fit

The structural model must be fitted to test and examine the research hypotheses, which are the essential part of the research and result in significant conclusions, allowing the relationships between the constructs to be reviewed and the significance of each of these relationships to be determined. In other words, we need to assess whether the available data support the conceptual model of the research. In this section, the structural equation model is fitted separately for accountants and auditors. The fitted structural model for the accountants' data is shown in Table 18 and Figure 13.

Table 17. Examining the convergent validity and reliability of the constructs

Specialty	Measurement model	AVE	CR
Accountants	Risk Environment	0.402	0.674
	Internal Controls Environment	0.437	0.675
	Work Pressure	0.377	0.607
	Financial Knowledge	0.397	0.763
	Experience	0.455	0.867
	Quality of Judgment and Decision Making	0.600	0.899
Auditors	Risk Environment	0.391	0.662
	Internal Controls Environment	0.445	0.698
	Work Pressure	0.372	0.671
	Financial Knowledge	0.422	0.763
	Experience	0.418	0.855
	Quality of Judgment and Decision Making	0.557	0.889

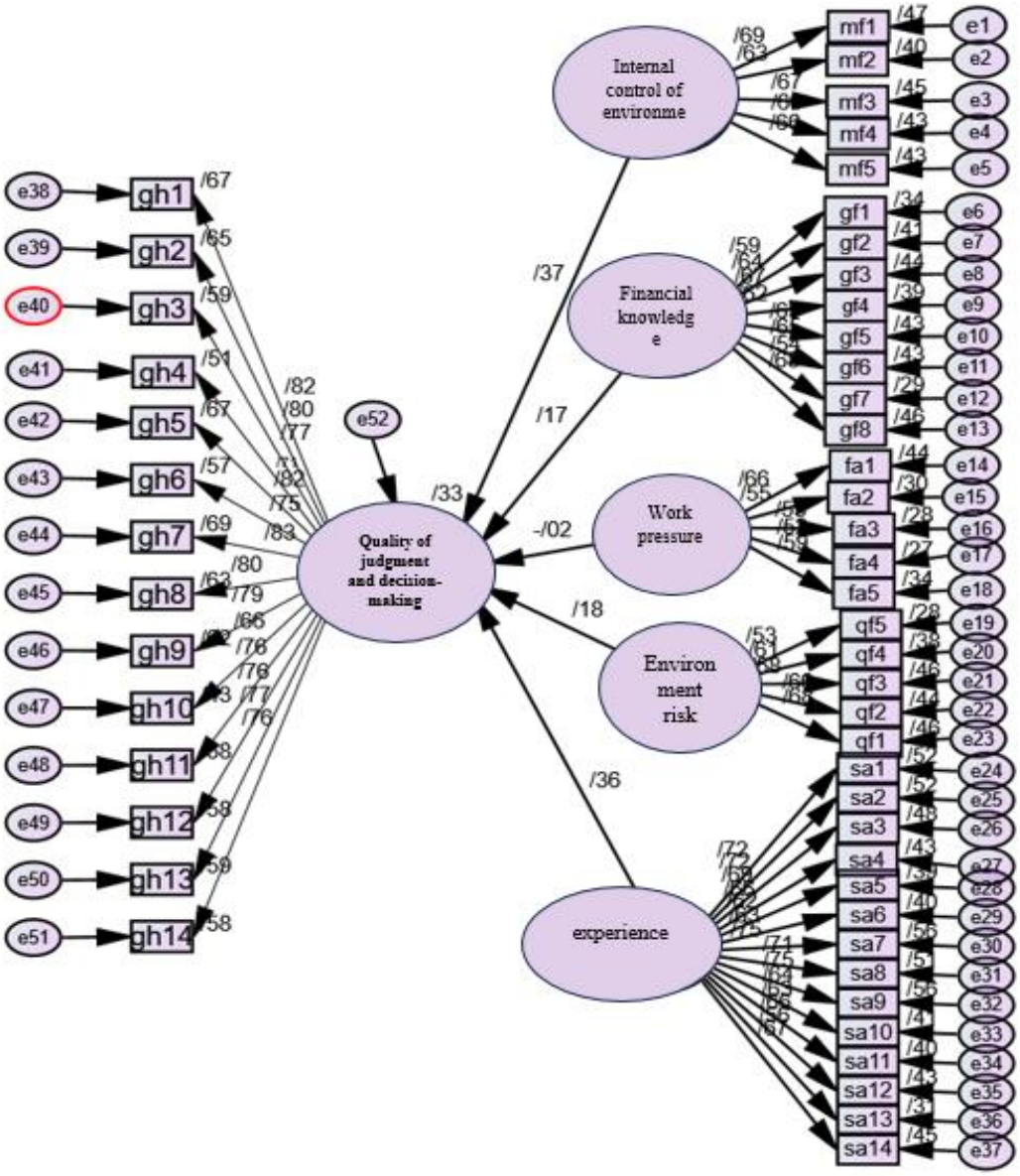


Figure 13. Structural model fitting for accountants

Table 18. Structural equation model fitting results for accountants

Path			Non-standard coefficient	SD	Test statistic	P-value	Standard coefficient
Ghezavat	<---	Danesh	0.245	0.079	3.102	0.002	0.171
Ghezavat	<---	Feshar	0.250	0.094	-0.268	0.789	-0.016
Ghezavat	<---	Kontrol	0.480	0.082	5.831	<0.001	0.370
Ghezavat	<---	Risk	0.348	0.113	3.075	0.002	0.183
Ghezavat	<---	Tajrobe	0.450	0.074	6.121	<0.001	0.356
gf8	<---	Danesh	1.000			<0.001	0.675
gf7	<---	Danesh	0.803	0.096	8.390	<0.001	0.536
gf6	<---	Danesh	1.030	0.103	9.982	<0.001	0.653
gf5	<---	Danesh	1.018	0.102	9.990	<0.001	0.654
gf4	<---	Danesh	0.978	0.102	9.599	<0.001	0.624
gf3	<---	Danesh	1.116	0.110	10.135	<0.001	0.665
gf2	<---	Danesh	1.016	0.104	9.775	<0.001	0.637
gf1	<---	Danesh	0.918	0.101	9.089	<0.001	0.586
gh14	<---	Ghezavat	1.000			<0.001	0.764
gh13	<---	Ghezavat	0.932	0.064	14.601	<0.001	0.765
gh12	<---	Ghezavat	1.010	0.070	14.480	<0.001	0.760
gh11	<---	Ghezavat	0.982	0.067	14.548	<0.001	0.763
gh10	<---	Ghezavat	0.721	0.059	12.208	<0.001	0.656
gh9	<---	Ghezavat	1.083	0.072	15.122	<0.001	0.788
gh8	<---	Ghezavat	1.155	0.075	15.330	<0.001	0.797
gh7	<---	Ghezavat	1.175	0.073	16.142	<0.001	0.831
gh6	<---	Ghezavat	0.936	0.065	14.349	<0.001	0.754
gh5	<---	Ghezavat	1.204	0.076	15.772	<0.001	0.816
gh4	<---	Ghezavat	0.835	0.062	13.387	<0.001	0.711
gh3	<---	Ghezavat	0.968	0.066	14.629	<0.001	0.766
gh2	<---	Ghezavat	1.144	0.074	15.492	<0.001	0.804
gh1	<---	Ghezavat	1.174	0.074	15.773	<0.001	0.816
fa5	<---	Feshar	1.000			<0.001	0.587
fa4	<---	Feshar	0.922	0.140	6.572	<0.001	0.522
fa3	<---	Feshar	0.849	0.129	6.598	<0.001	0.526
fa2	<---	Feshar	1.002	0.148	6.788	<0.001	0.550
fa1	<---	Feshar	1.168	0.157	7.422	<0.001	0.664
mf5	<---	Kontrol	1.000			<0.001	0.658
mf4	<---	Kontrol	0.878	0.094	9.362	<0.001	0.659
mf3	<---	Kontrol	1.009	0.107	9.467	<0.001	0.669
mf2	<---	Kontrol	1.047	0.115	9.077	<0.001	0.632
mf1	<---	Kontrol	1.070	0.111	9.637	<0.001	0.687
qf5	<---	Risk	1.000			<0.001	0.525
qf4	<---	Risk	1.307	0.179	7.320	<0.001	0.614
qf3	<---	Risk	1.393	0.181	7.681	<0.001	0.676
qf2	<---	Risk	1.390	0.182	7.617	<0.001	0.664
qf1	<---	Risk	1.494	0.194	7.690	<0.001	0.678
sa14	<---	Tajrobe	1.000			<0.001	0.674
sa13	<---	Tajrobe	0.752	0.081	9.259	<0.001	0.558
sa12	<---	Tajrobe	0.951	0.088	10.805	<0.001	0.659
sa11	<---	Tajrobe	0.858	0.082	10.420	<0.001	0.634
sa10	<---	Tajrobe	0.865	0.082	10.559	<0.001	0.643
sa9	<---	Tajrobe	1.135	0.094	12.088	<0.001	0.747
sa8	<---	Tajrobe	1.132	0.098	11.594	<0.001	0.713
sa7	<---	Tajrobe	1.187	0.098	12.086	<0.001	0.747
sa6	<---	Tajrobe	0.881	0.084	10.429	<0.001	0.634
sa5	<---	Tajrobe	0.864	0.084	10.232	<0.001	0.621
sa4	<---	Tajrobe	0.877	0.081	10.781	<0.001	0.658
sa3	<---	Tajrobe	1.022	0.091	11.277	<0.001	0.691
sa2	<---	Tajrobe	1.077	0.092	11.696	<0.001	0.720
sa1	<---	Tajrobe	1.138	0.098	11.672	<0.001	0.718

The fitted structural model for the auditors' data can be shown in Table 19 and Figure 14.

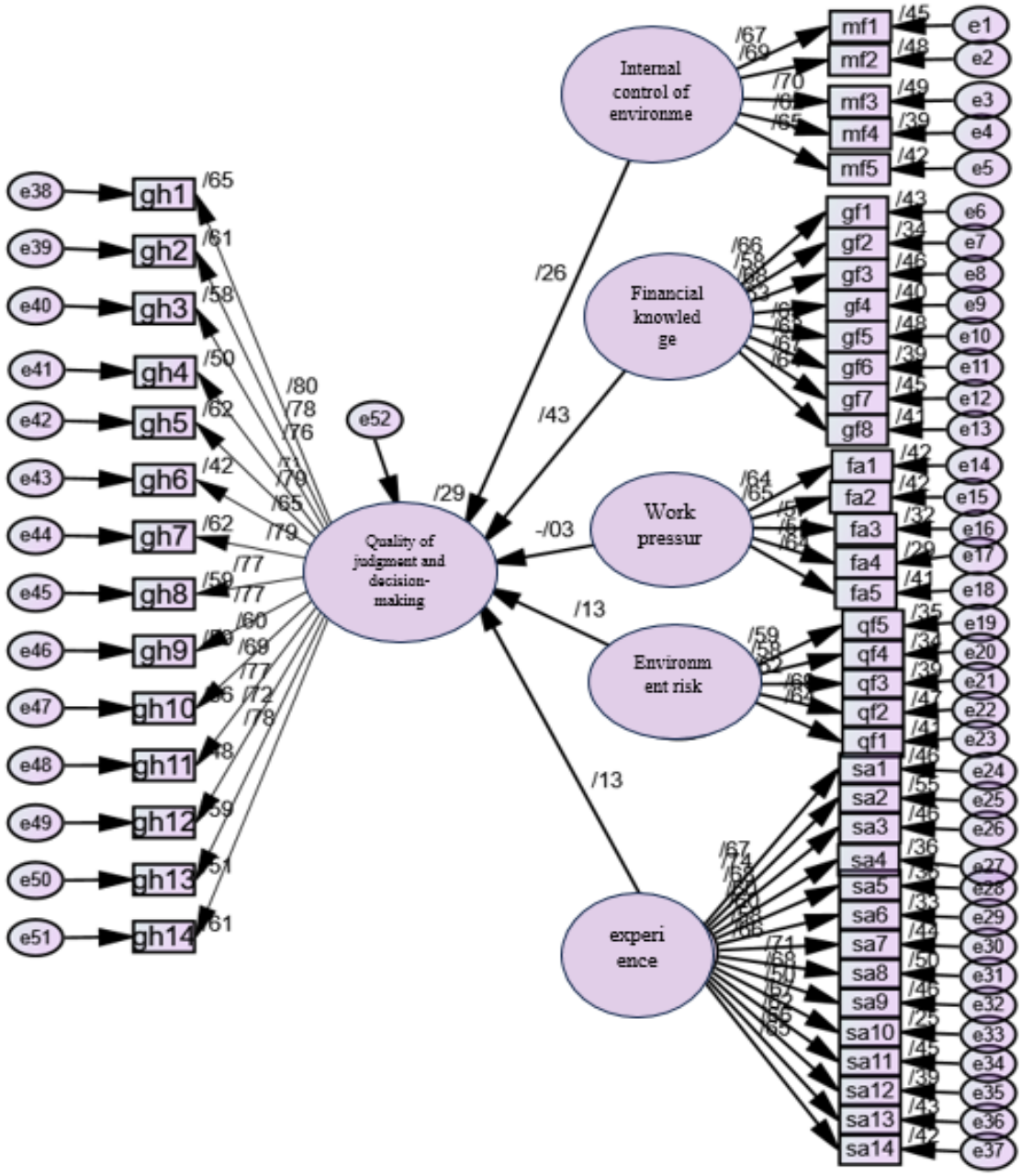


Figure 14. Structural model fitting for auditors

4.3.5 Goodness-of-Fit Indices for the Structural Model

The goodness-of-fit indices for the structural equation model are reported in Table 20, and these indices are in an acceptable range, indicating a good fit for the model.

According to Table 21, the results of Hypothesis 1 indicate a significant and positive relationship between financial knowledge and the quality of judgment and decision-making in accountants (p-value less than 0.05), with a path coefficient or effect size of 0.171, suggesting a direct relationship.

Table 19. Structural equation model fitting results for auditors

Path			Non-standard coefficient	SD	Test statistic	P-value	Standard coefficient
Ghezavat	<---	Danesh	0.607	0.092	6.610	<0.001	0.431
Ghezavat	<---	Feshar	0.530	0.093	-0.564	0.572	0.330
Ghezavat	<---	Kontrol	0.370	0.086	4.322	<0.001	0.262
Ghezavat	<---	Risk	0.231	0.103	2.233	0.026	0.132
Ghezavat	<---	Tajrobe	0.174	0.075	2.331	0.02	0.125
gf8	<---	Danesh	1.000			<0.001	0.644
gf7	<---	Danesh	1.034	0.103	10.017	<0.001	0.674
gf6	<---	Danesh	0.998	0.105	9.465	<0.001	0.628
gf5	<---	Danesh	1.105	0.108	10.203	<0.001	0.690
gf4	<---	Danesh	1.089	0.114	9.512	<0.001	0.632
gf3	<---	Danesh	1.070	0.106	10.105	<0.001	0.682
gf2	<---	Danesh	0.867	0.098	8.891	<0.001	0.583
gf1	<---	Danesh	1.152	0.117	9.826	<0.001	0.658
gh14	<---	Ghezavat	1.000			<0.001	0.783
gh13	<---	Ghezavat	0.847	0.062	13.758	<0.001	0.715
gh12	<---	Ghezavat	0.999	0.066	15.094	<0.001	0.770
gh11	<---	Ghezavat	0.811	0.061	13.280	<0.001	0.695
gh10	<---	Ghezavat	0.668	0.060	11.193	<0.001	0.600
gh9	<---	Ghezavat	0.939	0.062	15.093	<0.001	0.770
gh8	<---	Ghezavat	0.969	0.064	15.030	<0.001	0.768
gh7	<---	Ghezavat	1.092	0.070	15.552	<0.001	0.789
gh6	<---	Ghezavat	0.736	0.060	12.207	<0.001	0.647
gh5	<---	Ghezavat	1.041	0.067	15.486	<0.001	0.786
gh4	<---	Ghezavat	0.852	0.062	13.654	<0.001	0.711
gh3	<---	Ghezavat	0.961	0.064	14.920	<0.001	0.763
gh2	<---	Ghezavat	1.064	0.069	15.328	<0.001	0.780
gh1	<---	Ghezavat	1.084	0.068	15.941	<0.001	0.804
fa5	<---	Feshar	1.000			<0.001	0.639
fa4	<---	Feshar	0.839	0.114	7.362	<0.001	0.539
fa3	<---	Feshar	0.905	0.118	7.645	<0.001	0.567
fa2	<---	Feshar	1.092	0.131	8.333	<0.001	0.649
fa1	<---	Feshar	1.102	0.133	8.307	<0.001	0.645
mf5	<---	Kontrol	1.000			<0.001	0.646
mf4	<---	Kontrol	0.916	0.103	8.882	<0.001	0.623
mf3	<---	Kontrol	1.107	0.115	9.647	<0.001	0.700
mf2	<---	Kontrol	1.121	0.117	9.569	<0.001	0.691
mf1	<---	Kontrol	1.095	0.117	9.371	<0.001	0.671
qf5	<---	Risk	1.000			<0.001	0.593
qf4	<---	Risk	1.113	0.146	7.600	<0.001	0.580
qf3	<---	Risk	1.168	0.147	7.953	<0.001	0.622
qf2	<---	Risk	1.289	0.154	8.393	<0.001	0.687
qf1	<---	Risk	1.336	0.165	8.091	<0.001	0.641
sa14	<---	Tajrobe	1.000			<0.001	0.646
sa13	<---	Tajrobe	0.936	0.091	10.295	<0.001	0.658
sa12	<---	Tajrobe	0.951	0.097	9.815	<0.001	0.622
sa11	<---	Tajrobe	0.998	0.095	10.462	<0.001	0.670
sa10	<---	Tajrobe	0.693	0.085	8.123	<0.001	0.501
sa9	<---	Tajrobe	1.065	0.101	10.523	<0.001	0.675
sa8	<---	Tajrobe	1.180	0.108	10.964	<0.001	0.709
sa7	<---	Tajrobe	1.060	0.103	10.326	<0.001	0.660
sa6	<---	Tajrobe	0.810	0.088	9.208	<0.001	0.577
sa5	<---	Tajrobe	0.870	0.092	9.489	<0.001	0.598
sa4	<---	Tajrobe	0.875	0.092	9.469	<0.001	0.596
sa3	<---	Tajrobe	1.025	0.097	10.591	<0.001	0.680
sa2	<---	Tajrobe	1.202	0.105	11.389	<0.001	0.744
sa1	<---	Tajrobe	1.141	0.108	10.522	<0.001	0.675

Table 20. Goodness-of-Fit indices for the structural equation model

Index	Accountants	Auditors
χ^2	1297.128	1306.535
$\chi 2/df$	1.064	1.072
GFI	0.869	0.868
AGFI	0.858	0.857
RMR	0.087	0.085
CFI	0.989	0.986
RMSEA	0.014	0.015

4.3.6 Examining research hypotheses

Table 21. Goodness-of-Fit indices for the structural equation model

Path			Non-standard coefficient	SD	Test statistic	P-value	Standard coefficient
H1: There is a significant relationship between financial knowledge and the quality of judgment and decision-making of accountants.							
Ghezavat	<---	Danesh	0.245	0.079	3.102	0.002	0.171
H2: There is a significant relationship between experience and the quality of judgment and decision-making of accountants.							
Ghezavat	<---	Tajrobe	0.450	0.074	6.121	<0.001	0.356
H3: There is a significant relationship between environmental risk and the quality of judgment and decision-making of accountants.							
Ghezavat	<---	Risk	0.348	0.113	3.075	0.002	0.183
H4: There is a significant relationship between internal controls in the environment and accountants' quality of judgment and decision-making.							
Ghezavat	<---	Kontrol	0.480	0.082	5.831	<0.001	0.370
H5: There is a significant relationship between work pressure and the quality of judgment and decision-making of accountants.							
Ghezavat	<---	Feshar	-0.025	0.094	-0.268	0.789	-0.016
H6: There is a significant relationship between financial knowledge and the quality of judgment and decision-making of auditors.							
Ghezavat	<---	Danesh	0.607	0.092	6.610	<0.001	0.431
H7: There is a significant relationship between experience and the quality of judgment and decision-making of auditors.							
Ghezavat	<---	Tajrobe	0.174	0.075	2.331	0.02	0.125
H8: There is a significant relationship between environmental risk and the quality of judgment and decision-making of auditors.							
Ghezavat	<---	Risk	0.231	0.103	2.233	0.026	0.132
H9: There is a significant relationship between internal controls in the environment and auditors' quality of judgment and decision-making.							
Ghezavat	<---	Kontrol	0.370	0.086	4.322	<0.001	0.262
H10: There is a significant relationship between work pressure and the quality of judgment and decision-making of auditors.							
Ghezavat	<---	Feshar	-0.053	0.093	-0.564	0.572	-0.033

The results of Hypothesis 2 show a significant and positive relationship between experience and the quality of judgment and decision-making in accountants (p-value less than 0.05), with a path coefficient or effect size of 0.356, indicating a direct relationship.

The results of Hypothesis 3 demonstrate a significant and positive relationship between environmental risk and the quality of judgment and decision-making in accountants (p-value less than 0.05), with a path coefficient or effect size of 0.183, suggesting a direct relationship.

The results of Hypothesis 4 present a significant and direct relationship between internal controls in the environment and the quality of judgment and decision-making in accountants (p-value less than 0.05), with a path coefficient or effect size of 0.37, indicating a direct relationship.

The results of Hypothesis 5 indicate that there is no significant relationship between work pressure and the quality of judgment and decision-making in accountants (p-value greater than 0.05).

The results of Hypothesis 6 show a significant and positive relationship between financial knowledge and the quality of judgment and decision-making in auditors (p-value less than 0.05), with a path coefficient or effect size of 0.431, suggesting a direct relationship.

The results of Hypothesis 7 present a significant and positive relationship between experience and the quality of judgment and decision-making in auditors (p-value less than 0.05), with a path coefficient or effect size of 0.125, indicating a direct relationship.

The results of Hypothesis 8 represent a significant and positive relationship between environmental risk and the quality of judgment and decision-making in auditors (p-value less than 0.05), with a path coefficient or effect size of 0.132, suggesting a direct relationship.

The results of Hypothesis 9 show a significant and direct relationship between internal controls in the environment and the quality of judgment and decision-making in auditors (p-value less than 0.05), with a path coefficient or effect size of 0.262, indicating a direct relationship.

The results of Hypothesis 10 indicate no significant relationship between work pressure and the quality of judgment and decision-making in auditors (p-value greater than 0.05).

5. Discussion and conclusion

This study examined judgment and decision-making in accounting and auditing, considering the perspectives of the individual, task, and environment. The research variables include auditor financial knowledge, auditor experience, audit environment risk, internal controls in the audit environment, time-budget pressure in auditing, and the quality of judgment and decision-making. In testing the first hypothesis, the study investigated whether there is a significant relationship between financial knowledge and the quality of judgment and decision-making by accountants. Statistical results showed a positive and significant relationship (at a 95% confidence level) between financial knowledge and the quality of judgment and decision-making by accountants. Thus, the first hypothesis of the study is confirmed. These results suggested that financial knowledge gained through repetition may significantly impact the quality of judgment and decision-making by accountants. Repetition leads to the automation of procedures, which reduces the demand on the accountant's information processing capacity, freeing up resources to complete other parts of the task, increasing efficiency and enhancing effectiveness in cases of time pressure. In such cases, cognitive structures become more accurate, allowing judges to better distinguish important information, provide further explanations about the processed information, and easily retrieve information, thereby increasing efficiency. These relationships indicate that the quality of judgment and decision-making by accountants improves as the quality of financial knowledge increases. Additionally, the research findings showed a significant positive relationship (at the 95% significance level) between experience and the quality of judgment and decision-making by accountants. Therefore, the second hypothesis of the study is accepted. These results suggested that individuals with more experience, whether derived from years of service or job rank, make better judgments. Furthermore, their judgment and decision-making quality are enhanced because they interact more with the ethical environment. In other words, experience gained by providing the necessary skills or knowledge to perform such tasks can improve efficiency. Consequently, accountants can make further improvements in the quality of their judgments.

Furthermore, this specific work experience significantly enhanced accountants' decision-making abilities. In other words, experienced accountants tend to act more effectively in problem-solving, making better judgments, and crafting more precise decisions because they apply general principles

and highly relevant conditions for solving such issues. At the same time, less experienced accountants cannot use general principles and, consequently, cannot make accurate judgments. On the other hand, the results showed a significant positive relationship (at a 95% confidence level) between environmental risk and the quality of judgment and decision-making by accountants. Thus, the third hypothesis of the study is confirmed. These results suggested that environmental risk is one of the key factors influencing decision-making and judgment in accountants. The level of tolerance for environmental risk indicates the willingness of accountants to make decisions in uncertain conditions. Accountants' perception of environmental risk affects their behavior, and their perspective on environmental risk positively influences their judgment and decision-making. Therefore, their tolerance for environmental risk influences accountants' judgment and decision-making. When this factor is combined with other individual components, such as personality traits, it has a more significant impact. The results also showed a significant positive relationship (at the 95% significance level) between internal controls in the environment and the quality of judgment and decision-making by accountants. Hence, the fourth hypothesis of the study is accepted. These results indicated that the effectiveness of internal controls helps business units achieve their core objectives, and effective internal controls can equip accountants with information about progress or lack thereof in achieving those objectives. Furthermore, they help improve the quality of judgment and decision-making regarding uncontrollable events or phenomena. Consequently, accountants' demand for better internal control systems and performance reporting increases. With further attention, internal controls serve as a valuable tool for solving potential problems and improving judgment and decision-making quality.

This study revealed that internal controls are related to accounting and financial matters and encompass all units and their activities. Additionally, the results showed a negative and non-significant relationship (at a 95% confidence level) between work pressure and accountants' quality of judgment and decision-making. Therefore, the fifth hypothesis of the study is not confirmed. These findings indicated that higher work pressure reduces cognitive capacity, eroding the individual's control abilities and ultimately diminishing the quality of accountants' judgment. In other words, the depletion of mental capacity due to increased workload reduces the brain's energy reserves because of engaging in various mental tasks, including decision-making and self-regulation, to prevent emotional and behavioral outbursts. This issue is associated with a disruption in cognitive abilities, as the work pressure affects the capacity to process information, thereby reducing the quality of judgment and decision-making by accountants. Additionally, the results demonstrated a positive and statistically significant correlation between accountants' financial expertise and the accuracy of their judgment and decisions at the 95% significance level. Thus, the study's sixth hypothesis is validated. Based on these results, accountants' judgment and decision-making could be much improved by practicing what they know about finance. Automating repetitive tasks through repetition frees up the accountant's information processing capacity, allowing them to focus on other aspects of the task at hand, which in turn increases efficiency and, in situations where time is of the essence, effectiveness. As a result, decision-makers are able to more accurately segregate key information, offer additional explanations about processed data, and retrieve information easily, all of which contribute to even greater efficiency. According to these correlations, the quality of accountants' judgment and decision-making is directly correlated with the quality of their financial knowledge. Additionally, the results demonstrated a positive and statistically significant correlation between accountants' level of expertise and the accuracy of their judgment and decisions at the 95% significance level. So, the seventh research hypothesis is accepted. These results implied that the greater the amount of time spent interacting with the ethical environment, the better judgments are made by those with more experience, whether that be

measured in terms of years of service or job rank. Thus, efficiency and decision-making are both enhanced by the experience obtained from learning the skills and information needed to do such activities. Accountants' decision-making skills are greatly improved by this particular work experience.

As stated, experienced accountants make more accurate assessments and excel in problem-solving since they can apply broad ideas and situations that are quite pertinent to address such problems. Less experienced accountants lack the necessary knowledge, cannot use general concepts and make correct decisions. Furthermore, the findings revealed a noteworthy positive correlation (at the 95% significance level) between environmental risk and the quality of judgment and decision-making by accountants. Consequently, the eighth theory of the research is verified. These results revealed that environmental risk is among the main elements affecting accountants' judgment and decision-making. The degree of tolerance for environmental risk represents the readiness of accountants to make choices under doubtful circumstances. The accountant's view regarding environmental risk influences their behavior, so their judgment and decision-making improve from this perspective. Thus, it is reasonable to assume that accountants' risk tolerance affects their decision-making and judgment, but the combined effects of this and other individual factors, including traits, will be much stronger. Accounting professionals' ability to use sound judgment and sound decision-making is positively correlated with environmental restrictions at the 95% significant level.

So, the study's eighth hypothesis is accepted. According to these findings, business units are able to accomplish their primary goals with the support of efficient internal controls. To better make judgments and choices about things beyond their control, accountants might benefit from having information about the progress (or lack thereof) in achieving those objectives provided by effective internal controls. As a result, there has been a rise in the demand from accountants for performance reporting and better internal control systems. In light of the fact that internal controls cover all units and their activities, not just accounting and finances, they are an effective tool for preventing problems and enhancing judgment and decision-making. Additionally, accountants' judgment and decision-making quality were negatively correlated with work pressure, but this was not statistically significant (at the 95% confidence level). Thus, the study's tenth hypothesis remains unproven. According to these results, accountants' judgment suffers as a result of increasing mental strain, which in turn lowers their control abilities. Therefore, the brain's ability to make decisions and self-regulate to avoid behavioral and emotional outbursts is negatively impacted by the depletion of mental capacity caused by increased workloads. Since accountants' ability to process information is severely affected by work pressure, the quality of their judgment and decision-making is reduced, and this issue is linked to a disturbance in cognitive abilities.

6. Suggestions for future research

After completing the stages of a scientific study, when the research is conducted systematically and scholarly, the researcher can provide insights based on the findings and results and propose strategies and suggestions for the improvement and expansion of future research. Therefore, the following suggestions are presented in alignment with the research findings and for future studies.

6.1 Practical Recommendations

1. *Based on the results of the incremental effect of financial knowledge on the quality of judgment and decision-making by accountants,* it is recommended that accountants increase their specialized knowledge to enhance their skills. With this increase in expertise, the accuracy of data entry and information processing in their minds will improve, and the speed of these

processes will increase. This characteristic will reduce negative effects on the quality of their judgments and decisions due to specialized financial knowledge.

2. *Based on the incremental effect of work experience on the quality of judgment and decision-making by accountants,* it is recommended that managers pay more attention to highly experienced individuals when making accounting and financial decisions for the company. Experienced individuals are less likely to be influenced by the form and presentation of information and are less affected by initial impressions, which could increase behavioral biases in judgments. Consequently, the quality of judgment and decision-making by experienced accountants will be better than that of less experienced accountants.
3. *Based on the positive relationship between environmental risk and the quality of judgment and decision-making by accountants,* it is recommended that accountants recognize the impact of different environmental risks on their emotions and motivations. The analysis of their information is influenced by the environment in which they are situated, and their confidence level increases when dealing with complex issues, reducing the difficulty and uncertainty in judgment and decision-making. Therefore, accountants should prefer working in a secure environment, free from peripheral or risky issues that could impair the quality of their work.
4. *Based on the results of the incremental effect of internal controls on the quality of judgment and decision-making by accountants,* it is recommended that managers create conditions where the company maintains strong internal controls, both administrative and financial. A robust internal control environment will enhance the input of proper and accurate information into accountants' minds, increasing their information processing capacity. As a result, the quality of judgment and decision-making will be improved, contributing to the company's achievement of its core objectives.
5. *Based on the results of the effect of reducing work pressure on the quality of judgment and decision-making by accountants,* it is recommended that accountants take a break after periods of high work pressure to restore their analytical decision-making abilities, thus preventing any negative impact on the quality of their judgment. Consequently, it is advised that managers avoid subjecting accountants to excessive work pressure during critical periods when the company requires optimal decision-making.

6.2 Suggestions for future research

To further enhance the results of the research, it is suggested that the following topics be explored:

1. A study examining the effect of accountants' self-confidence on the quality of judgment and decision-making.
2. A study investigating the impact of financial and non-financial incentives on the quality of judgment and decision-making by accountants.
3. A study exploring the effect of career advancement and professional development on the quality of judgment and decision-making by accountants.
4. A study analyzing the effect of social and environmental relationships on the quality of judgment and decision-making by accountants.

6.3 Limitations of the study

All research studies inherently have limitations. These limitations provide opportunities for future and new research. This study is no exception to this rule. The results of scientific research should be evaluated in light of the existing limitations. The limitations of this study are as follows:

1. The central and most crucial restriction in research grounded on inferential statistics is

connected to extending its conclusions to other situations and times. Likely, the links found in this study could not hold at other times or under different circumstances than those taken into account in this study, or the nature of these relationships would vary. Consequently, great care should be used while extending the findings of this research.

2. The replies to the questionnaire were from people at a particular moment. Hence, it is likely that elements like carelessness, tiredness, or other diseases affected the responses. Therefore, these elements should be considered while extending the findings to different periods.

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IJAAF; Vol. 10, No. 1, Winter 2026, Serial 34

Ferdowsi University of Mashhad

Iranian Journal of
Accounting, Auditing & Finance

Quarterly

RESEARCH ARTICLE

The Impact of Changes and Ranking Discrepancies in Sustainability Reporting on Stock Returns

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How to cite this article:
Azimi Ashtiani, N. , Sadeqian, S. and Khodabakhshi Parijan, K. (2026). The Impact of Changes and Ranking Discrepancies in Sustainability Reporting on Stock Returns. Iranian Journal of Accounting, Auditing and Finance, 10(1), 151-166. doi: 10.22067/ijaaf.2026.46937.1534
https://ijaaf.um.ac.ir/article_46937.html

ARTICLE INFO

Article History
Received: 2025-02-27
Accepted: 2025-04-28
Published online: 2026-02-01

Abstract

Sustainable investing has been a hot topic among lawmakers, academics, and investors as of late. Here, the goal of both academic research and sustainable investment methods is to compare how well various companies report on sustainability. Despite the attention on sustainability reporting, empirical research is still needed on the relationships among sustainability report errors, stock returns, and the timing of such reports. To analyze the impact of variations and ranking inconsistencies in sustainability reporting on stock returns, this study was conducted. Consequently, 130 Tehran Stock Exchange companies from 2015 to 2022 were analyzed using multivariate modeling and Eviews 9. The ESG, CSP, and CSR indices showed that sustainability reporting significantly impacted stock returns. Furthermore, these three sustainability reporting indices had a comparatively greater influence on prospective stock returns. Additionally, the three sustainability reporting indices had a considerable impact on the stock performance of the following stocks. Both present and future stock returns were adversely affected by inconsistencies in sustainability reporting rankings derived from different sustainability reports. Sustainability reporting, along with changes and inconsistencies in rankings, should be taken seriously by investors and market participants. Moreover, this study could help reduce investor uncertainty about sustainability reporting and encourage sustainable investment by focusing on differences and changes in sustainability reporting rankings across several approaches and years, and on their effects on stock returns. This study also examined how sustainability reporting rankings affect future stock returns. This study identifies discrepancies across various sustainability reporting rankings and examines how they affect stock returns and future performance. This study also contributes to the literature on sustainability reporting in Iran. By emphasizing differences and variations in sustainability reporting rankings across methods and years, and their impact on stock returns, this research aims to reduce investor confusion about sustainability reporting and promote sustainable investment. Moreover, this study focuses on the impact of changes in sustainability reporting rankings on future stock returns.

Keywords:
Ranking Discrepancies, Sustainability Reporting, Stock Returns

https://doi.org/10.22067/ijaaf.2026.46937.1534

NUMBER OF REFERENCES
30

NUMBER OF FIGURES
-

NUMBER OF TABLES
6

Homepage: https://ijaaf.um.ac.ir
E-Issn: 2717-4131
P-Issn: 2588-6142

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1. Introduction

The worldwide focus on sustainable development has resulted in an explosion of sustainability reporting in financial markets. The Global Sustainable Investment Alliance (GSIA) estimates that by 2020, global sustainable investment will have totaled over $30.7 trillion (Wang et al., 2024). Moreover, from 50% in 2014 to 73% of the world was ready to pay more for sustainable solutions in 2015. Market-based research contends that exemplary implementation of Environmental, Social, and Governance (ESG) initiatives improves corporate financial performance (Hoepner et al., 2016). Therefore, it can be claimed that legislators, analysts, and investors have paid great interest in sustainable investments in recent years. Both sustainable investment practices and academic research aim to measure and compare the sustainability reporting performance of various companies using ESG ranking data. For instance, an increasing number of studies provide theoretical support for the development of sustainability reporting (Gibson, Brandon et al., 2021; Asante-Appiah and Lambert, 2023; Berg et al., 2022; Serafeim and Yoon, 2023; Wang et al., 2024).

Sustainability reporting can help optimize investments, assess risks, and value companies. Many corporations are unable to report on sustainability due to transparency issues or misaligned incentives. For example, to achieve short-term profits, corporations may temporarily or selectively disclose some sustainability components to improve their image and maintain high sustainability rankings. These shifts in the rankings may indicate that corporations are trying to mislead investors with their sustainability reports.

It is also important to note that sustainability reporting is often voluntary, especially in markets such as Iran, where mandatory reporting has not been fully enforced. Because of this voluntary nature, rankings fluctuate, influencing how investors evaluate a company's risks and opportunities. In addition to supporting valuation, risk assessment, and decision-making, sustainability reporting is a valuable tool for investors. However, there are certain uncertainties regarding corporate sustainability reporting that impact the development of sustainable investment. For example, companies may not always be motivated to disclose extensive sustainability reports because Iran does not require mandatory sustainability reporting. They may engage in only more sustainability activities to meet specific objectives each year (Friske, 2023). In this sense, changes in sustainability reporting rankings can be used as a warning sign of misuse of sustainability reporting. Studies by Ahmadi and Rahmani (2023) indicate that company reports are often not well-known and receive limited attention. The Securities and Exchange Organization's corporate governance guidelines (both the old and the new) state that companies should voluntarily report on their sustainability efforts. However, a look at reports from companies listed on the Tehran Stock Exchange shows they have paid little attention to sustainability issues when reporting on their sustainability performance.

This issue highlights the significance of this research, as a more detailed analysis of the impact of discrepancies in sustainability rankings and how they change over time can contribute to improving transparency and the reporting process in Iran. In many cases, these changes may indicate companies' improper incentives to mislead investors or attract their attention through temporary improvements in rankings.

In addition, there is no universally accepted metric for sustainability reporting, and previous studies have used a wide variety of components (Berg et al., 2022). This leads to differences in rankings of sustainability reporting, indicating that people have different opinions on its pros and cons.

These disparities in rankings could result from management's divergent goals for the organization. For instance, managers who are solely concerned with the short term may temporarily adjust rankings to make the company's performance look better. Such changes can lead to

fluctuations in rankings, influencing strategic decisions and potentially boosting short-term stock returns. However, in the long run, these adjustments may result in a decline in future stock performance.

Giese et al. (2019) found that confusion in the financial markets arises from inconsistent and conflicting sustainability reporting rankings. This uncertainty affects investment decisions, corporate financing, reputation, and the formulation of regulations and policies regarding sustainability reporting. Sustainable investment in the Iranian context is affected by ranking inconsistencies and the importance of sustainability reporting. This is because research on sustainability reporting is still in its early stages, particularly for ESG reporting, and there are no mandatory reporting requirements.

The erosion of investor trust and the subsequent detrimental impact on future stock returns might result from changes in sustainability rankings that are driven by unethical business incentives. If investors find out that these rating changes were only cosmetic upgrades to trick the market, they might rethink their investments in those companies.

Consequently, this study is important because it can lead to greater transparency and better investment decisions by examining differences and inconsistencies in sustainability reporting rankings and assessing their effects on stock returns. Additionally, this study can play a crucial role in strengthening the credibility of sustainability reporting in Iran and establishing a more reliable framework for sustainable investments.

Investors are confused by corporate sustainability reporting rankings over the years and several checklists, which reduces their effectiveness and credibility (Chatterjee et al., 2009). Therefore, examining the potential impact of sustainability reporting ranking discrepancies on sustainable investment is essential. In this regard, the primary focus of this study is on stock returns. Economic and financial conditions are reflected in stock returns (Wang et al., 2024) and are useful indicators of the future state of the economy. According to Rahmawati and Handayani (2017), stock returns reflect investors' collective assessment of a company's current profitability.

This work adds to this field's research in various ways. First, while sustainability reporting, particularly ESG about stock returns, is gaining global attention (e.g., Cao et al., 2023; Shanaev and Ghimire, 2022; La Torre et al., 2020), Iranian research has focused on CSR's impact on stock returns, a narrower form of ESG reporting. Furthermore, few studies have explored the role of ESG sustainability factors in stock returns (Marefati et al., 2022). Iranian ESG sustainability reporting can benefit from this study's findings. Second, this study can aid in the development of sustainable investment by clarifying the role of sustainability reporting for investors and highlighting the relationship between stock returns and sustainability report rankings over time. In addition, future stock returns are examined in relation to sustainability reporting rankings and their changes. The importance of this issue arises from the fact that the impact of sustainability reporting may become apparent in the subsequent years (Wang et al., 2024). However, the argument is that if companies aim to improve their sustainability reporting, it will positively affect future returns. Furthermore, if the manager's goal is to achieve personal gains, changes in rankings can decrease stock returns, even if they have a positive effect on stock returns.

Investors can gain valuable insight into sustainability reporting investment opportunities by analyzing how ranking variations affect stock performance. More trustworthy and accurate sustainability reporting, particularly in ESG reporting, can be achieved through research in this area, thereby increasing transparency and efficiency in sustainability reporting rankings. So, it's crucial to study how different sustainability reporting rankings affect stock returns and how discrepancies between them do so. After the theoretical underpinnings and literature review are provided in the next parts, the hypotheses are formulated. The next step is to outline the research technique, which

includes the research models and the sample. Descriptive statistics and model fit are also part of the study's findings. A summary and some suggestions make up the last section.

2. Literature review and research background

2.1 The impact of sustainability reporting ranking discrepancies on stock returns

Disputes between rating criteria can affect the ranking of sustainability performance in sustainability reports. The study also emphasizes how sustainability reporting rankings have evolved with time (Giese et al., 2019). Investors can be confused when sustainability reporting rankings are inconsistent, which can affect stock returns (Wang et al., 2024). According to Serafeim and Yoon (2023), investors' expectations for a company's future performance can vary when sustainability reporting rankings differ, as investors interpret the rankings differently.

ESG reporting is the focus of these studies, while changes in rankings over time and discrepancies across checklists have received little attention. These differences include differences in corporate governance criteria, socioeconomic performance, and other factors.

While ranking differences make it harder for stock prices to reflect value-relevant sustainability reporting news, ESG rankings show what the market expects in the future and can foretell news stories, according to Serafeim and Yoon (2023). Market participants view ESG factors as a credible signal, which, according to La Torre et al. (2020), is associated with higher stock returns. Nevertheless, the majority of this research has ignored differences and inconsistencies in sustainability reporting ranks in favor of ESG reporting. A study by Shanaev and Ghimire (2022) examined how ESG rankings changed over time and found that higher ESG rankings were associated with higher positive anomalous returns.

The optimism bias hypothesis holds that optimistic investors dominate the market and assign higher values than the company's intrinsic value. As a result, stock prices become inflated relative to the company's actual value, leading to decreased stock returns.

The optimism bias leads investors to make more favorable evaluations of companies and hold optimistic expectations for their future performance, creating an unrealistically positive perception of a company's reality. As a result, investors may overvalue a company's stock, driving prices above their true worth. Ultimately, this can lead to stock price inflation and lower future stock returns. Miller (1977) argues that in markets with high selling costs, pessimistic investors are sidelined, and thus, price responses reflect more optimistic valuations.

In this context, optimism bias among investors leads to current asset prices being primarily determined by optimistic investors, who often overestimate a company's prospects. This type of misvaluation, when investors fail to achieve their expected outcomes, results in price declines and lower future stock returns. In other words, since pessimistic investors face short-selling constraints, the price of current assets is primarily determined by optimistic investors, who often overestimate a company's prospects. Consequently, the greater the discrepancy between market stock prices and actual values, the lower future stock returns (Diether et al., 2002; Wang et al., 2024).

Sustainability reporting ranking differences are similar to those in credit ratings and analyst forecasts, reflecting different perspectives and opinions that affect market participants' perceptions of risk and value.

Investing data can be interpreted differently by investors depending on these differences and biases. As a result, their investment decisions may be influenced by unrealistic and often overly optimistic assessments. Studies on credit ratings and analyst forecast discrepancies are relevant to the present study. To give just one example, Ackert and Athanassakos (1997) state that when uncertainty levels rise, analysts are more likely to be positive about a company's future. Stock returns were negatively correlated with the standard deviation of analyst projections. Also, because

these companies tend to be overpriced, Sadka and Scherbina (2007) argue that stocks with a wider gap between analysts' top rankings tend to have lower future returns.

According to Ahmadi et al. (2023, the Iranian capital market is relatively inefficient, and ESG practices are still in their infancy. Analysts and investors in Iran's capital market are unable to do accurate evaluations due to the market's unique sustainability reporting issues. The lack of regulatory mandates for sustainability reporting is a significant problem because it discourages businesses from being transparent about their environmental improvement efforts. Investors and analysts are left confused by sustainability reporting data due to uncertainty caused by inadequate reporting standards and a lack of transparency at the market level. Consequently, market participants may act irrationally or even negatively due to incomplete or incorrect data.

Thus, emerging markets are better suited to behavioral finance theories (Han and Li, 2017) that center on investors' irrationality and the lack of market efficiency. The highest-ranked companies tend to be favored by investors when sustainability reports are inconsistent. As a result, they undervalue future sustainability concerns and overestimate the company's sustainability success. As a result, their stock is overvalued, and their future returns on investment are diminished, according to the optimism bias argument.

This optimism bias in developing markets can lead to misguided investment decisions and artificially inflate stock prices, ultimately resulting in declining future returns.

Optimism bias refers to the tendency of investors to set unrealistic expectations. Additionally, irrational investors exhibit overconfidence and rely more on their own judgments than on available market information. As a result, stock prices are overvalued, leading to lower future returns (Hirshleifer and Luo, 2001). Berg et al. (2022) stated that the effect of ESG performance on stock returns is more substantial than previously estimated. Higher stock returns are associated with differences in ESG rankings, according to Gibson, Brandon et al. (2021). If, on the other hand, the ranking differences are examined year over year, investors may think the firm is consistently improving its sustainability reporting disclosures if the changes are getting better each year. So, if sustainability reporting rankings improve, stock returns and future returns will go up. So, the research hypothesis is as follows:

Research Hypothesis: **Discrepancies in sustainability reporting rankings significantly impact stock returns.**

2.2 Previous research

Several studies, both at home and abroad, have examined how sustainability reporting affects stock returns and how sustainability reporting rankings affect market returns. According to Pahlavan et al. (2024), corporate governance enables greater profit comparability, enhanced stock liquidity, and reduced risk of future stock price declines. However, this study primarily focused on the risk of price declines and measured only the governance component of sustainability reporting. In another study, Hoseini et al. (2021) showed that corporate social responsibility (CSR) negatively and significantly impacts stock return volatility. Although this study focused on CSR, ESG sustainability was not addressed. Abdi et al. (2020) classified the drivers of sustainability reporting into five groups and 24 indices. Environmental requirements, corporate governance features, and the company's structural characteristics were considered the most important factors. While this study ranked the drivers of sustainability reporting, the significance of these drivers was based solely on expert opinions, and no analysis was conducted at the company level. Hashemi et al. (2019) found that the impact of a company's sustainability performance and disclosure on its socio-economic performance, as reflected in excess stock returns, was significant and negative.

Additionally, the effect of sustainability performance and disclosure on a company's profitability was insignificant. Khoshkar et al. (2020) demonstrated that environmental reporting has a significant positive effect on disclosure quality and, through this impact, is significantly associated with stock returns. Although these studies address aspects of sustainability performance differently from ESG reporting, they have not examined the effects of changes in rankings over time. Furthermore, Marefati et al. (2022) argued that ESG sustainability is associated with higher stock returns. Moreover, the COVID-19 pandemic has strengthened the impact of ESG sustainability on stock returns. This study is the closest to the present research; however, several key differences exist. Like other studies, this research fails to account for variations and inconsistencies in rankings across years. Secondly, this study does not evaluate various methodologies for sustainability reporting, including CSR reporting, corporate sustainability performance (CSP), and ESG reporting.

2.3 International studies

There have been numerous international studies as well. Here, Wang et al. (2024) showed that in the Chinese stock market, there is a strong negative relationship between company returns and the lack of consensus in ESG rankings. Additional research shows that differences in ESG rankings can dampen investor enthusiasm, thereby reducing stock returns. In the heterogeneity analysis, this negative effect is more pronounced in state-owned companies, companies with higher ESG ratings, and companies with fewer institutional investors. The corporate governance dimension also plays a critical role in decreasing stock returns. To reduce decision-making bias, investors and decision-makers should consider ESG rankings from multiple rating agencies. Moreover, Berg et al. (2022) examined two new ESG rankings and found that the effect of ESG performance on stock returns, as measured by these methods, is stronger than previous estimates. Gibson Brandon et al. (2021) found a positive correlation between stock returns and ESG ranking discrepancies, suggesting that high-rated companies have larger discrepancies. The main thing driving this partnership is disagreement over the environmental aspect. Various agencies' ESG rankings were studied in these studies, but the effect of changes in rankings over time was not examined. Although ranking disparities make it difficult to incorporate sustainability reporting news about value into stock prices, ESG rankings reflect market expectations for future developments and news, according to Serafeim and Yoon (2023). In their 2020 paper, La Torre et al. contended that stock returns rise when market forces view ESG considerations as a suitable proxy. Without addressing changes in sustainability reporting rankings, these studies primarily focus on ESG reporting. Researchers Shanaev and Ghimire (2022) concluded that higher ESG rankings were associated with higher positive anomalous returns over time.

In this study, as in Shanaev and Ghimire (2022), changes in rankings across years are considered, while discrepancies in rankings are measured using various checklists, as per the methodology of Wang et al. (2024). Although this study differs from and has different reasons than existing research, its main distinguishing feature is that it was conducted in Iran. Due to sanctions, the emerging nature of the economy, and the unstable and uncertain conditions, sustainability reporting in Iran is approached differently than in other countries. Moreover, in Iran, no institutions are dedicated to ranking sustainability reporting, and data on sustainability reporting must be collected via checklists.

3. Research Methodology

Research of this type is descriptive of the correlational type in terms of its nature, as it is applied in terms of its objective, retrospective in terms of its time frame, and applied in terms of its objective. Through regression analysis, variables are examined, and their relationships are analyzed.

Data were collected manually from companies' disclosed reports on the Codal website. After collecting data from the statistical population, the next step is to analyze the data to test the hypotheses. Given the enormous volume of data and the need for processing, Excel and EViews software are used to estimate descriptive statistics, model parameters, and statistical analysis and inference. The research model is estimated using panel data and robust standard regression.

This study includes all companies listed on the Tehran Stock Exchange between 2015 and 2022, as shown in Table 1. After applying the following criteria, 130 companies (1,040 firm-years) remained from the total number of companies listed on the Tehran Stock Exchange. They were included in the accessible population for the study:

1. Holding companies, insurance companies, credit institutions, or banks should not own the companies.
2. The companies must have maintained their listing status on the Tehran Stock Exchange throughout the study period.
3. The companies should not have had a trading suspension of more than three months.
4. Esfand (the last month of the Iranian calendar year) should be the end of the companies' fiscal year.
5. The necessary data for the research must be available for the sample companies.

Table 1. Sample selection process

Limitation	Number of Companies
Statistical Population	389
Companies whose fiscal year does not end in Esfand	(54)
Investing, holding, financial intermediary, or insurance companies	(97)
Trading suspensions of more than three months during the study period	(23)
Companies that remained listed on the stock exchange throughout the study years	(48)
Companies for which data was available and usable	(37)
Final Sample	130

3.1 Research model and variables

Based on the studies of Wang et al. (2024) and Marefati et al. (2022), Model 1 is estimated to test the research hypothesis.

Model 1:

$$\text{Ret}_{it} = \beta_0 + \beta_1 SRDis_{it} + \beta_2 Size_{it} + \beta_3 ROE_{it} + \beta_4 ATO_{it} + \beta_5 ROCF_{it} + \beta_6 \text{MB}_{it} + \beta_7 SOE_{it} + \beta_8 Age_{it} + \beta_9 Inst_{it} + \beta_{10} OwnMng_{it} + \beta_{11} Growth_{it} + \beta_{12} Rec_{it} + \beta_{11} FixRatio_{it} + \varepsilon_{it}$$

In Model 1, if the coefficient β_1 is significant, then the research hypothesis is confirmed. Otherwise, the research hypothesis will be rejected. It should be noted that the model is tested using rankings of sustainability reporting, changes in ranking, ranking discrepancies, and future stock returns to gain a comprehensive understanding of the relationship between sustainability reporting and stock returns.

Dependent variable: stock return (Ret): According to Wang et al. (2024, this is the cumulative return on stocks during a financial year. To calculate Ret, equation (1) is used:

Equation 1:

$$Ret_{it} = \frac{D_t + P_t(1 + \alpha + \beta) - (P_{t-1} + Ca)}{P_{t-1} + Ca}$$

Where:

Dt: Cash dividend paid

Pt: Market value of each share at time t

Pt_{-1}: Market value of each share at time t-1
α: Percentage increase in capital from claims and cash contributions
β: Percentage increase in capital from reserves
Ca: Capital increase from cash contributions paid by investors

Independent Variable: Sustainability Reporting Ranking Discrepancy (SRDis): Two methods are considered to measure this variable.

First method: Similar to the study by Wang et al. (2024), this method extracts information from three types of sustainability reporting checklists (ESG, CSP, and CSR). The standard deviation of these three variables is then considered as a measure of ranking discrepancy. A larger standard deviation indicates greater ranking discrepancies, suggesting fundamental differences in sustainability reporting ranking methods. The following approach is applied to measure the three variables (ESG, CSP, and CSR):

Environmental, Social, and Governance (ESG) Reporting data is collected based on the checklist developed by Fakhari et al. (2017). This checklist includes three indices, 30 dimensions, and 86 components. If a company discloses a component, it is scored as 1; otherwise, it is scored as 0. Finally, the ESG rank is calculated by dividing the acquired score by the maximum possible score. It is important to note that since 20 components from the 86 criteria were not disclosed by any of the companies, they were excluded from the analysis.

According to Amin and Salehnezhad (2020), Corporate Sustainability Performance (CSP) Reporting data are collected using a checklist. This checklist includes seven indices and 47 components. If a company discloses a component, it is scored as 1; otherwise, it is scored as 0. The CSP rank is then calculated by dividing the acquired score by the maximum possible score.

Corporate Social Responsibility (CSR) Reporting data is collected based on the checklist developed by Bahri Sales and Farrokhi (2023). This checklist includes four indices and 20 components. If a company discloses a component, it is scored as 1; otherwise, it is scored as 0. The CSR rank is then calculated by dividing the acquired score by the maximum possible score.

Second method: The sustainability reporting ranking discrepancy indicator is based on changes in ESG, CSP, and CSR.

Control variables

According to the study by Wang et al. (2024), the control variables are as follows:

Company Size (Size): The natural logarithm of total assets.

Return on Equity (ROE): Defined as the ratio of net income to the book value of equity.

Asset Turnover (ATO): Defined as sales minus cost of goods sold, adjusted by total assets.

Operating Cash Flow (OCF): Defined as the net cash flow from operating activities divided by total assets.

Market-to-Book Ratio (MB): Defined as the ratio of the market value of equity to the book value of equity.

Ownership Type (SOE): A binary variable, where if the government or state institutions own more than 50% of the company's shares, it is scored as 1; otherwise, it is scored as 0.

Company Age (Age): Defined as the natural logarithm of the years since the company's establishment.

Institutional Shareholders (Inst): Defined as the percentage of shares owned by institutional investors holding more than 5% of the company's shares.

Managerial Ownership (OwnMng): The percentage of shares company managers own.

Sales Growth (Growth): The difference between the current year's and previous year's sales, divided by the previous year's sales.

Receivables Ratio (REC): Defined as the ratio of net receivables to total assets.
Fixed Asset Ratio (FixRatio): The net property, plant, and equipment ratio to total assets.

4. Research findings

Table 2 presents descriptive statistics for the variables. It is important to note that the research variables have been normalized at a 5% error level. Table 2 shows that the average stock return over the study period was 132.7%, significantly higher than the return from fixed bank interest rates. This return is primarily attributed to the bull market of 2019 and 2020. Similarly, the average sustainability reporting scores for ESG, CSP, and CSR were 20.5%, 23.1%, and 22.6%, respectively. These figures indicate that, on average, companies focus on sustainability reporting from 20% to 23%. The highest value suggests that none of the companies have disclosed more than 50% of their sustainability reports. Furthermore, the ranking discrepancy, calculated based on the standard deviation of the three indices (ESG, CSP, and CSR), is 6.2%.

Moreover, the statistical results indicate that the average company size is 15.96, while the average company age is 3.18 years. The return on equity (ROE) is 46.7%. Similarly, operating income accounts for 20% of total assets; on average, companies have an operating cash flow (OCF) of 11.8%. The market value of equity is approximately 5 times the book value. Institutional shareholders hold 65.3% of the shares, while company managers hold 52.5%. Moreover, enterprises have had an average yearly sales growth of 40%. This sales gain is primarily due to price increases and inflation rather than improvements in production, given the nation's inflation rate. Receivables indicate that, on average, accounts receivable account for 22.7% of total assets in each company. Furthermore, 24.8% of these companies' total assets are fixed assets. In addition, 51.92% of the shares are owned by the government and state institutions.

Table 2. Descriptive statistics of the research variables

Panel A: Continuous variables

Variable	Symbol	Mean	Median	Maximum	Minimum	Standard Deviation
Stock Return	RET	1.327	0.583	7.364	-0.484	2.058
ESG Reporting	ESG	0.205	0.197	0.348	0.083	0.073
CSP Reporting	CSP	0.231	0.233	0.400	0.067	0.094
CSR Reporting	CSR	0.226	0.233	0.433	0.050	0.118
Ranking Discrepancy	SRDis	0.062	0.057	0.133	0.017	0.033
Company Size	SIZE	15.096	14.952	18.029	12.725	1.380
Return on Equity	ROE	0.467	0.464	0.825	0.131	0.200
Operating Income	ATO	0.200	0.168	0.488	-0.002	0.143
Operating Cash Flow	OCF	0.118	0.096	0.395	-0.062	0.121
Market-to-Book Ratio	MB	5.058	3.515	18.337	0.940	4.565
Company Age	AGE	3.018	3.045	3.689	2.485	0.304
Institutional Shareholders	INST	0.653	0.700	0.909	0.204	0.200
Managerial Ownership	OWNMNG	0.525	0.610	0.886	0.000	0.289
Sales Growth	GROWTH	0.400	0.346	1.336	-0.248	0.429
Receivables Ratio	REC	0.227	0.197	0.535	0.036	0.143
Fixed Asset Ratio	FIXRATIO	0.248	0.208	0.623	0.031	0.174

Panel B: Discrete Variables

Variable	Symbol	Percentage 1	Percentage 1
Ownership Type	SOE	51.923	48.077

Table 3 shows the effect of each sustainability reporting dimension on stock returns. It should be noted that robust standard errors were used to estimate the research models, addressing issues such as heteroscedasticity and autocorrelation in the error terms (Peterson, 2009). Additionally, all

research models were estimated to have fixed effects after performing the F-Limer and Hausman tests. Based on the results, all three models are statistically significant, as the p-value of the F-statistic is zero. Additionally, the adjusted R-squared indicates that the defined variables in the models can explain 38% to 41% of stock returns.

Table 3. Results of the impact of sustainability reporting on stock returns

Variable	Coefficient	t-Statistic	Coefficient	t-Statistic	Coefficient	t-Statistic
ESG Reporting	4.582**	5.710				
CSP Reporting			2.455**	3.065		
CSR Reporting					1.179*	1.697
Company Size	-0.253**	-2.564	-0.223**	-2.223	-0.252**	-2.488
Return on Equity (ROE)	3.314**	7.380	3.175**	6.808	3.249**	7.044
Asset Turnover (ATO)	-0.815	-1.301	-0.588	-0.929	-0.523	-0.834
Operating Cash Flow (OCF)	-0.654	-1.448	-0.618	-1.319	-0.448	-0.962
Market-to-Book Ratio (MB)	0.298**	24.775	0.289**	23.709	0.290**	24.065
Ownership Type (SOE)	0.740**	2.089	0.682*	1.941	0.647*	1.817
Company Age	-1.247*	-1.809	-0.895	-1.281	-0.876	-1.247
Institutional Shareholders (Inst)	0.828	1.511	0.766	1.394	0.881	1.594
Managerial Ownership (OwnMng)	0.059	0.182	0.088	0.270	0.058	0.190
Sales Growth (Growth)	0.439**	4.114	0.424**	3.827	0.463**	4.166
Receivables Ratio (REC)	0.001	0.002	0.003	0.006	0.008	0.014
Fixed Asset Ratio (FixRatio)	0.595	1.310	0.521	1.128	0.549	1.202
Constant	3.881**	2.406	2.875*	1.703	3.410**	2.023
F-statistic	6.086	5.586	5.566			
F-statistic p-value	0.000	0.000	0.000			
Adjusted R-squared	0.410	0.385	0.384			
Observations	1040	1040	1040			

Note: Significance indicators at the 95% and 90% levels are denoted by ** and *, respectively.

A statistically significant gain in stock returns is evident in Table 3 based on sustainability reporting grounded on the ESG index. Similarly, CSR reporting has a statistically significant positive effect on stock returns at the 90% and 95% confidence levels. Consequently, it can be inferred that greater disclosure in the sustainability reporting framework is associated with higher stock returns. Table 4 shows how indices (ESG, CSP, and CSR) and ranking discrepancies (ESGR, CSP, and CSR) affect stock returns. According to the results, differences in sustainability reporting rankings between the current and previous years do not statistically affect stock returns. However, the rating disparities across ESG, CSP, and CSR confuse investors and negatively affect stock returns at the 95% confidence level.

4.1 Sensitivity test

Considering that sustainability reporting may significantly impact stock returns in the long run, the effects of past sustainability reporting (t-1) and the sustainability ranking discrepancy with a one-year lag on stock returns were also tested. The results are reported in Tables 5 and 6. According to Table 5, an increase in sustainability reporting in the previous year, across all three indices (ESG, CSP, and CSR), is associated with higher stock returns, as the coefficients for these variables are statistically significant at the 95% confidence level. However, compared to Table 5, the impact of sustainability reporting with a time lag is more pronounced on stock returns.

Table 4. Results of the impact of the sustainability reporting ranking discrepancy on stock returns

Variable	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
ESG - ESGt-1	0.694	0.764						
CSP - CSPt-1			0.065	0.081				
CSR - CSRt-1					-1.086	-1.441		
SRDis (ESG, CSP, CSR)							-4.849**	-2.791
Company Size	-0.232**	-2.085	-0.235**	-2.089	-0.242**	-2.169	-0.270**	-2.677
Return on Equity (ROE)	3.433**	6.895	3.414**	6.866	3.404**	6.779	3.207**	6.889
Operating Income (ATO)	-0.848	-1.232	-0.855	-1.239	-0.812	-1.169	-0.650	-1.011
Operating Cash Flow (OCF)	-0.218	-0.427	-0.213	-0.414	-0.256	-0.500	-0.524	-1.113
Market-to-Book Ratio (MB)	0.301**	23.015	0.300**	23.066	0.300**	22.787	0.293**	24.062
Ownership Type (SOE)	0.688*	1.804	0.679*	1.779	0.683*	1.802	0.605*	1.716
Company Age (Age)	-1.874**	-2.209	-1.812**	-2.141	-1.866**	-2.203	-0.992	-1.417
Institutional Shareholders (Inst)	0.731	1.202	0.708	1.164	0.778	1.284	0.590	1.066
Managerial Ownership (OwnMng)	-0.012	-0.032	-0.001	-0.003	-0.119	-0.304	0.231	0.723
Sales Growth (Growth)	0.457**	3.755	0.456**	3.735	0.469**	3.811	0.468**	4.189
Receivables Ratio (REC)	-0.465	-0.725	-0.458	-0.712	-0.476	-0.741	-0.112	-0.190
Fixed Asset Ratio (FixRatio)	0.419	0.833	0.426	0.844	0.484	0.952	0.548*	1.178
Constant	6.556**	3.361	6.449**	3.315	6.704**	3.438	4.790**	2.904
F-statistic	4.833	4.829	4.771	5.590				
p-value (F-statistic)	0.000	0.000	0.000	0.000				
Adjusted R-squared	0.375	0.374	0.371	0.385				
Number of Observations	910	910	910	1040				

Note: Significance at the 95% and 90% levels is denoted by ** and *, respectively.

According to Table 6, stock returns rise after a year if sustainability reporting ranks change. All three indices show this effect, and it's statistically significant with a 95% confidence level. Hence, it is reasonable to assume that future stock returns are higher due to the disparity in sustainability reporting rankings, especially the rise in rankings over a year. Nevertheless, stock returns are unaffected by changes in rankings that occur within the same year. In addition, stock returns are severely affected when sustainability reporting ranks differ by more than 1 year, as indicated by the standard deviation of the three indices.

5. Conclusion and recommendations

In recent years, sustainable investments have garnered considerable interest from investors, scholars, and politicians. In this context, both sustainable investing strategies and academic research seek to assess and compare the sustainability reporting performance of various organizations.

Nonetheless, despite the emphasis on sustainability reporting, two primary concerns arose.

Table 5. Results of the impact of sustainability reporting with a one-year lag on stock returns

Variable	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
ESG Reporting	3.566**	3.705				
CSP Reporting			2.536**	2.876		
CSR Reporting					3.324**	3.491
Company Size	-0.238**	-2.139	-0.249**	-2.261	-0.216*	-1.934
Return on Equity (ROE)	3.357**	6.774	3.253**	6.560	3.374**	6.755
Operating Income (ATO)	-1.075	-1.564	-1.012	-1.486	-0.782	-1.132
Operating Cash Flow (OCF)	-0.228	-0.455	-0.222	-0.451	-0.255	-0.496
Market-to-Book (MB)	0.296**	22.959	0.296**	23.035	0.298**	22.628
Ownership Type (SOE)	0.690*	1.796	0.730*	1.888	0.610	1.599
Company Age (Age)	-1.649*	-1.927	-1.438*	-1.704	-1.813**	-2.147
Institutional Shareholders (Inst)	0.694	1.123	0.721	1.181	0.931	1.543
Managerial Ownership (OwnMng)	0.070	0.188	0.066	0.180	-0.248	-0.635
Sales Growth (Growth)	0.463**	3.868	0.457**	3.876	0.467**	3.814
Receivables Ratio (REC)	-0.390	-0.609	-0.367	-0.573	-0.414	-0.649
Fixed Asset Ratio (FixRatio)	0.517	1.021	0.451	0.902	0.409	0.806
Constant	5.297**	2.692	4.956**	2.509	5.418**	2.745
F-statistic	5.030	4.904	4.893			
p-value of F-statistic	0.000	0.000	0.000			
Adjusted R^2	0.386	0.379	0.378			
Number of Observations	910	910	910			

Table 6. Results of the impact of discrepancy in sustainability reporting rankings with a one-year lag on stock returns

Variable	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic	Coefficient	t-statistic
ESGt-1 - ESGt-2	5.865**	6.409						
CSPt-1 - CSPt-2			2.967**	3.749				
CSRt-1 - CSRt-2					5.432**	6.039		
SRDis (ESG, CSP, CSR)t-1							-6.055**	-2.789
Company Size	-0.100	-0.786	-0.071	-0.554	-0.094	-0.726	-0.246**	-2.233
Return on Equity (ROE)	4.094**	8.114	3.817**	7.259	3.916**	7.588	3.452**	6.912
Operating Income (ATO)	-1.210	-1.599	-1.045	-1.357	-0.807	-1.072	-1.079	-1.566
Operating Cash Flow (OCF)	0.162	0.289	-0.001	-0.001	-0.015	-0.027	-0.241	-0.494
Market-to-Book (MB)	0.309**	22.399	0.302**	21.692	0.307**	22.083	0.299**	23.272
Ownership Type (SOE)	0.465	1.027	0.533	1.224	0.597	1.367	0.656*	1.723
Company Age (Age)	-4.416**	-4.382	-4.597**	-4.527	-5.010**	-4.979	-1.588*	-1.892
Institutional Shareholders (Inst)	1.426**	2.124	0.901	1.350	0.741	1.142	0.661	1.090
Managerial Ownership (OwnMng)	-0.042	-0.098	-0.082	-0.189	-0.412	-0.933	0.076	0.205
Sales Growth (Growth)	0.454**	3.506	0.424**	3.220	0.427**	3.318	0.464**	3.956
Receivables Ratio (REC)	-0.283	-0.398	-0.223	-0.302	-0.379	-0.528	-0.306	-0.479
Fixed Asset Ratio (FixRatio)	-0.048	-0.087	-0.061	-0.108	0.009	0.015	0.425	0.849
Constant	11.809**	5.316	12.418**	5.518	14.150**	6.467	6.307**	3.253
F-statistic	4.972	4.317	4.647	4.950				
p-value of F-statistic	0.000	0.000	0.000	0.000				
Adjusted R^2	0.420	0.377	0.399	0.382				
Number of Observations	780	780	780	910				

Note: ** and * indicate statistical significance at the 95% and 90% confidence levels, respectively.

At first, if a company's sustainability reporting rankings go up, it might be a sign that they're serious about sustainability reporting, which investors would take as a sign of sustainable behavior and could lead to better stock returns. Uncertainty among investors has contributed to a decline in stock returns as the gaps between rating reports widen due to discrepancies in the checklists used to analyze sustainability reporting. This study investigated the effects of alterations and ranking inconsistencies in sustainability reporting on stock returns.

Using the ESG, CSP, and CSR reporting indices for sustainability reporting has a positive, substantial effect on stock returns and future stock returns. The impact on future stock returns, however, was somewhat stronger due to these measures. Investors view a company's enhanced sustainability reporting as an indication of its health and future focus, and they pay particular attention to sustainable investments as a result. Stock returns go up because of this. Marefati et al. (2022), La Torre et al. (2020), and Berg et al. (2022) all reached similar conclusions.

While changes in sustainability reporting rankings have little effect on stock returns this year, they dramatically boost returns in the market going forward, according to the data. One possible explanation for this correlation is that when a company's rankings go up, investors start to think that it's really trying to improve the quality of its sustainability reports. Consequently, future stock returns will be higher if sustainability reporting rankings improve. However, in the short term, changes in sustainability reporting rankings cannot be viewed by investors as a signal of enhanced sustainable investment. These results align with the findings of Shanaev and Ghimire (2022).

According to the results, both the present and future stock returns are negatively affected by rankings that are inconsistent or generated from multiple sustainability reporting criteria. As a result, stock returns are affected by investors' muddled thinking, which relies on sustainability reporting rankings for decision-making. Various investor expectations for the company's future might negatively impact stock returns due to differing perceptions of sustainability reporting. Disputes over sustainability reporting rankings can also dampen investor enthusiasm, thereby reducing stock returns. Regarding the reduction in future returns, it should be noted that the price of current assets is primarily determined by optimistic investors who often overestimate a company’s outlook. Optimistic investors will consider the highest sustainability reporting rank when multiple rankings are available. Consequently, the greater the discrepancy between market stock prices and actual values, the lower future stock returns are. Similar findings were reported in the studies by Wang et al. (2024) and Serafeim and Yoon (2023).

In this regard, the psychological effects on investors play a crucial role in their decision-making. Companies with higher sustainability reporting rankings are more likely to be trusted by investors, as they are seen as indicators of stability and reliability. Stock prices can be artificially inflated above their actual value due to price bubbles, which can cause this fact. Consequently, when the market eventually aligns with reality, stock returns may decline.

To be more precise, rising sustainability rankings are good news for investors, as they indicate that report quality and transparency are improving over time. Over the long term, these positive shifts may benefit stock performance. Based on the findings, it is recommended that decision-makers carefully assess a company’s sustainability reporting ranking. The regulatory body should establish requirements to improve sustainability reporting and establish specific standards to reduce ranking variances. Increasing transparency in rankings would help investors make more precise evaluations and avoid decisions based on misleading information. Furthermore, investors should recognize that greater disclosure in sustainability reporting is associated with improved stock returns and future performance. Nevertheless, they should adopt a cautious approach by considering the lowest ranking across various sustainability reporting checklists to mitigate future risks to returns.

5.1 Suggestions for future research

A further analysis of how these shifts impact investor behavior and the prediction of future returns could be conducted, given the importance of ranking changes and their long-term effects. Furthermore, future studies in this area could be facilitated by investigating the relationship between long-term sustainability evaluations and improved stock returns.

The results suggest that decision-makers should carefully consider a company's sustainability reporting ranking. To reduce ranking inconsistencies and improve sustainability reporting, regulatory agencies may issue regulations. Additionally, investors need to know that better sustainability reporting disclosures lead to higher stock returns and future profits, and that positive changes in sustainability reporting can increase returns. Nevertheless, they must also recognize that a prudent approach regarding the lowest rank should be adopted among diverse sustainability reporting checklists to mitigate potential complications with future returns.

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IJAAF; Vol. 10, No. 1, Winter 2026, Serial 34

Ferdowsi University of Mashhad

Iranian Journal of
Accounting, Auditing & Finance

Quarterly

RESEARCH ARTICLE

Investigation of the Relationship Between Debt Structure, Credit Rating, and Audit Fees in Companies

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How to cite this article:
Khorramabadi, M. (2026). Investigation of the Relationship Between Debt Structure, Credit Rating, and Audit Fees in Companies. Iranian Journal of Accounting, Auditing and Finance, 10(1), 167-185. doi: 10.22067/ijaaf.2026.47410.1570
https://ijaaf.um.ac.ir/article_47410.html

ARTICLE INFO

Article History
Received: 2025-01-18
Accepted: 2025-07-20
Published online: 2026-02-01

Keywords:
Audit fees, Credit Rating, Short-term Debt, financial Reporting quality, Emerging Markets

Abstract

The present study examined the relationships between short-term debt structure, auditor credit ratings, and audit fees in companies listed on the Tehran Stock Exchange (TSE) between 2013 and 2023. An analysis of the relationships among debt maturity, credit quality, and audit pricing was conducted using data from 136 non-financial firms and panel data regression results. Five hypotheses were tested to examine the direct relationship between short-term debt and audit fees, with the moderating effects of auditor rating, firm size, corporate life cycle stage, and financial reporting quality. Audit fees were significantly correlated with short-term debt, indicating that auditors exert greater effort and increase their compensation in response to greater liquidity risk. However, this was moderated by the auditor's credit rating: higher ratings are associated with lower overall audit costs, while high short-term debt increases audit fees, suggesting greater audit caution under complex financial conditions. Moreover, this joint effect is more prominent in larger firms, early-stage companies, declining companies, and companies with delayed financial reporting, highlighting how context influences audit pricing. This research contributed novel insights to the audit literature, especially within the context of emerging capital markets by integrating multi-level interaction effects and applying robust econometric models. The findings emphasized the strategic importance of financial structure management, timely reporting, and auditor selection in controlling audit-related costs for managers, auditors, and regulators. We encourage future studies to replicate this model using more granular governance and audit-quality proxies in other institutional settings.

https://doi.org/10.22067/ijaaf.2026.47410.1570

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NUMBER OF REFERENCES
51

NUMBER OF FIGURES
-

NUMBER OF TABLES
7

Homepage: https://ijaaf.um.ac.ir
E-Issn: 2717-4131
P-Issn: 2588-6142

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1. Introduction

Financial resource management and other related decision-making are among the absolute priorities of managers of companies in the modern, competitive market. As one of the major aspects of financial decision-making, the debt structure of a company is also very important in terms of determining the financial risk, the capacity of the company to attract financial resources, and even its operational costs. As a result, the credit rating of a company is one of the most important factors used to determine a company's financial health and its economic performance, as it indicates the degree of confidence that investors and creditors have in its ability to repay its debts (Arhinful et al., 2024). In addition, credit rating agencies apply ratings based on the financial credibility of companies by using both quantitative and qualitative data that is retrieved through public and privately available information (Chen & Chen, 2022). As a result of a good credit rating, a company's liquidity risk and agency costs are reduced, which minimizes audit risk and corresponding audit costs(Chen & Chen, 2022).

According to the research done by Gul and Goodwin (2010), the firms with a credit rating and higher short-term debts incur reduced audit fees from the auditors. This discovery, according to the authors, indicates that such firms are less prone to financial misreporting. However, a limitation of their study is that the impact of firm size and corporate life cycle was not fully considered, which is a key focus of this research. Moreover, they found that there was a strong negative correlation between credit ratings and audit fees, and that audit fee charging policies are based on the assumption that credit ratings reflect the client's liquidity risk anxieties and charge lesser fees to companies with good credit ratings. But the advantage of short-term debt is largely witnessed in those firms that have low credit ratings(Gul & Goodwin, 2010). Auditing is an essential part of the financial and economic system because it is a mechanism of increasing financial transparency and giving a guarantee to stakeholders (King & McKennie, 2023). Audit fees, which are a part of financial reporting, are affected by a lot of things. These include the degree of reported risk, the complexity of a company's financial framework, and the regulations that are in place. Accordingly, this paper explicitly examines the effects of firm-specific characteristics, such as size, life cycle stage, and quality of reporting.

Specifically, the current relationship is stronger in firms that are lower rated in terms of credit rating, and this means that auditors have considered the monitoring aspect of lenders when pricing their services (Gul & Goodwin, 2010). Firms with lower quality earnings, small firms, or firms in the growth stage benefit more from short-term debt on owed audit costs (Opare & Bhuiyan, 2023). Additionally, the larger share of public debt and the smaller share of bank debt in the composition of the financing of a company are linked with high audit quality. The outcome is even more significant when the information asymmetry between the firm is high and weak corporate governance, implying that the better the audit quality, the higher the transparency and the lower the possibilities of moral hazard risks between the management and holders of the public debt (Chen et al., 2018).

Based on a study of Tehran Stock Exchange companies, the proposed paper will hopefully shed light on the relationship between debt structure, credit rating, and audit fees. Due to their enormous volume of financial transactions and financial openness, the listed corporations would make suitable research subjects for this topic. Unlike earlier research from other developing countries, this one focuses on how institutional context affects audit pricing. This study will primarily aim at presenting both scientific and practical evidence of the influence of financial structure and credit rating on audit costs. The results of this research can help managers of businesses, investors, auditors, and regulating agencies come up with proper financial policies and better estimate the costs involved. The findings highlight the importance of strategic financial management and the

selection of appropriate auditors in controlling audit-related costs, which is a key contribution of this study.

2. Literature review

Firms' financial governance and strategic decisions are impacted by the relationship between short-term debt and audit fees, making it a crucial subject in financial and auditing studies. A company's financial profile and structure are affected by its short-term debt, which consists of obligations that are repayable within a year and are usually financed by loans or credit lines. The complexity of the financial situation, the size of the company, and the nature of the risk all play a role in determining the audit price. The purpose of this study is to synthesize the existing literature on the topic of audit fees and how various factors, such as short-term debt, credit ratings, company size, business life cycle, and financial reporting quality (FRQ), interact with one another. The review draws attention to both the similarities and differences in the results.

2.1. Short-term debt and audit fees

Audit fees and short-term debt have a complicated and situationally dependent relationship. The negative correlation between short-term debt and audit fees in rated enterprises was discovered by (Gul & Goodwin, 2010). This suggests that improved monitoring leads to a decrease in audit work. Supporting this view is Opare and Bhuiyan's (2023) observation that smaller enterprises, firms in the growth stage, and firms with worse earnings quality experience higher effects (Opare & Bhuiyan, 2023). On the other hand, except privately held companies, audit fees are greater for Chinese companies that use short-term financing to finance long-term projects (Hong & ZHANG, 2020). Reasons for this discord probably have to do with institutional variations, notably China's more stringent regulatory supervision (Hong and Zhang, 2020). In a study conducted by Feito-Ruiz et al. (2023), lower debt maturities were associated with Big 4 auditors and higher ownership concentration in SMEs. In contrast, Gandía and Huguet (2020) found that Spanish SMEs experienced a decrease in debt costs due to higher audit fees in voluntary audits, as lenders place a high value on audit quality (L Gandía & Huguet, 2020). The need to study this link in the Tehran Stock Exchange, where distinct institutional variables may influence financial actions and auditor assessments, is underscored by these contradictory results. Based on this, it can be stated that the initial hypothesis of the present study is the following:

H1: There is a relationship between short-term debt and audit fees.

2.2. Credit ratings and audit fees

Credit ratings are important tools in moderating the short-term debt and audit fee relationship because they are indicators of the financial credibility of a given firm. This part of the research synthesizes the previous works by analyzing the effects of credit ratings on the audit fees in terms of the debt structure, corporate governance, and perceived risk, and how the points differ and converge to support further research on the topic in the Tehran Stock Exchange.

- *Impact of credit ratings on short-term debt and audit fees*

Enhanced lender monitoring reduces the risks of financial misreporting, which is reflected in lower audit fees (Gul & Goodwin, 2010). This is especially true for higher credit ratings and short-term debt. Lenders' increased scrutiny of lower-rated businesses has a greater impact on audit efficiency (Gul & Goodwin, 2010). According to Opare and Bhuiyan (2023), the impact is more noticeable for smaller firms or those with lower earnings quality, as this relationship differs

according to firm size and financial reporting quality (Opare & Bhuiyan, 2023). On the other hand, according to Dhaliwal et al. (2008), audit fees have a positive effect on debt costs for investment-grade issuers (Dhaliwal et al., 2008). This suggests that in some cases, higher fees may indicate that the auditors are putting more effort into inspecting the financial statements. These differing results probably come from differences across institutions, such as how much regulatory monitoring or market openness there is. This shows that we need to look into this dynamic in Iran's rising market.

- *Credit ratings and corporate governance*

Higher credit ratings frequently mean better company governance, which can lead to higher audit fees because of more monitoring. Alali et al. (2012) and Mili and Alaali (2023) show that companies with better credit ratings have better governance procedures, which means they are more open about their short-term debt (Alali et al., 2012; Basu et al., 2022; Mili & Alaali, 2023). Bortolon et al. (2013) and Griffin et al. (2008) say that this increased transparency may require more audit effort. They find that strong governance, like active audit committees, is linked to higher audit fees (Bortolon et al., 2013; Griffin et al., 2008; JANUARTI et al., 2020; Zaman et al., 2011). These studies agree that credit ratings show how well a company is run, which affects the price of audits. However, they disagree on how much the charge should go up, which depends on the governance requirements of the market.

- *Credit ratings and debt structure*

Credit ratings affect the maturity structure of debt, which in turn affects audit fees. According to Diamond (1991), companies with high credit ratings choose short-term debt to show that they are financially flexible, whereas companies with low credit ratings prefer long-term debt to lower their liquidity risk. This decision affects how risky an audit is thought to be. Short-term debt in high-rated enterprises usually means lower fees because the risk is smaller, while low-rated firms have to pay higher fees because they are being looked at more closely (Gul and Goodwin, 2010). Chong et al. (2015) also say that higher credit ratings are linked to more short-term debt disclosures, which lowers information asymmetry but may make audits harder (Chong et al., 2015). These results indicate a complicated relationship between credit ratings, debt maturity, and audit fees, with differences caused by the risk profiles of individual companies. Empirical research is necessary in Iran, where distinct institutional elements, including regulatory frameworks and market dynamics, may influence this relationship in a different way, due to the contradictory results about the direction and size of the effect of credit ratings on audit fees. In high-rated companies, for example, short-term debt could mean good financial management, which would cut audit costs. In lower-rated companies, on the other hand, short-term debt could be seen as riskier, which would draw more attention from auditors. This complexity supports the following hypothesis:

H2: The relationship between short-term debt and audit fees is influenced by the firm's credit rating.

2.3. Firm size and audit fees

Owing to firm size, financing, investment, and risks are managed in varying ways, and this impacts the connection between short-term debt, credit ratings, and audit fees. Using a summary of the existing literature, we examine how the size of a firm affects audit prices and how that effect is influenced by credit ratings and short-term debt, and find overlap and support for extending the research to the Tehran Stock Exchange.

- *Impact of firm size on audit fees*

As a result of greater organizational and financial complexity, larger firms usually incur higher audit fees (Lim & Mali, 2021). This complexity comes from having many different ways to get money and complicated financial systems, which makes audit procedures more complicated. However, they may have less leverage to negotiate with auditors, which might lead to different cost structures depending on how the market changes. Xu et al. (2022) note that audit fees are higher in high-risk firms with weak corporate governance and larger firms, as auditors address enhanced information asymmetry (Xu et al., 2022). This calls for further research into Iran's developing market since the results agree that larger firms pay more in audit fees, but disagree on how much of an impact this link has, which is affected by factors like governance quality and industry specifics.

- *Interaction of firm size with credit ratings and short-term debt*

Credit ratings and short-term debt interact with firm size to shape audit fees. Moalla and Baili (2019) discovered that firms with higher ratings, which are usually bigger, are more likely to get unqualified audit opinions. This could lead to higher audit fees because people want high-quality audits (Moalla & Baili, 2019). Lim and Mali (2021) and Xu et al. (2022) propose that auditors impose elevated fees on larger, higher-rated enterprises to alleviate information asymmetry, especially in markets characterized by rigorous regulatory scrutiny (Lim & Mali, 2021; Xu et al., 2022). On the other hand, Chong et al. (2015) show that there is a non-linear relationship between credit ratings and trade credit use. For example, low-rated companies cut back on trade credit as their ratings go up, but high-rated companies (which are frequently bigger) increase trade credit, which could be a symptom of predatory behavior. This difference shows that short-term debt in bigger companies may be seen as less hazardous, which might cut audit costs. On the other hand, short-term debt in smaller, lower-rated companies may be seen as more risky, which could raise audit costs (Chong et al., 2015). These mixed findings underscore the need to examine how firm size moderates the joint effect of short-term debt and credit ratings on audit fees in Iran, where unique institutional factors, such as regulatory frameworks and market transparency, may lead to distinct outcomes.

H3: The joint effect of short-term debt and credit rating on audit fees varies across firms of different sizes.

2.4. Corporate life cycle and audit fees

The audit fees are influenced significantly by the stages of the corporate life cycle, according to some studies. Audit fees associated with mature firms are higher than those of growth firms because they have a higher business risk. The negative correlation relationship between short-term debt and credit ratings and audit fees of rated firms shows there is an improved system of monitoring and governance of the firms (Gul & Goodwin, 2010). Credit ratings, small size, growth stage, and weak earnings quality all contribute to the effect (Opare & Bhuiyan, 2023). The effects of the life cycle stages on audit fees have been reported in different markets, such as Egypt, where this association was discovered in a substantial relationship between the audit fees and the introduction, growth, maturity, and decline of life cycle characteristics (Murad, 2018). These findings indicate that the assessment of several firm-related aspects, including life cycle stages, debt structure, and credit rating, is crucial for setting the audit fee and evaluating the quality of financial reporting. It is prudent to consider that the overall impact of short-term debt and credit rating on audit fees will vary at different stages of the firm's corporate life cycle, given their significant influence on audit fees and the established correlation between short-term debt, short-term credit rating, and audit pricing. For instance, the dynamics of audit fees for growth-stage organizations may range significantly from those for mature or falling firms, as growth-stage firms are viewed as having

varying levels of risk, along with more financial complexities and monitoring needs. These results show that different periods of life affect how audit fees work, which means that more research is needed in Iran.

H4: The joint effect of short-term debt and credit rating on audit fees varies across different stages of the corporate life cycle.

- *Financial reporting quality and audit fees*

Optimal auditing has conducted numerous studies about the factors influencing paid audit fees and financial reporting quality (FRQ). A number of studies on the factors that influence audit fees and FRQ have been produced by Optimal Auditing. Audit fees are positively correlated with firm profitability (Elswah et al., 2024). An analysis by Li and Liu (2024) found that FRQ drops as abnormal audit fees go up (Li & Liu, 2024). For high-risk small firms with poor corporate governance, Xu et al. (2022) found that audit fee premiums are higher when investors pay for rating agencies' coverage. This suggests that these companies offer auditors and rating agencies complementary monitoring services (Xu et al., 2022). A study conducted by Yuan et al. (2025) in the Chinese market found that audit fees are negatively affected by financial report readability. This effect is influenced by factors like the similarity of annual reports and the auditors' experience in specific industries. All these studies are indicative of an intricate relationship between audit fees, FRQ, and other corporate attributes and external utilities (Yuan et al., 2025). These results highlight the multidimensional and multifaceted relationship between audit fees, financial reporting quality (FRQ), and other firm-level attributes and external institutions, including credit rating agencies. Although financial reporting quality is reported to lead to low audit fees because of the low perception of audit risk, its moderating effect on the connection between short-term debt, credit rating, and audit price has not been conclusively determined. Considering that short-term debt can be related to higher transparency because of stronger lender monitoring, and that higher credit ratings are linked with better corporate governance, it can be assumed that the quality of financial reporting contributes eminently to the determination of the effects of these two factors on the audit fees. These studies suggest FRQ moderates the effect of short-term debt and credit ratings on audit fees, a relationship yet to be fully explored in Iran.

H5: The joint effect of short-term debt and credit rating on audit fees is moderated by the firm's financial reporting quality.

3. Research Methodology

This study is practical research that seeks to examine the relationship between short-term debt, credit ratings, and audit fees, utilizing prior theories as a foundation. It uses preexisting archive data to assess variable relationships without control methods; it is descriptive-correlational. This section contains the data collection, a sample selection, variable measurement, regression models, analysis techniques, and a more powerful justification of the Tehran Stock Exchange (TSE) firms and their relevance to the institutions.

3.1. Data collection and sample selection

We used library-based approaches and document analysis to collect data from databases such as Rahavard Novin 3, Codal, TSE, and Iran Fara Bourse (IFB) after the event. The theoretical framework and literature assessment were based on books, academic journals, dissertations, and official reports. Empirical data were sourced from financial statements and related disclosures in the TSE and IFB databases. The statistical population includes all firms listed on the TSE from 2013 to 2023. Several eligibility criteria were applied to ensure data homogeneity and comparability,

including the following criteria:

- Companies with a fiscal year other than March ending are excluded.
- The companies that altered their fiscal year within the framework of the research were not included.
- The exclusion of any investment, holding, and financial intermediary firms was because of the structural variation in their reporting on financial accounts.
- Firms that did not publish or had missing information on their finances were restricted.
- Companies that traded with a suspension of over three months were also deleted.

The final sample, after these filters, consists of 136 companies, which is enough to draw strong statistical conclusions and is reflective of previous study standards. The data structure is panel (longitudinal), integrating cross-sectional and time-series data, which enhances control for unobservable heterogeneity and improves the reliability of the results.

3.2. Justification for using Tehran Stock Exchange firms

Because of Iran's unique institutional framework, which includes economic sanctions, high inflation, concentrated ownership, and strict regulatory requirements, the TSE is a great place to examine audit fees. These variables affect how companies handle their debt, how trustworthy they are, and how risky they think their auditors are, which is very different from how things work in developed markets. Sanctions, for instance, make it harder to get international finance, which makes people rely more on short-term debt. Regulatory mandates in Iran require detailed financial disclosures, increasing audit complexity. With TSE firms, this study provides insights applicable to similar markets and addresses a gap in the literature regarding international audit pricing evidence.

3.3. Variable measurement

The key variables are defined and operationalized as follows to ensure clarity and consistency in Table 1.

3.4. Research variables

Panel data regression models are employed using EViews 8 and Stata 12 to test the hypotheses, with a consistent format incorporating main effects, interaction terms, and moderating effects. The models are specified as follows:

In line with the study by Gul and Goodwin (2010), the following regression model is developed to test the first hypothesis.

$$\text{LN-AF}_{i,t} = \beta_0 + \beta_1 DM3_{i,t} + \beta_2 RATING_{i,t} + \beta_3 LN_NAF_{i,t} + \beta_4 OPIN_{i,t} + +\beta_5 BIG4_{i,t} + \beta_6 LN_TENURE_{i,t} + \beta_7 ICW_COUNT_{i,t} + \beta_8 SIZE_{i,t} + \beta_9 lev_{i,t} + \beta_{10} MTB_{i,t} + \beta_{11} ROA_{i,t} + \beta_{12} LOSS_{i,t} + \beta_{13} INVREC_{i,t} + \beta_{14} QUICK_R_{i,t} + \beta_{15} TANGIB_{i,t} + \beta_{16} FORSALE_{i,t} + \varepsilon_{i,t} \quad (1)$$

We extend Equation (1) by including the interaction term between DM3 and RATING as an additional independent variable to examine the joint effect of debt maturity and credit rating on audit fees, to test the second hypothesis.

$$\begin{aligned} \text{LN} - \text{AF}_{i,t} = {} & \beta_0 + \beta_1 DM3_{i,t} + \beta_2 RATING_{i,t} + \beta_3 DM3_{i,t} \times RATING_{i,t} + \beta_4 SIZE_{i,t} + \beta_5 lev_{i,t} \\ & + \beta_6 MTB_{i,t} + \beta_7 ROA_{i,t} + \beta_8 LOSS_{i,t} + \beta_9 INVREC_{i,t} + \beta_{10} QUICK_R_{i,t} \\ & + \beta_{11} TANGIB_{i,t} + \beta_{12} FORSALE_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (2)$$

Table 1. Definition of variables

Variable	Definition
LN_AF	Natural logarithm of audit fees.
DM3	Total liabilities divided by current liabilities plus debt maturing in the next two or three years.
RATING	Composite score from Iranian credit rating agencies, scaled from 1 (lowest) to 5 (highest), based on financial health, liquidity, and default risk.
LN_NAF	Natural logarithm of non-audit fees paid to the auditor.
OPIN	In the absence of going concern comments in the audit opinion, the dummy variable equals 1.
ARL (delay)	A proxy for financial reporting quality (delay-based) as well as the number of days between the end of the fiscal year and the issuance of the auditor's report.
BIG4	Dummy variable equal to 1 if the firm is audited by a Big 4 audit firm, and 0 otherwise.
IND_SPEC	An industry-specific auditor will have a dummy value of 1; otherwise, a dummy value of 0 will be used.
BUSY	In the case of a fiscal year-end in December, the dummy variable is set to 1, otherwise to 0.
LN_TENU	A natural logarithm is the number of consecutive auditing years for a particular firm by the auditor.
ICW_COUNT	Firms with weaknesses in internal control are assigned a dummy variable of 1, and those without are assigned a dummy variable of 0.
SIZE	Natural logarithm of total assets.
LEV	Ratio of current liabilities to total liabilities.
MTB	Market-to-book ratio of equity.
ROA	Return on assets is measured as net income divided by total assets.
LOSS	Dummy variable equal to 1 if ROA is less than zero, and 0 otherwise.
INVREC	Ratio of inventories and receivables to total assets.
QUICK_R	Divide current assets by current liabilities to get the quick ratio.
TANGIB	Tangibility of assets, measured as fixed assets divided by total assets.
FORSALE	If the firm exports, it has a dummy variable of 1. Otherwise, it has a dummy variable of 0.
FLC_Growth	If the firm is in the growth stage of its life cycle, the dummy variable will be 1; otherwise, it will be 0.
FLC_Decline	A dummy variable of 1 if the firm is in decline, and 0 otherwise.
FLC_Fall	If the firm is in the fall stage of its life cycle, the dummy variable is 1; otherwise, it is 0.
FLC_Maturity	An integer value of 1 indicates that the firm is in the maturity stage of the life cycle, whereas 0 indicates they are not.
FLC_Introduction	Firms in the introduction stage of their life cycle will have a dummy variable of 1; otherwise, they will have a dummy variable of 0.
RESTATE	Restated financial statements are reported as 1, and other financial statements as 0.
|DAC|	The absolute value of discretionary accruals is calculated using the performance-adjusted modified Jones model. The following equation is estimated for all firms in an industry with at least eight observations in a given year: (A.1) $\frac{ACC_{i,t}}{TA_{i,t-1}} = \gamma_0\left(\frac{1}{TA_{i,t-1}}\right) + \gamma_1\left[\frac{\Delta SALES_{i,t} - \Delta RECEIV_{i,t}}{TA_{i,t-1}}\right] + \gamma_2\left(\frac{PPE_{i,t}}{TA_{i,t-1}}\right) + \gamma_3(ROA_{i,t-1}) + \varepsilon_{i,t}$ ACC is total accruals calculated as income before extraordinary items and discontinued operations (IB) minus operating cash flow (OANCF). TA is the total assets at year t-1. ΔSALES is the change in sales from year t-1 to year t. ΔRECEIV is the change in accounts receivable from year t-1 to year t. PPE is gross property, plant, and equipment. ROA is return on assets, measured as income before extraordinary items and discontinued operations for the previous year divided by total assets of the same year. The estimated coefficients from equation (A.1) are used to compute the non-discretionary component (NDAC) for each firm. Discretionary accruals (DAC) are the residuals from this regression: DAC = ACC - NDAC.

Hypothesis 3 states that the joint effect of short-term debt and credit rating on audit fees varies across firms of different sizes. The regression model for testing this hypothesis is presented as follows:

(3)

$$\begin{aligned}\mathrm{LN-AF}_{i,t} = \beta_0 &+ \beta_1 DM3_{i,t} + \beta_2 RATING_{i,t} + \beta_3 (DM3_{i,t} \times RATING_{i,t}) \\ &+ \beta_4 (DM3_{i,t} \times RATING_{i,t} \times SIZE_{i,t}) + \beta_5 SIZE_{i,t} + \beta_6 lev_{i,t} + \beta_7 MTB_{i,t} \\ &+ \beta_8 ROA_{i,t} + \beta_9 LOSS_{i,t} + \beta_{10} INVREC_{i,t} + \beta_{11} QUICK_R_{i,t} + \beta_{12} TANGIB_{i,t} \\ &+ \beta_{13} FORSALE_{i,t} + \varepsilon_{i,t}\end{aligned}$$

Hypothesis 4 states that the joint effect of short-term debt and credit rating on audit fees varies across different stages of the corporate life cycle. The regression model for testing this hypothesis is presented as follows:

(4)

$$\begin{aligned}\mathrm{LN-AF}_{i,t} = \beta_0 &+ \beta_1 DM3_{i,t} + \beta_2 RATING_{i,t} + \beta_3 (DM3_{i,t} \times RATING_{i,t}) \\ &+ \beta_4 (DM3_{i,t} \times RATING_{i,t} \times FLC_Growth_{i,t}) \\ &+ \beta_5 (DM3_{i,t} \times RATING_{i,t} \times FLC_Decline_{i,t}) \\ &+ \beta_6 (DM3_{i,t} \times RATING_{i,t} \times \mathrm{FLC_Fall}_{i,t}) \\ &+ \beta_7 (DM3_{i,t} \times RATING_{i,t} \times FLC_Maturity_{i,t}) \\ &+ \beta_8 (DM3_{i,t} \times RATING_{i,t} \times FLC_Introduction_{i,t}) + \beta_9 SIZE_{i,t} + \beta_{10} lev_{i,t} \\ &+ \beta_{11} MTB_{i,t} + \beta_{12} ROA_{i,t} + \beta_{13} LOSS_{i,t} + \beta_{14} INVREC_{i,t} + \beta_{15} QUICK_R_{i,t} \\ &+ \beta_{16} TANGIB_{i,t} + \beta_{17} FORSALE_{i,t} + \varepsilon_{i,t}\end{aligned}$$

Hypothesis 5 states that the joint effect of short-term debt and credit rating on audit fees is influenced by the financial reporting quality of firms. The regression model for testing this hypothesis is presented as follows:

(5)

$$\begin{aligned}\mathrm{LN-AF}_{i,t} = \beta_0 &+ \beta_1 DM3_{i,t} + \beta_2 RATING_{i,t} + \beta_3 (DM3_{i,t} \times RATING_{i,t}) + \beta_4 delay_{i,t} \\ &+ \beta_5 (DM3_{i,t} \times RATING_{i,t} \times delay_{i,t}) + \beta_6 SIZE_{i,t} + \beta_7 lev_{i,t} + \beta_8 MTB_{i,t} \\ &+ \beta_9 ROA_{i,t} + \beta_{10} LOSS_{i,t} + \beta_{11} INVREC_{i,t} + \beta_{12} QUICK_R_{i,t} + \beta_{13} TANGIB_{i,t} \\ &+ \beta_{14} FORSALE_{i,t} + \varepsilon_{i,t}\end{aligned}$$

All research variables must be well specified and operationalized in order to conduct reliable empirical research and test the research hypotheses effectively.

3.5. Analytical methods

Ordinary Least Squares (OLS) is used as the baseline in panel data regression analysis. If heteroscedasticity or autocorrelation is observed, Generalized Least Squares (GLS) is performed. Model specification is determined using:

- F-Limer Test: To choose between pooled OLS and panel models.
- Hausman Test: To select between fixed and random effects models.
- Diagnostic tests ensure model reliability:
- Multicollinearity: Variance Inflation Factor (VIF) to confirm no severe collinearity (VIF < 10).
- Heteroscedasticity: White test or modified Wald test to detect non-constant variance, addressed via GLS if needed.
- Autocorrelation: To check for serial correlation, we use the Durbin-Watson statistic for autocorrelation. If the values are considerably different from 2, we make modifications.

The reliability of the results is improved by these tests, which guarantee fair and consistent estimations. The regressions examine main effects (e.g., DM3, RATING), interaction terms (e.g., DM3 × RATING), and moderating factors (e.g., SIZE, FLC stages, ARL), in accordance with the assumptions.

4. Research findings

4.1. Descriptive statistics

The descriptive statistics of the research variables are presented in Table 2, offering an overview of the central tendencies and dispersion of the variables under study. The LN_AF, which stands for the logarithm of audit fees, is a good candidate for modeling because it has a normal distribution (skewness = 0.5, kurtosis = 0.01), a standard deviation of 0.90, and an average of 7.35. In contrast, DM3 (short-term debt ratio) is left-skewed with high kurtosis, indicating that short-term debt is a major component for most companies, which could imply liquidity risk. This means that the data may need to be changed. The RATING variable is somewhat biased, which means that companies tend to hire auditors with good reputations, as seen by the auditor ratings. An interesting finding is the FLC_GROWTH variable, which shows a high mean (0.91), suggesting that most firms in the sample are in the growth stage. Subsequent analyses must take careful statistical considerations into account, as the descriptive analysis implies that some variables do not follow a normal distribution.

Table 2. Descriptive statistics

Variable Name	Mean	Median	Min	Max	Std Dev	Skewness	Kurtosis	Jarque-Bera
LN-AF	7.350	7.290	4.370	10.230	0.900	0.090	3.220	4.340
DM3	0.900	0.930	0.150	1.000	0.120	-2.340	10.450	4075
RATING	1.780	1.000	1.000	4.000	1.260	1.120	2.360	287.550
LN*NAF	10.290	11.110	0.000	18.360	3.960	-1.390	4.750	569.960
OPIN	1.100	1.000	1.000	2.000	0.290	2.750	8.560	3223.550
BIG4	0.300	0.000	0.000	1.000	0.460	0.890	1.790	243.500
BUSY	0.850	1.000	0.000	1.000	0.360	-1.980	4.940	1028.300
LN*TENURE	1.210	1.100	0.000	3.090	0.980	0.330	1.840	93.480
ICW*COUNT	0.710	1.000	0.000	1.000	0.460	-0.910	1.830	247.350
SIZE	15.280	15.050	11.160	21.900	1.750	0.650	3.560	104.700
LEV	0.530	0.520	0.010	1.960	0.230	0.540	4.820	236.450
MTB	5.350	3.100	-48.250	262.110	12.850	12.430	214.700	2394818
ROA	0.160	0.140	-0.620	0.890	0.160	0.370	4.480	144.460
LOSS	0.080	0.000	0.000	1.000	0.280	3.020	10.140	4612.270
INVREC	0.290	0.260	0.000	0.920	0.190	0.710	2.940	107.240
QUICK*R	1.450	0.950	0.110	47.070	2.940	9.700	116.700	701237.700
TANGIB	0.230	0.180	0.000	4.120	0.210	5.880	99.260	495704.400
FORSALE	0.550	1.000	0.000	1.000	0.500	-0.210	1.040	210.930
FLC*MATURITY	0.300	0.000	0.000	1.000	0.460	0.880	1.770	242.310
FLC*INTRODUCTION	0.010	0.000	0.000	1.000	0.070	13.330	178.720	1664969
FLC*GROWTH	0.910	1.000	0.000	1.000	0.290	-2.850	9.100	3669.030
FLC*FALL	0.170	0.000	0.000	1.000	0.370	1.780	4.170	739.930
FLC*DECLINE	0.100	0.000	0.000	1.000	0.300	2.690	8.230	2965.780

4.2. Hypothesis testing

To test Hypothesis 1, Regression Model (1) was used. The hypothesis assumes that firms with higher short-term debt face greater financial risk, influencing auditors' risk assessments and leading to higher audit fees. Table 3 presents the regression results.

DM3 (short-term debt ratio) shows a significant positive coefficient of 0.7847 (t = 5.83, p = 0.0005), confirming that higher short-term debt correlates with higher audit fees. This finding supports the hypothesis that auditors perceive higher risk in firms with more short-term debt, requiring more effort and compensation. RATING (auditor rating) shows no significant effect (p = 0.807), indicating that auditor rating alone does not substantially influence audit fees in this context. Firm size (SIZE) and internal control weaknesses (ICW_COUNT) have significant positive effects, indicating more audit costs for larger firms or those with reporting weaknesses. Opare and Bhuiyan (2023) discovered that short-term debt correlates with reduced audit expenses, particularly for

companies with subpar credit ratings and smaller dimensions. In contrast, the lack of significance in RATING here differs from Hong and Zhang (2020), where auditor ratings significantly impacted audit fees, particularly for firms using short-term debt for long-term investments.

Table 3. Results of the first Model test

Variables	Coefficients	t-Statistic	p-Value
DM3	0.784	5.836	0.0005
RATING	0.0014	0.250	0.807
LN_NAF	-0.006	-2.903	0.015
OPIN	-0.026	-1.279	0.229
BIG4	-0.048	-1.812	0.111
LN_TENURE	-0.011	-1.262	0.235
ICW_COUNT	0.079	4.836	0.0007
SIZE	0.294	15.503	0.000
LEV	0.161	4.048	0.002
MTB	0.0008	2.836	0.017
ROA	0.135	2.644	0.024
LOSS	0.071	4.139	0.002
INVREC	0.149	2.822	0.018
QUICK_R	-0.005	-2.391	0.037
TANGIB	0.032	0.812	0.435
FORSALE	-0.043	-2.896	0.015
C	2.774	10.501	0.000
R-squared	0.961	Adjusted R-squared	0.957
F-Statistic	218.177	Significance Level	0.000
Durbin-Watson Statistic		1.520	

To test Hypothesis 2, an interaction regression model was used, incorporating DM3, RATING, and their interaction term (DM3 × RATING). The results are shown in Table 4

Table 4. Results of the second Model test

Variables	Coefficients	t-Statistic	p-Value
DM3	-0.234	-2.806	0.018
RATING	-0.094	-2.767	0.019
DM3×RATING	0.112	2.872	0.016
SIZE	0.300	14.553	0.000
LEV	0.123	2.990	0.013
MTB	0.001	2.456	0.033
ROA	0.099	1.296	0.223
LOSS	0.071	4.892	0.000
INVREC	0.264	3.201	0.009
QUICK_R	-0.004	-2.282	0.045
TANGIB	0.037	1.091	0.300
FORSALE	-0.036	-2.116	0.060
C	2.806	8.261	0.000
DM3	-0.234	-2.8067	0.018
R-squared	0.956	Adjusted R-squared	0.952
F-Statistic	199.916	Significance Level	0.000
Durbin-Watson Statistic		2.148	

DM3 and RATING show significant negative coefficients, indicating that both higher short-term debt and higher auditor ratings are associated with lower audit fees. The interaction term DM3 ×

RATING is positive and significant (0.1129, p = 0.016), suggesting that the combination of high short-term debt and strong auditor ratings increases audit fees due to the added complexity of auditing such firms. Gul and Goodwin (2010) found that short-term debt negatively correlated with audit fees. This study's interaction between short-term debt and auditor rating provides a more nuanced perspective, especially in firms with complex financial conditions.

Hypothesis 3 examines whether the joint effect of short-term debt and auditor credit rating on audit fees varies across firms of different sizes. The results in Table 5 confirm that the interaction term DM3 × RATING × SIZE is statistically significant.

Table 5. Results of Model 3 estimation

Variables	Coefficients	t-Statistic	p-Value
DM3	-0.225	-2.606	0.009
RATING	-0.088	-2.328	0.020
DM3×RATING	0.189	2.028	0.042
DM3×RATING×SIZE	0.253	2.049	0.040
SIZE	0.295	45.514	0.000
LEV	0.124	2.961	0.003
MTB	0.0009	2.805	0.005
ROA	0.097	1.806	0.071
LOSS	0.073	2.912	0.003
INVREC	0.264	6.547	0.000
QUICK_R	-0.004	-1.841	0.065
FORSALE	-0.037	-1.801	0.071
TANGIB	0.036	0.981	0.326
C	2.880	22.136	0.000
R-squared	0.800	Adjusted R-squared	0.777
F-Statistic	199.895	Significance Level	0.000
Durbin-Watson Statistic		1.549	

The results of Model 3 indicate that the combined effect of short-term debt and auditor credit rating on audit fees varies according to firm size. The coefficient of the three-way interaction term (DM3 × RATING × SIZE) is 0.253, which is significant (t = 2.049, p = 0.040) and highlights the moderating role of firm size. In other words, for larger firms, the joint effect of short-term debt and auditor quality on increasing audit fees is stronger. Short-term debt alone reduces audit fees (β = -0.225, p = 0.009), while greater auditor credit rating also has a negative effect (β = -0.088, p = 0.020). However, the interaction term DM3 × RATING is positive and significant (β = 0.189, p = 0.042), indicating that when short-term debt is high and the auditor has a high credit rating, their combined effect leads to an increase in audit fees. Results support prior theory: audit fees are positively correlated with firm size (β = 0.295, p < 0.001), leverage (β = 0.124, p = 0.003), and inventory and receivables (β = 0.264, p < 0.001). Overall, these results suggest that auditors charge higher fees when dealing with large, high-risk firms, even in the presence of auditors with high credit ratings. The model exhibits a strong fit (R^2 = 0.800, Adjusted R^2 = 0.777), and the F-test confirms the overall significance of the model, reinforcing the robustness of the findings.

Hypothesis 4 tests whether the joint effect of short-term debt and auditor rating on audit fees varies across different stages of the firm life cycle (FLC). There is a significant moderating effect of life cycle stages in this relationship, as shown in Table 6.

Table 6. Results of Model 4 Test

Variables	Coefficient	t-statistic	p-value
DM3	-0.233	-3.231	0.001
RATING	-0.097	-2.975	0.003
DM3×RATING	0.123	3.106	0.001
SIZE	0.300	56.838	0.000
LEV	0.126	2.786	0.005
MTB	0.001	2.384	0.017
ROA	0.089	1.528	0.126
LOSS	0.067	2.869	0.004
INVREC	0.259	6.337	0.000
QUICK_R	-0.003	-1.872	0.061
TANGIB	0.035	0.778	0.436
FORSALE	-0.040	-1.909	0.056
DM3×RATING×FLC_FALL	-0.001	-0.189	0.849
DM3×RATING×FLC_MATURITY	0.007	1.133	0.257
DM3×RATING×FLC_INTRODUCTION	0.146	3.396	0.000
DM3×RATING×FLC_GROWTH	-0.012	-0.890	0.371
DM3×RATING×FLC_DECLINE	0.017	1.874	0.0611
C	2.805	25.133	0.000
R-squared	0.957	Adjusted R-squared	0.952
F-Statistic	194.462	Significance Level	0.000
Durbin-Watson Statistic		1.556	

The interaction term DM3 × RATING × FLC_Introduction is highly significant (β = 0.1464, p = 0.0007), indicating that in newly established firms, high short-term debt combined with a high auditor rating significantly increases audit fees due to the high operational and financial uncertainty in these firms. This suggests that auditors may still need to focus on liquidity risk at declining firms, despite what experts believe. The results for growth, maturity, and fall stages are statistically insignificant, implying that in these phases, other factors such as stability and process maturity may reduce the impact of short-term debt and auditor rating on audit fees. These findings align with the research by Murad Ali Ahmed (2018), who found that the life cycle stage has a significant effect on audit fees, particularly in the introduction stage. The results suggest that startups and declining firms face higher audit costs due to their higher risk and audit complexity. Feito-Ruiz et al. (2023) also highlighted that growth-stage firms tend to have more dynamic financial structures, which might mitigate the impact of short-term debt and auditor rating on audit fees.

4.3. Triple interactions with firm life cycle stages

- *Introduction Stage (DM3 × RATING × FLC_Introduction):* The interaction effect is positive and highly significant (β = 0.1464, p = 0.0007). This indicates that audit fees are substantially increased in newly formed enterprises due to the combination of short-term debt and a high auditor's reputation, which is especially problematic in these situations due to the high levels of operational and financial uncertainty. A startup's finances are generally new and fragile, and its capital structure is fragile, making it more challenging for auditors to conduct an audit of it, especially high-profile ones looking to maintain their credibility.
- *Decline Stage (DM3 × RATING × FLC_Decline):* The interaction is positive but only marginally significant (β = 0.0177, p = 0.0611). In declining firms, reduced operations may lower audit scope, yet high short-term debt may still raise concerns about liquidity risk, leading auditors to devote more effort to going-concern assessments.
- *Growth Stage (p = 0.3716), Maturity Stage (p = 0.2571), and Fall Stage (p = 0.8498):* These

interactions are statistically insignificant, implying no meaningful moderation effect of the firm life cycle stage in these phases. In growth-stage firms, diverse financing sources and a more dynamic structure may diminish the relative importance of short-term debt and auditor rating in determining audit fees. Mature firms have well-established processes, reducing audit risks. The audit considerations of short-term debt become less important in the fall phase as operations taper off, transactions become simpler, and operations become simpler.

- Specifically:
- *Maturity Stage (DM3 × RATING × FLC_Maturity):* Although the coefficient is positive (β = 0.0076), it is not significant (p = 0.2571), suggesting that the audit environment is stable and standard procedures apply, regardless of debt structure or auditor reputation.
- *Fall Stage (DM3 × RATING × FLC_Fall):* The coefficient is negative and insignificant (β = -0.0015, p = 0.8498), showing no observable effect. At this stage, reduced activity and audit scope likely make the interaction between short-term debt and auditor rating irrelevant.

The results show that the stage of the firm's life cycle affects the relationship between short-term debt, auditor rating, and audit fees. The interaction is most pronounced and significant in the introduction stage, marginal in decline, and negligible in other phases. Modeling and interpreting audit fees must take lifecycle dynamics into account. Overall, these results confirm that the joint effect of short-term debt and auditor credit rating on audit fees is more pronounced during the introduction and decline stages of the firm life cycle, while no significant differences are observed in other stages. Audit fee analysis should take a firm's life cycle into account, as shown by these results. A more thorough investigation of the stages (growth, maturity, and fall) that did not show statistical significance, as well as sensitivity analyses on control variables (such as ROA and TANGIB) that did not show statistical significance, should be considered for future research. Startup firms are known to have high levels of risk and uncertainty. Furthermore, leveraging larger datasets or more advanced statistical methods could provide a more comprehensive understanding of the determinants of audit fees.

The fifth hypothesis of this study posits that the joint effect of short-term debt and credit rating on audit fees is moderated by the quality of financial reporting. To test this hypothesis, the Regression Model (5) has been employed. A summary of the results from this analysis is presented in Table 7.

Financial reporting quality, as assessed by audit report delay (DELAY), moderates the joint effect of short-term debt (DM3) and auditor credit rating (RATING) on audit fees (LN-AF), according to the results of Table 7, which corresponds to the test of the fifth hypothesis. This supports the hypothesis. In regression model (5), the main variables DM3 (coefficient = -0.240, p-value = 0.001) and RATING (coefficient = -0.090, p-value = 0.006) have significant negative effects on audit fees. This means that higher short-term debt ratios and better auditor credit ratings are linked to lower audit fees. This could be because lower financial risk and more trust in high-quality auditors lead to lower audit fees. The interaction term DM3 × RATING (coefficient = 0.105, p-value = 0.004) shows a significant positive effect. This means that having a lot of short-term debt and a good reputation as an auditor makes audits more expensive, probably because they are more complicated. The audit delay variable (DELAY, coefficient = -0.001, p-value = 0.000) has a strong negative relationship with audit fees. This means that longer reporting delays may be linked to lower fees, which could be because of limited scope or efforts to cut costs. The three-way interaction term DM3 × RATING × DELAY (coefficient = 0.015, p-value = 0.000) is significant at the 1% level. This shows that the quality of financial reporting, as shown by the delay in the audit report, moderates the relationship between short-term debt and auditor rating with audit fees. The interaction between DM3 and RATING has a positive coefficient, which shows that when firms

take longer to report, the combined effect on audit fees is stronger. This could be because of higher audit risk, which needs more thorough scrutiny by qualified auditors. The lower R-squared (0.6500) and Adjusted R-squared (0.6200) numbers show that the model fits pretty well. This means that even though the key variables are important, audit fees may also be affected by other things.

Table 7. Results of Model 5 estimation

Variables	Coefficient	t-statistic	p-value
DM3	-0.240	-3.200	0.001
RATING	-0.090	-2.700	0.006
DM3×RATING	0.105	2.800	0.004
SIZE	0.295	16.600	0.000
LEV	0.115	2.150	0.032
MTB	0.002	1.400	0.162
ROA	0.095	0.950	0.343
LOSS	0.090	3.350	0.001
INVREC	0.280	3.500	0.000
QUICK_R	-0.005	-1.800	0.072
TANGIB	0.035	0.980	0.328
FORSALE	-0.025	-1.150	0.251
DM3 × RATING × DELAY	0.015	4.500	0.000
DELAY	-0.001	-3.600	0.000
C	3.020	9.998	0.000
DM3	-0.234	-3.125	0.001
RATING	-0.086	-2.685	0.007
DM3_RATING	0.101	2.775	0.005
R-squared	0.650	Adjusted R-squared	0.620
F-Statistic	195.000	Significance Level	0.000
Durbin-Watson Statistic		1.850	

5. Conclusion and suggestions

This study looks at how short-term debt, auditor credit rating, and audit fees are related in companies listed on the Tehran Stock Exchange. It does this by taking into account firm size, the life cycle of the company, and the quality of its financial reporting. Short-term debt correlates positively with elevated audit fees, as liquidity and financial concerns inherent in short-term liabilities require more comprehensive audits. The auditor's credit rating affects this relationship. Auditors with good credit ratings tend to be more cautious, especially when short-term debt levels are high, which raises the cost of the audit. Larger firms, due to operational and reporting complexities, experience greater audit fee increases when high short-term debt and auditor reputation interact. The firm life cycle stage significantly impacts the joint effect of short-term debt and auditor rating on audit fees. This effect is most pronounced during the introduction and decline stages, where financial uncertainty and operational instability increase audit risks. Financial reporting quality—as measured by audit report delay—moderates the relationship, with delayed reporting signaling weak internal controls and increasing audit efforts and costs.

This study contributes to the audit literature by moving beyond linear models, providing a nuanced understanding of how short-term debt, auditor reputation, and firm-specific characteristics interact to shape audit pricing in emerging markets. It highlights the conditional nature of these relationships, offering new insights into audit fee determinants that prior studies—focused solely on leverage or auditor reputation—did not address.

For corporate managers, the findings underscore the importance of controlling debt structure and

improving financial reporting practices to reduce audit risk and minimize costs. For auditors, the results emphasize the need for risk-adjusted audit strategies tailored to firm-specific dynamics (such as financial structure, life cycle stage, and reporting quality) to enhance audit quality and meet stakeholder expectations. For regulators (e.g., the Securities and Exchange Organization of Iran), the study suggests strengthening disclosure standards related to debt maturity and enhancing oversight of auditor rating frameworks to improve transparency and reduce audit costs.

Future studies could explore these dynamics in non-listed firms, other emerging markets, or different industries. Utilizing advanced econometric techniques such as dynamic panel models or multilevel regression could provide deeper insights into the audit pricing mechanism and improve the generalizability of the findings. Additionally, sensitivity analyses of nonsignificant control variables (e.g., ROA and TANGIB) could further refine our understanding of the determinants of audit fees.

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IJAAF; Vol. 10, No. 1, Winter 2026, Serial 34

Ferdowsi University of Mashhad

Iranian Journal of
Accounting, Auditing & Finance

Quarterly

RESEARCH ARTICLE

Identifying the drivers of asset quality review in Iranian banks

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How to cite this article:
Mehrabanpour, M. , Dana, M. M. and Botshekan, D. H. (2026). Identifying the drivers of asset quality review in Iranian banks. Iranian Journal of Accounting, Auditing and Finance, 10(1), 187-207. doi: 10.22067/ijaaf.2026.47478.1589
https://ijaaf.um.ac.ir/article_47478.html

ARTICLE INFO

Article History
Received: 2025-02-10
Accepted: 2025-09-12
Published online: 2026-02-01

Abstract

The purpose of this study was to examine a crucial issue in the Iranian banking industry: the assessment of asset quality. Previous studies have shown that a comprehensive model of asset quality review is still lacking. Only a few papers have systematically examined the factors affecting banks' asset quality. In addition, the key strategic drivers of Asset Quality Review (AQR) in Iranian banks were identify. A theoretical literature review, interviews with banking experts, fuzzy Delphi screening with 37 experts, and MICMAC software analysis of variable interrelationships were used. Findings revealed that the determinants of AQR fall into five categories: financial, credit, supervisory, macroeconomic, and institutional. In total, 53 sub-indicators were validated. Results showed that capital adequacy ratio, cost-to-income ratio, loan growth, non-performing loans, Collateral Valuation (CV), compliance, inflation and interest rates, as well as legal requirements and auditing, are the most significant strategic drivers in this domain.

Keywords:
Identification of drivers, Asset quality review in banks, Fuzzy Delphi approach, Futures studies

https://doi.org/10.22067/ijaaf.2026.47478.1589

CC BY

NUMBER OF REFERENCES
38

NUMBER OF FIGURES
7

NUMBER OF TABLES
9

Homepage: https://ijaaf.um.ac.ir
E-Issn: 2717-4131
P-Issn: 2588-6142

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1. Introduction

One of the prominent topics in accounting research is the examination of the quality of items that constitute financial statements (Dechow and Schrand, 2010). BS and IS have been consistently evaluated for quality, including in Iran, as the two primary financial statements. However, the degree of attention given to each is not balanced (Aminian, 2014). International studies show that IS goods have been assessed more for quality than BS items, particularly in terms of asset quality (Francis et al., 2004). This discrepancy is somewhat natural, as earnings are critical to decision-making by financial statement users. In Iran, the quality of BS items, especially assets, presents unique challenges, necessitating a focus on local, practical issues relevant to the economy and policymakers. Thus, Asset Quality Review (AQR) in Iranian banks, which are critical to the economy and often criticised, is crucial (Botshakan, 2018). Moreover, according to the World Bank (2025), conducting AQRs is essential for identifying banks suitable for restructuring and resolving structural weaknesses.

Efficiently mobilizing and allocating resources to promote sustainable economic growth is a basic role of every financial system (OECD, 2025). In 2025, the extra funds were channeled into productive investment through financial markets (365 Financial Analyst). Banks and capital markets primarily carry out this duty, and their actions have clear effects on the actual economy (Investopedia, 2025). The majority of Iran's financial transactions take place through banks because of the country's "bank-based system" (Aminian, 2014). The financial system is vital; understanding its state is essential. Laeven and Valencia (2013) and Peykani et al. (2025) found that AQRs have a crucial role in maintaining stable banks and avoiding crises. With sanctions limiting their access to external resources, Iran's banks must rely on their internal capabilities, making their resilience a matter of paramount importance. Problems with BS insolvency (the difference between assets and liabilities) and liquidity insolvency (the inability to meet withdrawal obligations) are also significant (Botshakan, 2018).

These flaws lead to a higher risk of credit losses, non-performing loans (NPLs), insolvency, insufficient cash, higher interbank rates, credit crunches, poor risk management, and insufficient capital. Some EU countries faced the same difficulties, but they fixed them by making fundamental changes that brought growth back. International experiences, such as the Comprehensive Assessment (CA) conducted by European central banks, provide Iran with useful insights (Zantheir and Kajiesfahani, 2018). CA means that central banks must carefully assess banks' financial health, ensure they are transparent about their finances, and ensure they have sufficient buffers against shocks. In Iran, stress testing is under-researched, so it mostly combines AQR and AQR (Botshakan, 2018).

According to a review of prior studies, AQR has received partial attention in the banking industry (Moore, 2019; Vo, 2018; Oberholzer, 2013; Swamy, 2017; Muneer et al., 2017; Ghaemi-Asl and Ghasemi-Nik, 2019; Shahcheraghi and Abolfathi, 2016; Seyed Shokri and Grossi, 2015; Aziznejad et al., 2019). However, a comprehensive model is lacking.

This work fills a crucial gap by creating a clear, evidence-based model that draws on theory, prior research, and expert opinions to identify the dimensions, components, and key indicators of AQR in Iranian banks and assess their relative relevance. The study’s innovative contribution lies in its multidimensional approach, applying **Fuzzy Delphi (FD)** and futures studies to refine indicators and enhance scientific validity. To enhance the efficiency and security of Iran's financial sector, this framework promotes research on AQR and supports strategic decisions with evidence.

2. Theoretical foundations and literature review

2.1. Bank asset quality

Given the pivotal role of banks as one of the most important pillars of the financial and economic system, analyzing the nature of the monetary transmission mechanism in any economy is

incomplete without considering their role. According to Farzinvash and Heydari (2011), the 2008 financial crisis in Europe and the US demonstrated that a handful of large banks can trigger a worldwide recession.

Research shows that international banking has a long tradition of assessing banks' performance, complete with dedicated organizations and widely used methods. The CAMELS Rating System and the EAGLES Rating System are two methods that use a variety of factors to assess the stability and soundness of banks (Ghasempour et al., 2016).

One of the most important supervisory and regulatory frameworks for assessing financial institutions is the evaluation of five key characteristics, known as the CAMELS indicators (Shams Abadi and Karimkhani, 2011). The U.S. National Credit Union Administration introduced the CAMELS rating system in October 1987. It was introduced in October 1987 by the U.S. National Credit Union Administration (Seraj And Taheri, 2012).

Since daily decision-making on deposit fund allocation directly affects credit risk, the likelihood of default, and potential write-offs, it is among the most crucial banking processes. Banks can evaluate this facet of performance through asset quality, which is part of the CAMELS rating system.

The most important component of CAMELS is asset quality, which reflects the efficiency of bank management and directly impacts capital adequacy, income, and liquidity. To improve this indicator, banks must rely on stable and liquid assets in their portfolios and allocate adequate reserves to offset potential devaluations.

Since most of a bank's assets are loans, the quality of those assets is usually the same as the quality of those loans. This is usually done by identifying NPLs and determining what percentage of the entire portfolio they represent. Asset quality worsens as NPLs increase and recovery prospects decline. Currently, Iran's bank loans are categorized into four categories based on repayment delays: current, past due, doubtful, and non-performing.

2.1.1. Factors affecting bank asset quality

Research shows that factors influencing bank asset quality can be divided into two main groups: **internal (non-systematic)** and **external (systematic).** Internal factors are controllable and related to the bank's own policies and operations, while external factors are beyond the bank's control and depend on a country's macroeconomic, political, and structural conditions.

2.1.1.1. Internal factors

Banks' internal rules and practices constitute the internal factors that affect asset quality.

- Weaknesses in assessing borrowers' creditworthiness and repayment capacity;
- Lack of skilled professionals to obtain and verify client information;
- Insufficient expertise and training of credit officers;
- Absence of a comprehensive credit information and centralized rating system;
- Reliance on outdated, traditional methods in loan appraisal and granting;
- Poor alignment of collateral with the borrower's credit capacity (quality of assets backing loans);
- Neglect of supervisory directives and non-compliance with banking regulations;
- Frequent managerial changes in bank branches (Shahcheraghi and Abolfathi, 2016).

Additionally, **bank-specific variables** significantly influence asset quality. These include bank size, structure of the banking market, lending interest rates, capital-to-assets ratio, deposits-to-assets ratio, loans-to-assets ratio, growth of total loans, and the share of joint revenues in total income.

2.1.1.2. External factors

The theoretical foundations suggest that macroeconomic variables, such as unemployment, inflation, GDP growth, market interest rates, and sanctions, play a significant role in shaping asset quality. (Mirzaei et al., 2016) Policy-related variables include changes in monetary and fiscal policy, regulatory reforms, and trade policy changes.

2.2. Empirical background

Numerous studies have been conducted on the quality of assets, NPLs, and banking system stability, which can be examined at both national and international levels. These studies identify a set of internal and external factors that significantly influence asset quality and bank performance.

In Iran, Seyed Shokri and Grossi (2015) showed that the growth of gross domestic product is associated with a decrease in the ratio of NPLs, while inflation has a negative effect on asset quality. Additionally, Shahcheraghi and Abolfathi (2016) examined internal and macroeconomic factors, such as the capital-to-asset ratio, return on assets, and loan growth, and found that they were strongly related to asset quality.

In the same vein, Hassas-Yeganeh et al. (2017) found that banks' financial distress is directly correlated with an increase in the ratio of nonperforming loans. Safarzadeh and Jafarimanesh (2019) demonstrated that the Central Bank of Iran's reserve model is not fully effective in managing banking risk and that forward-looking models can improve banking system stability. In a similar vein, Ghaemi-Asl and Ghasemi-Nik (2019) identified low-quality reserves as an important factor in the persistence of non-performing loans.

Pourkazemi et al. (2017) used neural networks to predict consumer default, and Kordmanjiri et al. (2020) used machine learning techniques to identify 10 significant determinants of banks' NPLs. These findings emphasize the importance of leveraging advanced analytical tools to improve asset quality.

At the international level, Laeven and Valencia (2013) concluded that larger banks are associated with higher systemic risk, whereas greater capitalization can mitigate this risk. Muneer et al. (2017) and Swamy (2017) showed that macroeconomic variables, such as GDP growth and exchange rates, directly affect asset quality, while inflation and operational costs negatively affect it.

Buch et al. (2017) highlighted that international banking policies can significantly influence asset quality and financial stability in other countries. In this context, Kozińska (2018) examined the effectiveness of tools such as “bad banks” and temporary banks for restructuring financial institutions, identifying bad banks as the most effective tool during banking crises. In addition to macroeconomic conditions, Vo (2018) noted that lending practices and collateral policies can play an important role in the emergence or prevention of banking crises.

In addition, the International Monetary Fund (2018) noted in its report that any structural reform in the banking system must include the immediate implementation of AQR programs by independent auditors. Abdul-Gafoor et al. (2018) showed that board members' independence and financial knowledge are associated with higher asset quality in corporate governance. Levels and Capel (2012) and Oberholzer (2013) also found that bank size, the types of assets it holds, the unemployment rate, and GDP growth are important factors affecting the quality of its assets.

In more recent studies, Moore (2019) confirmed the direct effect of asset quality on the profitability of bank branches. Finally, Kim et al. (2023) found, in their study of emerging markets, that in addition to macroeconomic conditions, factors such as bank size and capital structure play a crucial role in determining asset quality.

Overall, these studies indicate that bank asset quality is shaped by the interaction of

macroeconomic factors (inflation, economic growth, exchange rates, and unemployment) and bank institutional characteristics (size, capital structure, asset composition, and management quality). Additionally, neural networks and machine learning algorithms can play an important role in predicting default risk and improving asset quality.

2.3. Conceptual model of the research

Based on a review of the theoretical and empirical literature, the most important and frequently mentioned dimensions, variables, and factors influencing the AQR of banks were identified and categorized. The proposed conceptual model was refined and validated through an initial screening process using expert opinions and the **FD technique**.

As a result, the factors affecting banks' AQRs were classified into five main dimensions: **financial, credit (lending), supervisory, macroeconomic, and legal-institutional**. Sub-dimensions exist within each of these five main dimensions.

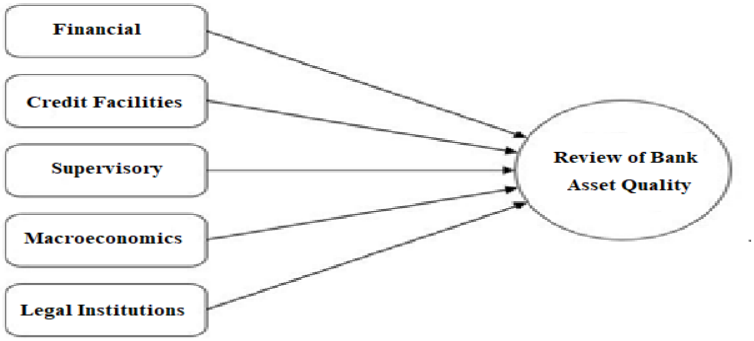


Figure 1. Conceptual model of the research

Figure 1 illustrates the conceptual model of this research. In addition, all indicators extracted from the theoretical foundations and expert interviews for each of the five independent variables in the conceptual model are presented and described in the table below. It is important to note that, according to this conceptual framework, the factors affecting banks' AQRs are categorized into the five key dimensions outlined above. The sub-dimensions that form these five main variables comprise **53 indicators in total**, all of which are presented in **Table 1**.

Table 1. Detailed conceptual model of the study: main and sub-dimensions affecting AQR of Banks

Main Dimension/Variable	Row	Indicator Code	Name of Sub-Indicator or Component
Financial	1	B1	Cost-to-income ratio
	2	B2	Bank size
	3	B3	Investment in shares of other companies
	4	B4	Receivables from the government sector
	5	B5	Deposit-to-capital ratio
	6	B6	Growth of bank stock value
	7	B7	Cost of maintaining the bank's fixed assets
	8	B8	Debt to the Central Bank
	9	B9	Bank's share of joint revenues to total bank revenues
	10	B10	Ratio of real estate to total assets
	11	B11	Capital adequacy ratio
Lending	12	T1	Growth in granted loans

	13	T2	Bank loan interest rate
	14	T3	Interbank loans
	15	T4	Loan-to-asset ratio
	16	T5	Non-performing loans
	17	T6	Directed loans to total loans
	18	T7	Non-performing loan ratio to total loans
	19	T8	Doubtful-to-collect loans
	20	T9	Re-installment and re-deferral of loans
	21	T10	Loan-to-deposit ratio
Supervisory	22	N1	Sufficient training for bank experts in risk management
	23	N2	Random audit by the bank's internal inspectors
	24	N3	Customer information review process
	25	N4	Valuation of collateral and guarantees obtained from the customer
	26	N5	Alignment of collateral and guarantees obtained from the customer with the amount of the granted loan
	27	N6	Recruitment and employment of expert personnel to obtain confidential customer information and verify information
	28	N7	Borrower creditworthiness and financial capability
	29	N8	Borrower's motivation for taking the loan
	30	N9	Periodic change of the bank’s branch credit manager
	31	N10	Post-loan supervision (supervision of loan usage)
	32	N11	Periodic change of the bank’s branch manager
	33	N12	Attention to issued circulars regarding loan granting
	34	N13	Having a comprehensive system for customer information and rating
Macroeconomic	35	E1	Financial crises
	36	E2	Issuance of high-interest participation papers and government treasury bills by the Central Bank
	37	E3	Difference between bank deposit interest rate and inflation rate
	38	E4	Recessionary conditions affecting businesses
	39	E5	Sanctions and severe exchange rate fluctuations
	40	E6	Volume of non-oil exports
	41	E7	Market interest rate
	42	E8	GDP growth rate
	43	E9	Unemployment rate
	44	E10	Inflation rate
Legal Institutions	45	G1	The role of the Securities and Exchange Organization in improving the transparency of bank financial statements
	46	G2	Drafting of executive guidelines by the Central Bank
	47	G3	Independent audit of bank financial statements by certified accountants
	48	G4	Amending the articles related to bankruptcy in the commercial law
	49	G5	Drafting a standard for loan loss provision by the Audit Organization
	50	G6	Establishment of a special court to handle non-performing loan cases above a certain amount
	51	G7	Mandatory submission of audited financial statements by corporate loan applicants by certified accountants
	52	G8	Drafting a standard for valuing bank assets by the Audit Organization
	53	G9	Central Bank’s supervision over the correct implementation of issued guidelines

3. Research Methodology

This study is a **descriptive survey** with an **applied-developmental** orientation. Data collection in the first phase was conducted through a **researcher-developed questionnaire** consisting of 53 items. The things were first looked at qualitatively and then given a number using triangular fuzzy numbers. The questionnaire was constructed utilizing the preliminary conceptual model, informed by theoretical and empirical literature with first expert insights. Following the screening and

validation of all 53 sub-dimensions, a following questionnaire of 50 items was created to evaluate the validated sub-dimensions affecting the AQR of banks, utilizing a five-point Likert scale, and was subsequently disseminated to experts.

Although the overall approach of this study is quantitative, **FD technique** a qualitative method was initially employed to screen the conceptual framework. The qualitative expert judgments were then quantified. The research process involved reviewing theoretical foundations and previous studies. Then, the preliminary conceptual model was extracted and proposed. Using the FD technique, the preliminary model was evaluated and screened. Finally, the conceptual model was identified and finalized. Using MICMAC software, the most critical strategic drivers were determined, and the overall fit of the model was assessed. Finally, the research report was prepared based on the significance of the dimensions and drivers affecting AQR.

Members of the statistical population were recruited from ten separate Tehran-based banks and were all considered specialists or experts in their respective fields of accounting, economics, and management. Experts were chosen from six different locations: one from each bank's headquarters and three from each of the five branches. We selected experts based on their willingness to participate, the availability of adequate time, and the approval of security offices and senior management. The sampling was purposeful and convenience-based.

The ten selected banks were: **Bank Melli, Bank Keshavarzi, Bank Sarmayeh, Bank Tejarat, Bank Mellat, Bank Saderat, Bank Refah, Bank Pasargad, Bank Parsian, and Bank Qarz-al-Hasaneh Resalat**.

For the **fifth step** of the research process (identification of key drivers), a sample of **210 willing experts** was selected, as detailed in **Table 5** of the findings section. Table 2 presents 37 experts from the banking sector and academia in relevant fields selected for the third step (implementation of FD technique). The discrepancy in sample size is due to the fact that the two methodological methods are different and have different needs.

Table 2. Characteristics of selected experts for FD technique

Row	Selected Experts	Education Level	Work Experience	Number (Persons)
1	Central Bank Managers	Master's degree or higher	More than 20 years	4
2	Bank Branch Supervisors' Managers	Master's degree or higher	More than 20 years	9
3	Bank Branch Managers and Deputies	Master's degree or higher	More than 20 years	16
4	University Professors and Professional Consultants (in the fields of Finance, Banking, Accounting, Economics, and Management)	Master's and Ph.D.	More than 15 years	8
Total Number of Selected Experts (Available) for FD Technique				37

In the findings and analysis part, alongside the problem-solving process, are detailed the procedures and methods of implementation of the methodologies utilized in this study, including the FD approach and the identification of key drivers.

To enhance methodological transparency, additional clarification regarding expert selection and data collection procedures is provided. Three factors were used to pick the experts: (1) their willingness to engage in several Delphi rounds; (2) their expertise with asset quality assessment and regulatory frameworks; and (3) the length of time they had worked in banking, finance, or academia. Of the 45 experts who were first contacted, 37 gave valid responses, which means that about 82% of them responded. In order to reduce the possibility of bias, we made sure to include

participants from a variety of public, private, and specialized banks, as well as from diverse functional areas and managerial levels. Moreover, anonymity was maintained throughout the Delphi rounds to prevent dominance bias, and consensus reliability was assessed by examining the stability of defuzzified mean values between successive rounds ($\Delta \leq 0.2$), confirming an acceptable level of agreement among experts.

The expert group was purposefully crafted to incorporate academics with countrywide viewpoints, professionals from both public and private banks, and others to address concerns about representation. Many respondents had advisory or supervisory responsibilities that extended beyond multiple provinces and regional branches, even though most of them were situated in Tehran owing to accessibility and institutional limitations. That way, the views represented the varied operating realities of Iran's banking system as a whole, not just those in Tehran. However, we do recognize this as a contextual restriction; it points the way toward future research that can expand the analysis to include worldwide and regional banking settings.

4. Findings and analysis

In this section, the conceptual model derived from the literature review and expert interviews is first **screened through FD method** based on expert opinions. Following this stage, which ultimately leads to the **final conceptual model of the study**, a questionnaire was designed, and the dimensions and variables of the conceptual model were subsequently assessed and validated by identifying the **key drivers** using **MICMAC software**.

4.1. Implementation of FD process with multiple rounds

The iterative procedure that FD method takes requires a certain amount of time to reach a saturation point and expert consensus. After converting the qualitative or linguistic assessments of the expert panel into triangular fuzzy numbers (L, M, U) as presented in Table 3 the fuzzy averages for each indicator were calculated. There are other ways to find these averages, and some research use the simple arithmetic mean.

In this study, the linguistic terms used by experts and their corresponding quantitative and fuzzy equivalents are first presented in Table 3.

Here is the English translation of the table you provided:

Table 3. Linguistic variables for survey and their corresponding quantitative and Fuzzy equivalents (Sevkli et al., 2012)

Linguistic Variable	Fuzzy Equivalent with Triangular Numbers
Extremely Low	(1, 2, 3)
Very Low	(2, 3, 4)
Low	(3, 4, 5)
Medium	(4, 5, 6)
High	(5, 6, 7)
Very High	(6, 7, 8)
Extremely High	(7, 8, 9)

For calculating the average opinions of experts and the corresponding triangular fuzzy numbers, various approaches and formulas have been proposed. In this study, one of the most reliable and widely used methods—namely, the geometric mean of each element—was applied to evaluate the indicators (j=1,2,…,mj = 1,2,…,mj=1,2,…,m) based on expert judgments (i=1,2,…,ni = 1,2,…,ni=1,2,…,n). Accordingly, the fuzzy mean for each indicator (Lj,Mj,Uj)(L_j, M_j, U_j)(Lj ,Mj,Uj) is expressed as follows:

Equation (1)

$$\widetilde{a_{ij}} = \left(L_{ij}, M_{ij}, U_{ij}\right), i = 1,2, \dots, n, j = 1,2, \dots, m$$

Equation (2)

$$L_j = (\prod_{i=1}^{n} L_{ij})^{\frac{1}{n}}$$

Equation (3)

$$M_j = (\prod_{i=1}^{n} M_{ij})^{\frac{1}{n}}$$

Equation (4)

$$U_j = (\prod_{i=1}^{n} U_{ij})^{\frac{1}{n}}$$

In the next step, using the defuzzification method below, the crisp value (A) of each indicator is calculated. If the crisp or defuzzified value (A)(A)(A) is greater than 7, the indicator is accepted and validated; otherwise, if the defuzzified value (A)(A)(A) is **less** than **7**, the indicator is rejected and excluded from the list (Wu and Fang, 2011).

Equation (5)

$$A_j = \frac{L_j + 4M_j + U_j}{6}$$

In general, one approach to determining the termination of the Delphi process is to compare the mean or defuzzified values of the indicators between the first and second rounds. The process is considered saturated if the difference between the two rounds is less than the very small threshold of 0.2. Otherwise, a third round is conducted (Babajani et al., 2019).

The results of these computations are presented in Table 4.

Table 4. Results from implementing FD process in two different rounds

Indicator	Round 1			Round 2			Difference
	Fuzzy Mean	Defuzzified Value	Result	Fuzzy Mean	Defuzzified Value	Result	
1	(6.10, 7.20, 9.30)	7.37	Accepted	(5.30, 7.80, 8.80)	7.55	Accepted	0.18
2	(5.30, 7.80, 9.50)	7.67	Accepted	(6.70, 7.30, 9.60)	7.58	Accepted	0.09
3	(5.30, 7.00, 8.90)	7.03	Accepted	(5.40, 7.20, 9.13)	7.22	Accepted	0.19
4	(5.50, 8.00, 9.50)	7.83	Accepted	(5.60, 7.90, 8.81)	7.67	Accepted	0.16
5	(5.30, 7.10, 9.50)	7.20	Accepted	(5.30, 7.80, 8.80)	7.13	Accepted	0.07
6	(5.60, 7.30, 9.10)	7.32	Accepted	(5.60, 7.30, 9.40)	7.37	Accepted	0.05
7	(4.30, 5.90, 7.80)	7.95	Accepted	(5.30, 7.80, 8.80)	7.23	Accepted	0.18
8	(5.80, 8.30, 9.70)	8.12	Accepted	(6.01, 8.40, 9.50)	8.19	Accepted	0.07
9	(5.40, 7.00, 8.80)	7.03	Accepted	(5.90, 7.10, 8.40)	7.12	Accepted	0.09

10	(5.30, 5.50, 7.60)	7.82	Accepted	(5.43, 7.08, 9.60)	7.02	Accepted	0.14
11	(5.60, 8.09, 9.40)	7.89	Accepted	(5.40, 7.90, 9.30)	7.72	Accepted	0.17
12	(5.20, 7.09, 9.10)	7.11	Accepted	(6.50, 6.78, 8.97)	7.10	Accepted	0.01
13	(5.00, 7.50, 9.40)	7.40	Accepted	(6.10, 7.50, 8.80)	7.48	Accepted	0.08
14	(4.80, 6.99, 9.40)	7.03	Accepted	(5.40, 7.08, 9.60)	7.22	Accepted	0.19
15	(6.70, 7.08, 9.20)	7.37	Accepted	(5.09, 7.50, 9.20)	7.38	Accepted	0.01
16	(6.30, 7.60, 9.30)	7.67	Accepted	(6.90, 7.60, 8.20)	7.58	Accepted	0.09
17	(4.80, 7.30, 9.40)	7.23	Accepted	(5.20, 7.50, 9.00)	7.37	Accepted	0.14
18	(5.00, 7.50, 9.40)	7.40	Accepted	(5.80, 7.08, 9.60)	7.29	Accepted	0.11
19	(5.60, 8.10, 9.40)	7.90	Accepted	(5.60, 8.10, 9.21)	7.87	Accepted	0.03
20	(5.40, 7.80, 910)	7.62	Accepted	(6.30, 7.30, 9.10)	7.43	Accepted	0.19
21	(5.60, 7.08, 8.50)	7.07	Accepted	(5.40, 7.17, 8.89)	7.16	Accepted	0.09
22	(6.40, 7.00, 8.30)	7.12	Accepted	(5.91, 7.11, 9.50)	7.31	Accepted	0.19
23	(5.13, 6.99, 9.10)	7.03	Accepted	(5.60, 7.08, 8.76)	7.11	Accepted	0.08
24	(5.80, 7.10, 8.81)	7.17	Accepted	(5.55, 7.11, 8.90)	7.14	Accepted	0.03
25	(6.30, 8.09, 9.10)	7.96	Accepted	(6.70, 8.09, 9.75)	8.14	Accepted	0.18
26	(5.90, 7.81, 9.80)	7.82	Accepted	(5.40, 8.16, 9.30)	7.89	Accepted	0.07
27	(5.50, 6.68, 9.40)	7.06	Accepted	(4.60, 7.40, 8.91)	7.19	Accepted	0.13
28	(5.90, 7.43, 9.71)	7.56	Accepted	(5.08, 7.40, 9.30)	7.45	Accepted	0.11
29	(5.20, 7.61, 8.88)	7.42	Accepted	(6.00, 7.21, 9.31)	7.36	Accepted	0.06
30	(5.14, 7.01, 8.90)	7.01	Accepted	(5.01, 7.09, 9.01)	7.06	Accepted	0.05
31	(6.01, 7.86, 8.90)	7.73	Accepted	(5.98, 7.74, 8.61)	7.59	Accepted	0.14
32	(5.30, 6.87, 9.40)	7.03	Accepted	(4.60, 7.19, 8.99)	7.06	Accepted	0.03
33	(5.12, 7.17, 8.80)	7.10	Accepted	(6.01, 8.60, 9.70)	7.23	Accepted	0.13
34	(6.30, 8.80, 9.70)	8.53	Accepted	(6.20, 8.60, 9.70)	8.38	Accepted	0.15
35	(5.50, 6.90, 9.40)	7.08	Accepted	(6.14, 7.01, 8.98)	7.20	Accepted	0.12
36	(4.80, 7.30, 9.40)	7.23	Accepted	(5.30, 6.90, 9.39)	7.05	Accepted	0.18
37	(5.60, 7.20, 8.98)	7.23	Accepted	(5.10, 7.30, 9.20)	7.25	Accepted	0.02
38	(5.50, 7.89, 9.50)	7.76	Accepted	(5.10, 8.15, 9.10)	7.80	Accepted	0.04

39	(5.30, 8.30, 9.80)	8.05	Accepted	(6.10, 8.40, 9.70)	8.23	Accepted	0.18
40	(5.20, 7.09, 8.97)	7.09	Accepted	(5.20, 6.10, 8.20)	7.30	Accepted	0.19
41	(5.10, 7.05, 9.50)	7.13	Accepted	(4.90, 7.40, 8.90)	7.23	Accepted	0.10
42	(6.10, 8.60, 9.80)	8.38	Accepted	(5.80, 8.40, 9.80)	8.20	Accepted	0.18
43	(6.89, 7.08, 9.12)	7.39	Accepted	(5.60, 7.17, 9.30)	7.26	Accepted	0.13
44	(5.50, 7.23, 9.50)	7.32	Accepted	(4.60, 7.64, 8.90)	7.34	Accepted	0.02
45	(5.00, 7.50, 9.70)	7.45	Accepted	(6.19, 7.23, 8.98)	7.35	Accepted	0.10
46	(6.30, 7.98, 9.20)	7.90	Accepted	(4.90, 8.04, 9.60)	7.78	Accepted	0.12
47	(5.30, 7.10, 9.00)	7.12	Accepted	(5.10, 7.20, 9.30)	7.20	Accepted	0.08
48	(6.10, 6.80, 8.98)	7.05	Accepted	(6.60, 7.01, 8.78)	7.24	Accepted	0.19
49	(4.20, 7.30, 9.50)	7.15	Accepted	(5.60, 6.90, 8.90)	7.02	Accepted	0.13
50	(5.80, 6.90, 8.70)	7.02	Accepted	(5.60, 7.03, 8.91)	7.11	Accepted	0.09
51	(4.90, 7.40, 9.20)	7.28	Accepted	(5.20, 7.80, 8.40)	7.47	Accepted	0.19
52	(4.80, 7.30, 9.10)	7.18	Accepted	(4.80, 7.30, 8.08)	7.13	Accepted	0.06
53	(4.80, 8.30, 9.40)	7.90	Accepted	(6.01, 7.80, 9.06)	7.72	Accepted	0.18

Based on the results presented in the above table, among the 53 indicators, all were validated across the two rounds of FD process. In the second stage, using the expert-based questionnaire data, the **key drivers influencing** AQR **in Iranian banks** were identified. For this purpose, the **MICMAC software** was employed. In what follows, the dimensions are elaborated in detail.

4.2. Key drivers governing AQR in Iranian banks

4.2.1. Analysis of key drivers in financial indicators

Figure 2 shows that the factors “Capital Adequacy Ratio (B11),” “Deposits-to-Capital Ratio (B5),” and “Cost-to-Income Ratio (B1)” had the highest column values, indicating the greatest influence over other variables. These factors are categorized as input (primary) variables**.**

In other words, the most important feature of these variables is their low susceptibility to external influence combined with their high level of influence on other factors**.** This finding suggests that these variables play a crucial role in shaping and determining AQR processes within the financial dimension. Consequently, changes in these indicators can exert broad and significant impacts on other related factors. Therefore, special attention to the management and optimization of these indicators is essential for improving the soundness and sustainability of the banking system.

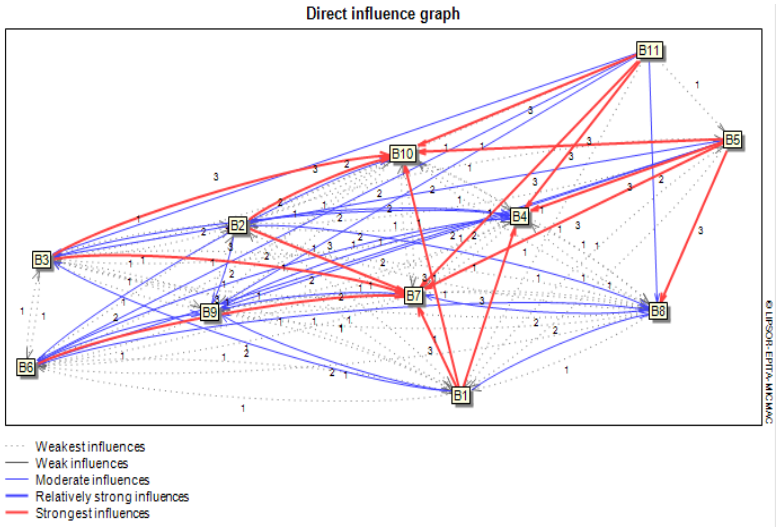


Figure 2. Map of direct relationships between variables (very weak to very strong effects)

Table 5. Net influence of financial drivers on AQR of Iranian banks

N°	Variable	Row Sum	Column Sum	Net Influence
1	B1	18	7	11+
2	B2	15	9	6+
3	B3	13	13	0
4	B4	7	20	13-
5	B5	20	3	17+
6	B6	14	11	3+
7	B7	6	24	18-
8	B8	9	16	7-
9	B9	10	15	5-
10	B10	7	21	14-
11	B11	20	0	20+
	Totals	139	139	-

4.2.2. Analysis of credit-related drivers in the review of asset quality in Iranian banks

The most important driving forces can be summarized as follows, according to the data in Figure 3. Out of the ten variables that were looked at for the credit dimension, "Growth of Granted Facilities (T1)," "NPLs (T5)," and "Loan-to-Asset Ratio (T4)" had the highest column values and the most significant effect on the other variables. These three variables are therefore considered main (input) variables.

This finding highlights the particular importance of these variables as decisive and key factors in managing and controlling the quality of banks' assets. Asset quality can be strengthened or undermined by changes in these indicators and can influence other related dimensions. Therefore, focusing on the optimization of these variables appears essential for enhancing the financial health of banks.

4.2.3. Analysis of supervisory drivers

According to Figure 4, the three main (input) variables that had the biggest impact on other variables were "Valuation of collaterals and guarantees obtained from customers (N4)," "Alignment of collaterals and guarantees with the amount of granted facilities (N5)," and "Eligibility and financial capability of loan applicants (N7)."

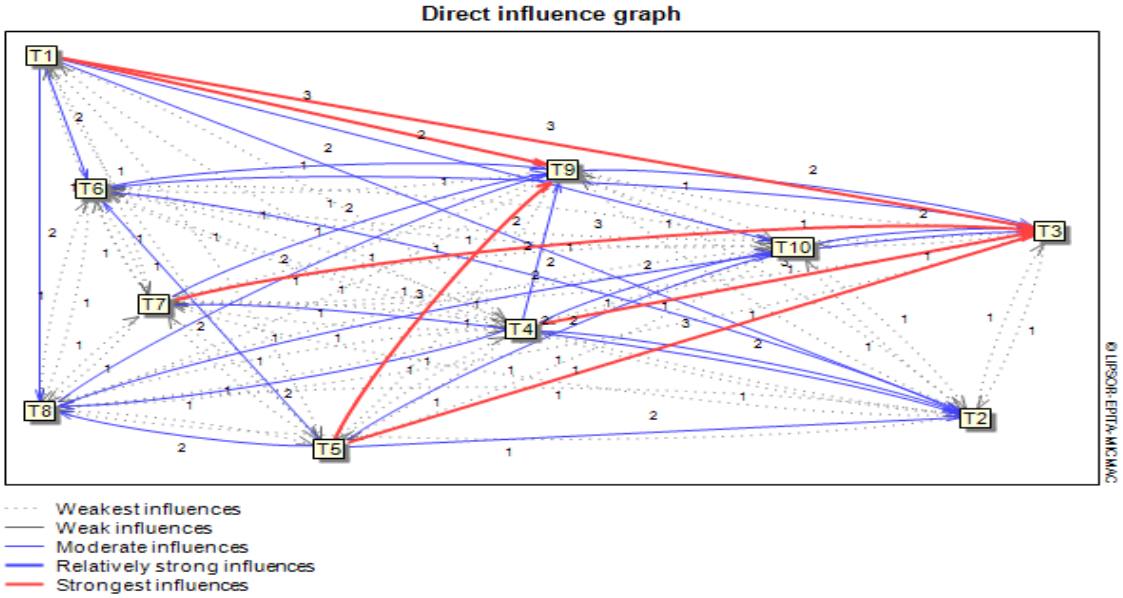


Figure 3. Map of direct relationships between variables (very weak to very strong effects)

Table 6. Net influence of lending drivers on AQR of Iranian banks [1]

N°	Variable	Row Sum	Column Sum	Net Influence
1	T1	17	3	14+
2	T2	7	14	7-
3	T3	6	21	15-
4	T4	15	7	8+
5	T5	17	6	11+
6	T6	10	11	1-
7	T7	13	9	4+
8	T8	10	12	2-
9	T9	8	17	9+
10	T10	9	12	3-
	Totals	112	112	-

In other words, the most significant characteristic of these variables is their low susceptibility to influence while exerting a strong impact on others. This underscores the pivotal and decisive role of these factors in ensuring the soundness of the lending process and in controlling banks' credit risk. A thorough and accurate review of collaterals and guarantees, as well as a thorough evaluation of applicants' financial abilities, can greatly increase the quality of assets and lower the risks that come with giving out loans.

4.2.4. Analysis of macroeconomic drivers affecting AQR in Iranian banks

"Market interest rate (E7)," "inflation rate (E10)," and "the difference between bank deposit interest rate and inflation rate (E3)" are the three input variables that have the highest calculated column values and the greatest influence on other variables, according to Figure 5's results and the ten variables examined in the dimension of macroeconomic drivers. This highlights the significant importance of macroeconomic variables in determining the quality of banking assets, such that changes in the market interest rate, inflation rate, and the gap between deposit interest rates and inflation play a crucial role in shaping financial risks and the performance of banks. Proper management of these factors can greatly contribute to maintaining the stability and soundness of the banking system.

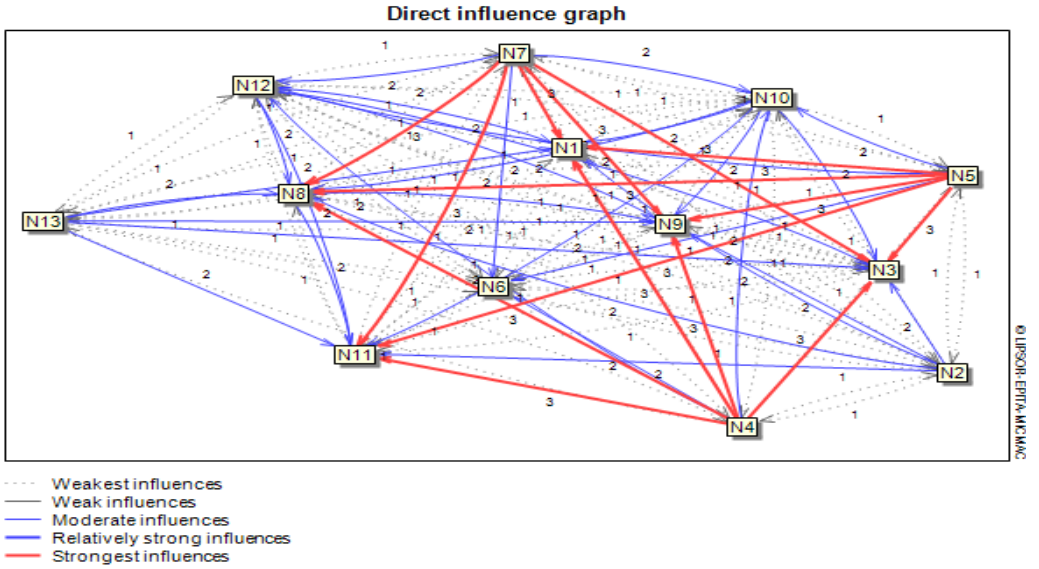


Figure 4. Map of direct relationships between variables (very weak to very strong effects)

Table 7. Net influence of supervisory drivers on AQR of Iranian banks

N°	Variable	Row Sum	Column Sum	Net Influence
1	N1	7	20	13-
2	N2	16	7	9+
3	N3	7	22	15-
4	N4	25	4	19+
5	N5	23	6	17+
6	N6	6	15	9-
7	N7	24	7	17+
8	N8	11	21	10-
9	N9	7	21	14-
10	N10	16	14	2+
11	N11	7	23	16-
12	N12	15	15	0
13	N13	17	6	11+
	Totals	181	181	-

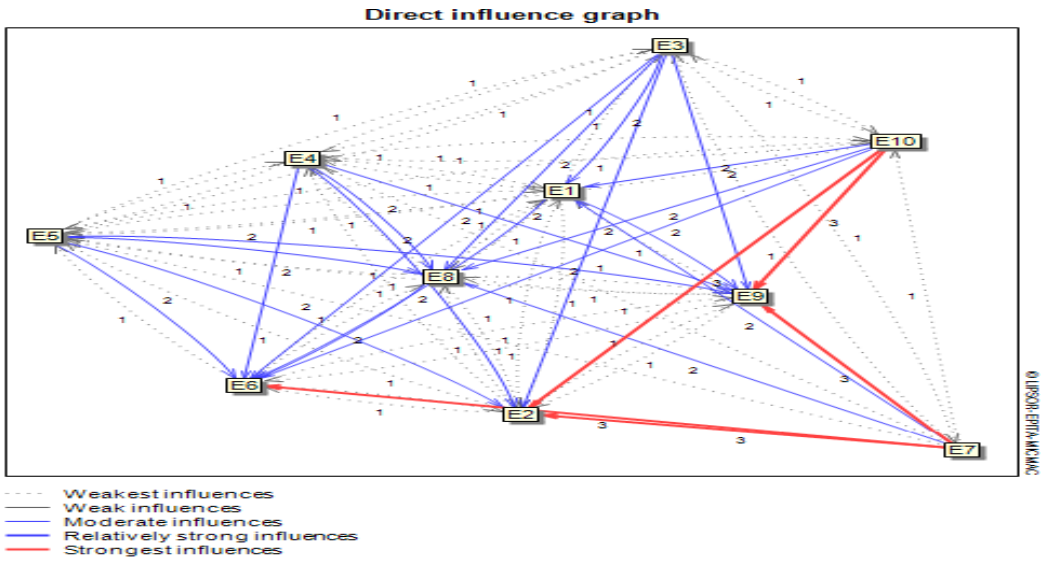


Figure 5. Map of direct relationships between variables (very weak to very strong effects)

Table . Net influence of macroeconomic drivers on AQR of Iranian banks

N°	Variable	Row Sum	Column Sum	Net Influence
1	E1	9	12	3-
2	E2	6	16	10-
3	E3	14	5	9+
4	E4	12	7	5+
5	E5	12	9	3+
6	E6	5	17	12-
7	E7	17	1	16+
8	E8	7	14	7-
9	E9	5	17	12-
10	E10	15	4	11+
	Totals	102	102	-

4.2.5. Analysis of regulatory institutional drivers affecting AQR in Iranian banks

Figure 6 shows the results of the study into the ten variables that affect AQR in Iranian banks. The factors that have the highest calculated column values and the most significant effects on other variables are "independent auditing of banks' financial statements by certified public accountants (G3)," "the requirement for legal entities applying for loans to submit audited financial statements by certified public accountants (G7)," and "the role of the Securities and Exchange Organization in enhancing the transparency of banks' financial statements (G1)." These are therefore called "key" variables. Therefore, they are considered input (key) variables. This shows how important legal oversight and financial transparency are for improving the quality of banks' assets. Independent audits, requiring the submission of audited financial statements, and the Securities and Exchange Organization's effective role in promoting transparency are all key parts of keeping the banking system safe and building trust among investors and other stakeholders.

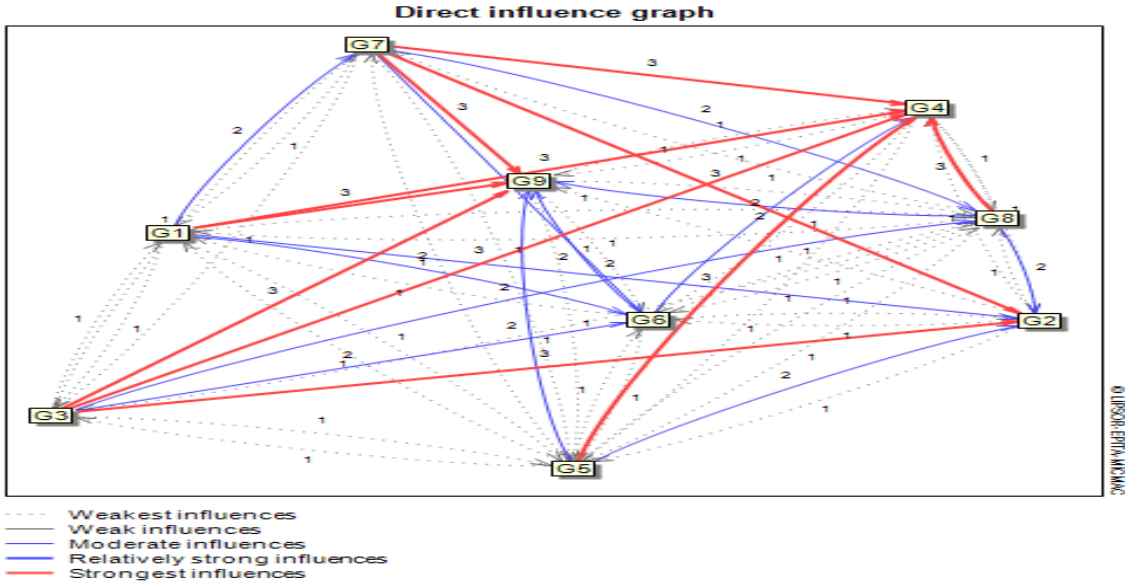


Figure 6. Map of direct relationships between variables (very weak to very strong effects).

5. Conclusion, limitations, and future research

As previously stated, the main objective of this study was to identify the key drivers for reviewing asset quality in Iranian banks and to define the critical factors influencing this model. Interviews with banking industry professionals and academic banking specialists, along with a

survey of the theoretical literature (books, journals, etc.), formed the basis of this research's initial conceptual model. This model comprised 53 indicators or components affecting the quality of banking assets, which were categorized into five independent groups. A review of banks' asset quality at the national level is influenced by these five groups. The five main variables are: (1) Financial, (2) Credit Facilities, (3) Supervision, (4) Macroeconomic, and (5) Regulatory Institutions.

Table 9. Net influence of legal institutions drivers on AQR of Iranian banks

N°	Variable	Row Sum	Column Sum	Net Influence
1	G1	15	5	10+
2	G2	5	14	9-
3	G3	16	4	12+
4	G4	5	19	14-
5	G5	12	8	4+
6	G6	8	11	3-
7	G7	16	5	11+
8	G8	12	10	2+
9	G9	4	17	13-
	Totals	93	93	-

In the next step, the 53 indicators affecting banking asset quality were evaluated and screened. To this end, the researchers applied the Delphi technique in a qualitative approach, seeking the opinions of experts. Subsequently, by employing a fuzzy approach with triangular numbers, the experts' views were quantified. We were able to reach theoretical saturation and unanimity after two rounds of participation from 37 available and interested experts. This part of the research confirmed that all 53 parameters were important in determining the national review of banks' asset quality.

In the next stage, after finalizing and refining the research model with expert input, a researcher-developed questionnaire was designed and distributed among a purposive accessible sample in order to collect the necessary data for conducting structural equation modeling. This process utilized software tools such as MICMAC to assess the overall fit of the conceptual model and to evaluate both the main and sub-indicators. The key objective of this phase was to determine whether the proposed model could adequately explain the factors influencing the review of banks' asset quality across the country, and whether it could fulfill the aims of both researchers and practitioners. This is why, prior to determining how well the models fit together, we officially and content-wise evaluated the research instruments' validity and reliability using expert opinions and software. The results, as reported in the preceding section, confirmed that the instruments possessed a high degree of validity and reliability, making the findings trustworthy.

Finally, the key drivers were identified through various indicators, showing that the five main variables affecting the review of banks' asset quality do not carry equal weight in terms of priority, importance, and impact. The order of priority and influence of these main variables in the review of banks' asset quality is as follows: (1) Supervisory factors, (2) Regulatory institutional factors, (3) Macroeconomic factors, (4) Credit facilities factors, and (5) Financial factors. This significant result can be observed in the radar chart presented in Figure 7.

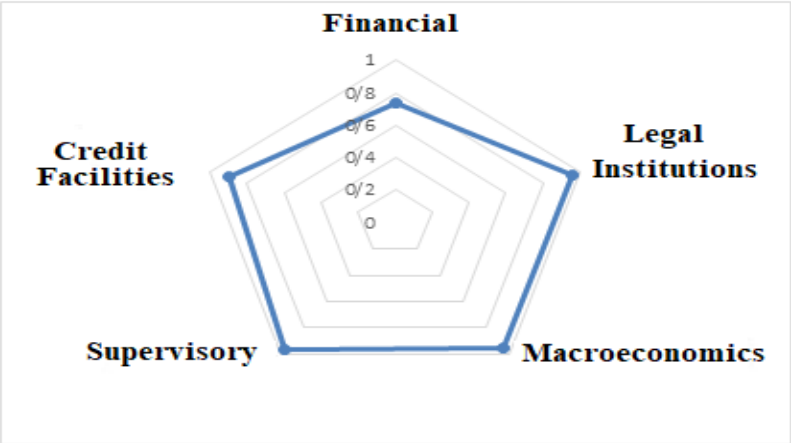


Figure 7. Prioritization of key variables affecting the review of bank asset quality from the perspective of path coefficients

If only one of the most important things that affects the examination of banks' asset quality at the national level had to be chosen, it would be the "supervisory" element. Based on its sub-indicators, it is important to focus on things like training staff in risk management, doing random internal audits, checking customer information, making sure that the CV is correct, making sure that the collateral matches the facilities that were given, hiring specialists to check customer data, checking the creditworthiness of applicants, checking the motivation of borrowers, periodically rotating credit and branch managers, monitoring after the loan is given, following loan-related rules, and setting up a complete customer information and credit rating system. Strengthening these indicators is vital for enhancing asset quality in the banking system.

The findings further showed that:

- In the financial dimension, the key indicators were “capital adequacy ratio (B11),” “deposit-to-capital ratio (B5),” and “cost-to-income ratio (B1).”
- In credit facilities, the most significant were “growth of facilities (T1),” “NPLs (T5),” and “loans-to-assets ratio (T4).”
- In supervisory drivers, the most impactful were “valuation of collateral (N4),” “alignment of collateral with facilities (N5),” and “creditworthiness of applicants (N7).”
- In macroeconomic drivers, the crucial ones were “market interest rate (E7),” “inflation (E10),” and “interest rate–inflation gap (E3).”
- In the regulatory dimension, the critical indicators were “independent auditing of financial statements (G3),” “submission of audited reports by legal entities (G7),” and “the role of the Securities and Exchange Organization in transparency (G1).”

Overall, the study aligns with works by Shahcheraghi and Abolfathi (2016), Hassas-Yeganeh et al. (2017), Swamy (2017), Levels and Capel (2012), Oberholzer (2013). Its novelty lies in the comprehensive set of variables and the two-stage qualitative–quantitative methodology, combining FD and structural equation modeling.

5.1. Research limitations

A major drawback of this study arises from its methodological emphasis: The research emphasized structural identification and qualitative modeling informed by expert consensus, utilizing Fuzzy Delphi and MICMAC analysis. So, the model's validation depends a lot on how well

the experts on the panel agree with the theory. We recognize that the lack of a thorough quantitative validation utilizing actual banking data, such as panel or time-series analysis, represents a constraint frequently encountered in preliminary structural modeling initiatives. The existing design does not have the resources or space to include such an empirical validation.

Future research could explore factors affecting AQR through qualitative methods, compare state-owned and private banks, apply multi-criteria decision-making for prioritization, employ machine learning for prediction, and examine the role of social and environmental sustainability factors in AQR. Given the limited studies on this subject in Iran, the validated model of this research can inform macro-level banking policies and serve as a reliable reference for future work.

It is essential that future studies use suitable econometric methods (such as GMM or Vector Autoregression) to test the experts' hypothesized causal relationships using real financial and macroeconomic time-series or panel data from Iranian banks. This will allow for a thorough quantitative validation of the identified structural model.

We also recognize that the present study utilizes a cross-sectional design centered on a certain time range. This method was used to make sure that collecting data from experts was possible and consistent. We do, however, fully understand how important it is to use dynamic modeling to show how asset quality changes over time, especially in light of Iran's changing economy. Consequently, forthcoming research ought to utilize longitudinal or time-series methodologies to track fluctuations in asset quality over time and evaluate the robustness of banks amongst diverse macroeconomic conditions.

Moreover, recent developments in the financial sector indicate that emerging technologies—such as financial technology (FinTech), artificial intelligence (AI), and digital banking—have begun to play a substantial role in determining the quality and performance of bank assets. These technologies can improve credit risk assessment, enhance real-time monitoring of loans, and reduce information asymmetry. Similarly, socio-environmental sustainability factors, including green lending policies and corporate social responsibility practices, are increasingly shaping asset quality in modern banking systems. Although these dimensions were not directly examined in the present model, they represent promising directions for extending the AQR framework in future research.

5.2. Practical implications

From a practical perspective, the findings of this study provide several actionable insights for policymakers and banking practitioners. Regulators like the Central Bank of Iran can use the major drivers that have been found to decide which areas of supervision to focus on first, notably those that have to do with CV, capital adequacy, and making sure that loans are in line with the borrower's ability to pay them back. Moreover, establishing an integrated information system for credit assessment and enhancing staff training in risk analysis can significantly strengthen the asset review process. Finally, adopting a periodic AQR framework—similar to international best practices—would enable Iranian banks to identify vulnerabilities early and improve overall financial resilience.

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IJAAF; Vol. 10, No. 1, Winter 2026, Serial 34

Iranian Journal of
Accounting, Auditing & Finance

Ferdowsi University of Mashhad

Quarterly

RESEARCH ARTICLE

The Impact of COVID-19 on the Credit Rating of Companies by Separate Industry

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How to cite this article:
Hosseini, S. A. and Mohammadi Khanghah, G. (2026). The Impact of COVID-19 on the Credit Rating of Companies by Separate Industry. Iranian Journal of Accounting, Auditing and Finance, 10(1), 209-218. doi: 10.22067/ijaaf.2026.47041.1455
https://ijaaf.um.ac.ir/article_47041.html

ARTICLE INFO

Article History
Received: 2025-03-19
Accepted: 2025-08-25
Published online: 2026-02-01

Abstract

Credit risk is an essential factor for attracting resources in a competitive business environment. This research investigated the impact of COVID-19 on companies' credit risk across industries to identify sectors that need government support and help improve the economic situation. This paper used 298 companies admitted to the Iranian capital market between 2019 and 2020. According to this research, credit ratings have increased in the automobile industry, parts, and essential metals. Given the increase in credit ratings in some industries, it can be concluded that other factors, such as inflation, the rise in the dollar, the withdrawal from the JCPOA, and economic variables, also affected credit ratings as COVID-19 spread.

Keywords:
Credit rating, credit risk,
COVID-19

https://doi.org/10.22067/ijaaf.2026.47041.1455

NUMBER OF REFERENCES
18

NUMBER OF FIGURES
-

NUMBER OF TABLES
4

Homepage: https://ijaaf.um.ac.ir
E-Issn: 2717-4131
P-Issn: 2588-6142

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1. Introduction

The business environment for companies is growing and very competitive. Accordingly, companies have to compete with various factors at the national and international levels and expand their operations through new investments to continue their activities. For this purpose, they need financial resources (Hosseinpour Bahabadi, 2014). Since creditors consider a company's credit rating when financing, companies are concerned about their credit rating. First, they may avoid a financial crisis by being unable to pay their principal and subsidiary debts. Secondly, lest the credit decisions of the managers today endanger the future financial flexibility of the company. The credit status of companies is essential to the companies themselves and other stakeholders (such as creditors, potential and actual investors, and lenders) (Mahmoudabadi and Ghiori Moghadam, 2019). Given the importance of credit risk from different perspectives, the effective factors should be identified. One of the factors was COVID-19, which had significant effects on credit risk (Yin et al., 2022).

Many recent studies have examined the economic impact of the COVID-19 pandemic across several aspects. According to Hao et al. (2022), credit risk significantly increased following the spread of the pandemic. Thus, the pandemic caused serious concerns about consumption consolidation, fiscal capacity, and export volatility. The COVID-19 pandemic led to economic crises and decreased investment in most areas, thereby affecting the economic growth rate (Shamshiri et al., 2019). The COVID-19 epidemic negatively affects various fields, such as the stock market (Xue et al, 2021), people's income, consumption, and, as a result, business income (Chetty et al., 2020), economic health, and credit risk (Baker et al., 2023).

In response to disease outbreaks, governments implemented strict preventive measures, such as restricting travel between cities and suspending business operations, which decreased economic growth. Consumption declined, supply chains were disrupted, and workers were in short supply (Xue et al., 2021).

The decline in consumption among non-essential categories, including restaurants, hotels, clothing, and department stores, was enormous, and the decline in essential categories was quite noticeable (Cox et al., 2020). The impact of COVID-19 was different in several industries. The essential life security, manufacturing, retail, and service sectors, and transportation were negatively affected by the epidemic. Services have suffered huge losses during the globalization outbreak as governments have suspended business operations and customers have reduced demand. Conversely, the demand for services such as healthcare information technology has increased (Xue et al., 2021).

Therefore, the purpose of this research is to investigate the impact of COVID-19 on the credit risk of companies across industries and identify sectors that need government support to improve the economic situation and industries.

2. Literature review

2.1 Theoretical review

Financing decisions have a prominent role in determining growth, investment, and production strategies. Access to low financing costs is one of the requirements of economic feasibility in development projects, and credit rating plays an essential role in financing. A credit rating is an independent assessment of a company's ability to pay its debts. Creditors are always looking for ways to ensure the company's ability to repay its debt (Vazifehdust et al., 2016). In light of the importance of credit ratings, this study investigates how COVID-19 has impacted investor uncertainty across industries.

The novel coronavirus emerged in Wuhan, China, in late December 2019, and then spread rapidly across China and other countries. According to the World Health Organization report, the

coronavirus emerged in early 2020, quickly spread into a global epidemic and caused severe economic contraction (Hao et al., 2022).

As a result, the Coronavirus crisis began, reduced investment in most areas, and changed economic growth rates (Shamshiri et al., 2019). Due to the shock of the pandemic, COVID-19 triggered a very different economic downturn than the 2008 financial crisis. A global pandemic can weaken a country's economic health and increase its credit risk, according to Baker et al. (2023). COVID-19 affects both short- and long-term credit risks of a firm, since a country's consumption usually recovers after a negative shock (Augustin, 2018).

2.2. Empirical review of related studies

Panahi et al. (2021) studied the prevalence of COVID-19 and its risk factors in two groups of industries, with and without occupational health management systems. The results indicated a significant difference between the values of occupational medicine parameters and the occupational health information management system, biological hazards risk management, employee training and participation, COVID-19 disease management, and disease prevalence between industries with and without occupational health management systems.

Osoolian and Koushki (2021) analyzed the risk in financial markets before the pandemic and during the COVID-19 period. The results of the research indicated that investing in a portfolio consisting of silver and gold, or silver and the total index, can be riskier during the epidemic period due to the increase in the level of correlation and mutual information between these pairs of markets. 2) Gold showed the lowest level of information deviation after the outbreak of the COVID-19 pandemic. Thus, the information perceived by gold investors did not affect their fear level during the pandemic. A safer investment portfolio can be created by investing in the S&P 500 and gold.

Shamshiri et al. (2019) investigated the risk of investment in research and development using the FMEA technique in light of the COVID-19 economic crisis. The research was conducted using a questionnaire, and 21 experts from the automotive industry were targeted. The results of the research showed that by examining previous studies and interviewing experts, the risks related to the field of investment were classified into four sections, including idea generation and design, initial and detailed evaluation stage, design and development stages, test and approval stage of mass production, and market introduction. Also, the risks related to the initial and detailed evaluation stage were prioritized over those associated with other locations related to the research and development.

Hao et al. (2022), in a study of COVID-19, examined consumption and absolute credit risk for a sample of 40 developed countries across several dimensions. The research results showed that the COVID-19 pandemic has increased credit risk.

Chetty et al. (2020) researched how COVID-19 and balancing policies affect spending and employment. For this purpose, they examined daily statistics on expenditures, business income, employment rates, and other key industry indicators, as well as the income group and business size of consumers. The results showed that people's income decreased as a result of COVID-19, and they drastically reduced their expenses, which led to a decrease in the income of small businesses.

Consumer behavior under the influence of COVID-19 was examined by Cox et al. (2020). They used bank account data at the household level to examine the heterogeneous effects of the pandemic on spending and savings. In general, the results indicated a decrease in costs. Among non-essential categories, reductions were made for restaurants, hotel accommodations, clothing, and large department stores. Among the essential types, the reductions in health care, ground transportation,

and fuel were the most significant.

Xue et al. (2021) investigated the stock market's reaction to the COVID-19 pandemic and the role of adjusting companies' big data strategies. This study empirically examines how stock markets react to the COVID-19 pandemic by developing a machine-learning-based learning criterion. Big data strategies protect the company from the impact of the epidemic. This issue is harmful across many sectors in China, except for information technology and healthcare, which have been affected by the COVID-19 outbreak.

3. Research methodology

The current research is applied in purpose and descriptive in terms of the data collection method. The research methodology is based on past necessary information measuring.

The study variables were collected from the audited financial statements of companies. Companies admitted to the Iranian capital market between 2019 and 2020 are the statistical population of this research after applying the following:

1. The end of the financial year of all companies should be the same.
2. In the study period, the company did not change the financial year.
3. The company's financial information is available in the study period.
4. It should not be a part of banks and financial institutions, and it should be accepted in the capital market by the end of 2017 and not be withdrawn from it during 2019-2021.

We obtained a sample of 298 companies admitted to the stock exchange by implementing the above restrictions. The limitations mentioned above are intended to enhance the integrity and consistency of the collected data. To collect the required data, the financial statements of listed companies were analyzed in Excel and classified using the affiliated equations. Following the summary of data, the Wilcoxon test was carried out using SPSS software.

Variables

Credit rating

An emerging-market score model was used to assess the company's credit rating using a quantitative risk approach. Jafari & Ahmadvand (2014) calculated a final adjusted ranking based on the evaluation of specific credit risks in the emerging market. In this model, first, the emerging market score and the equivalent value of the credit rating are extracted, then the equivalent rating of the emerging market score is based on three main factors, including;

1) Adjusted bond rating for foreign currency devaluation vulnerability
2) Adjusted for industry
3) Adjusted for competitive position

The emerging market score is measured using the following model (Altman and Hotchkiss, 1993):

$$EMS=3.25+6.56\boldsymbol{X_1}+3.26\boldsymbol{X_2}+6.72\boldsymbol{X_3}+1.05\boldsymbol{X_4}$$

$$\boldsymbol{X_1} = \frac{\textit{working capital}}{\text{total assets}}$$

$$\boldsymbol{X_2} = \frac{\text{retained earnings}}{\text{total assets}}$$

$$\boldsymbol{X_3} = \frac{\text{operating income}}{\text{total assets}}$$

$$X_4 = \frac{\text{book value of equity}}{\text{total liabilities}}$$

Table 1. Z-score and equivalent credit ratings by Altman and Hotchkiss (1993)

	Z" score	Equivalent credit ratings
Safe Zone	15.8 ≥	AAA
	60.7 -15.8	AA+
	7.30 – 60.7	AA
	7.00 – 7.30	AA-
	6.85 -7.00	A+
	6.65 – 6.85	A
	-6.40 6.65	A-
	6.25 -6.40	BBB+
	-5.85 6.25	BBB
	5.65 -5.85	BBB-
	5.25 -5.65	BB+
	95/4 -5.25	BB
	4.75 -4.95	BB-
Gray Zone	4.50 -4.75	B+
	-4.15 4.50	B
	-3.75 4.15	B-
	3.20 -3.75	CCC+
	-2.50 3.20	CCC
	1.75 -2.50	CCC-
Distress Zone	≤1.75	D

Based on the emerging-market score model, the scores were compared to the scores listed in Table 1. Based on the three factors mentioned, a credit rating equivalent to the score was obtained and adjusted in three stages:

Step 1: Adjusted bond rating for foreign currency devaluation vulnerability:

According to Jafari and Ahmadvand (2014) and Mohammadi et al. (2019), the effect of exchange rate changes on financing activity was reflected in the cash flow statement and liquidity ratio relative to current liabilities, both of which will be due in the next year. In this way, if the effect ratio of exchange rate changes on the company's cash or its current debt cash ratio is lower than the industry average, the equivalent credit rating will be adjusted by three degrees. For example, if the rating is BB+, it will be reduced to B+ after three grades. If the company's vulnerability status is neutral, a one-notch reduction in the equivalent credit rating is applied (e.g., from BB+ to BB). The credit rating does not change if the impact of exchange rate fluctuations on the company's cash or its cash-to-current-debt ratio is higher than the industry average.

Step 2: Adjusted for industry:

Finally, the z" model's average industry credit security rating is compared to the first step's comparable credit rating (Mohammadi et al., 2019). If the difference between these two ratings is 1 to 3 degrees, the adjusted equivalent credit rating in the first step has been changed by one degree. As an example, if the credit rating is BBB and the industry rating is BBB-, BB+, or BB, the equivalent credit rating is reduced by one grade. It is adjusted by two degrees if the difference is between three and six degrees; if the difference is more than six degrees, it is adjusted by three degrees.

Step 3: Adjusted for competitive position

The company's sales were divided by the industry's average sales to determine its competitiveness. According to Mohammadi et al. (2019), if this ratio is greater or less than one, the company is competitive or non-competitive.

After the above steps, the final adjusted credit rating was entered as a dependent variable in the research model. We divided the points assigned to the credit rating into seven categories based on previous research (MurciaI et al., 2014):

Table 2. Credit ratinsg classifications

	Credit Rating	Grade
Good investment level (Safe Zone)	AAA	7
	AA+	6
	AA	6
	AA-	6
	A+	5
	A	5
	A-	5
Low investment level (Gray Zone)	BBB+	4
	BBB	4
	BBB-	4
	BB+	3
	BB	3
	BB-	3
	B+	2
	B	2
	B-	2
speculative level (Distress Zone)	CCC+	1
	CCC	1
	CCC-	1
	D	1

Adapted from Ashbaugh-Skaife et al. (2006)

COVID-19:

The variable for the 2019 financial year was set to 1 as a result of the onset of the Coronavirus in early 2020, which quickly spread around the world. Before then, it was set to 0 since the Coronavirus disease had not spread to Iran yet.

4. Findings

4.1. Descriptive statistics

The descriptive statistics of the research variables are presented in Table 3. According to the results, the largest standard deviation is observed in the latex and plastic industry, indicating greater data dispersion and lower accuracy than in the other industries. Also, the average credit rating, calculated before and after the outbreak of coronavirus across all industries except food and beverage (excluding sugar), increased in the year compared to the previous year. We continued to perform statistical tests to assess the significance of this difference. Also, the probability of the Kolmogorov-Smirnov test statistic for all the variables of the research, except for agriculture industries and related services, latex and plastic, and machinery and equipment in 2020, is less than 5%. Thus, the research data are non-normal, so nonparametric tests (the Wilcoxon test) were used to test the hypotheses.

Table 3. Descriptive statistics of research variables

Industry	Number	year	Max	Min	Std. Deviation	Mean	Kolmogorov-Smirnov Test	probability of the Kolmogorov-Smirnov Test
Mining of metal ores	10	98	6	1	1.751	5.2	0.476	0.000
	10	99	6	1	1.581	5.5	0.524	0.000
Transportation	10	98	6	1	2.22	3.5	0.270	0.038
	10	99	6	1	1.911	4.1	1.181	0.200
Automobiles and parts	33	98	5	1	1.43	2.24	0.322	0.000
	33	99	5	1	1.5	2.57	0.314	0.000
Computer and related activities	9	98	6	2	1.53	5.111	0.385	0.000
	9	99	6	3	1.26	5.111	0.314	0.011
Agriculture and related services	12	98	7	1	1.825	4.66	0.239	0.057
	12	99	7	2	1.775	4.66	0.274	0.013
Other non-metallic ore products	14	98	6	1	1.847	3.785	0.245	0.023
	14	99	6	1	1.703	3.857	0.320	0.000
Lime cement and plaster	24	98	7	1	2.126	4.791	0.423	0.000
	24	99	6	1	2.074	4.958	0.484	0.000
Petroleum products, coke, and nuclear fuel	12	98	6	1	1.83	4.916	0.390	0.000
	12	99	6	5	0.288	5.916	0.530	0.000
Essential metals	37	98	6	1	1.682	5.05	0.362	0.000
	37	99	7	1	1.322	5.594	0.512	0.000
Latex and plastic	10	98	6	1	2.162	3.7	0.226	0.159
	10	99	7	1	2.366	4.4	0.351	0.001
Machinery and equipment	10	98	7	2	1.629	4.63	0.225	0.126
	10	99	6	1	1.921	4.909	0.442	0.000
Chemical products	43	98	6	1	2.130	4.53	0.382	0.000
	43	99	7	1	1.988	5.000	0.413	0.000
Food and beverage products except sugar	28	98	6	1	1.722	4.678	0.314	0.000
	28	99	6	1	1.773	4.535	0.295	0.000
Pharmaceutical materials and products	39	98	7	2	1.385	5.359	0.447	0.000
	39	99	6	2	1.224	5.359	0.418	0.000

4.2. Discussion of findings

Due to the non-normality of the data, the Wilcoxon test was used to assess the significance of differences in credit ratings before and after the coronavirus pandemic and examine the impact of COVID-19 on credit ratings across industries. Aside from the automotive, parts, and chemical goods sectors, there is no discernible change in the credit ratings of industries before and after COVID-19. Consequently, the research hypotheses are dismissed. We can conclude that the coronavirus outbreak has led to higher credit ratings for the automobile and parts industries, essential metals, and chemical products. This conclusion is supported by Table 4, which shows that the average grade after the Coronavirus increased compared to before, and the p-value from the Wilcoxon test is less than 5%, indicating that we cannot reject the null hypothesis that the ranks before and after the Coronavirus differ. The findings are not consistent with the theoretical underpinnings and with those of Hao et al. (2022) and Xue et al. (2021).

5. Conclusion

Based on the research's theoretical underpinnings and historical context, the study examined the impact of the Coronavirus Pandemic on credit ratings across 14 industries. According to the hypothesis test, the credit ratings of the automotive, metal, and chemical product sectors were

significantly different before and after the virus. The findings were inconsistent with the theoretical underpinnings and with those of Hao et al. (2022) and Xue et al. (2021).

Table 4. The impact of the coronavirus on the credit rating of industries

Industry	t-Statistics	p-value
Mining of metal ores	1.000	0.317
Transportation	-1.169	0.242
Automobiles and parts	-2/066	0.039
Computer and related activities	0/000	1.000
Agriculture and related services	-0.061	0.951
Other non-metallic ore products	-0.378	0.705
Lime cement and plaster	-1.069	0.285
Petroleum products, coke, and nuclear fuel	-1/604	0.109
Essential metals	-3.165	0.002
Rubber and plastic	-1.841	0.066
Machinery and equipment	-0.647	0.518
Chemical products	-2.55	0.011
Food and beverage products except sugar	-0.464	0.642
Pharmaceutical materials and products	-0.189	0.850

The disparity may be attributed to the confluence of various factors, including inflation, a stronger dollar, withdrawal decision from the JCPOA, and sector-specific variables and economic circumstances. The prices of essential metals fell at the beginning of the Coronavirus outbreak. Still, data on domestic and international demand for them suggests that the price drops in the first few months have been more than offset by a significant increase in demand since the second quarter, with boosted profits. The US withdrawal from the JCPOA and sanctions on Iran's auto industry led to a decline in imports, prompting foreign automakers to exit the Iranian market, even as car sales dropped after the Coronavirus outbreak. A combination of factors, including a spike in the exchange rate, sharply increased car prices. Fortunately, the industry has recovered from the demand drop thanks to price hikes. In other words, the increase in profitability, the company's financial strength, and its credit rating are not due to increased demand for the relevant product. Still, the price increase due to changes in the dollar rate can contribute to inflation. In light of these results, it is suggested that supporting institutions pay special attention to industries affected by exchange rate changes, as they can contribute to inflation in the country. It is also suggested that researchers re-examine the research hypothesis using regression analysis, controlling for inflation and JCPOA withdrawal. Since the companies' financial statements have not been reevaluated and due to the severe impact of inflation in recent years, ignoring inflation has been a limitation of this research.

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